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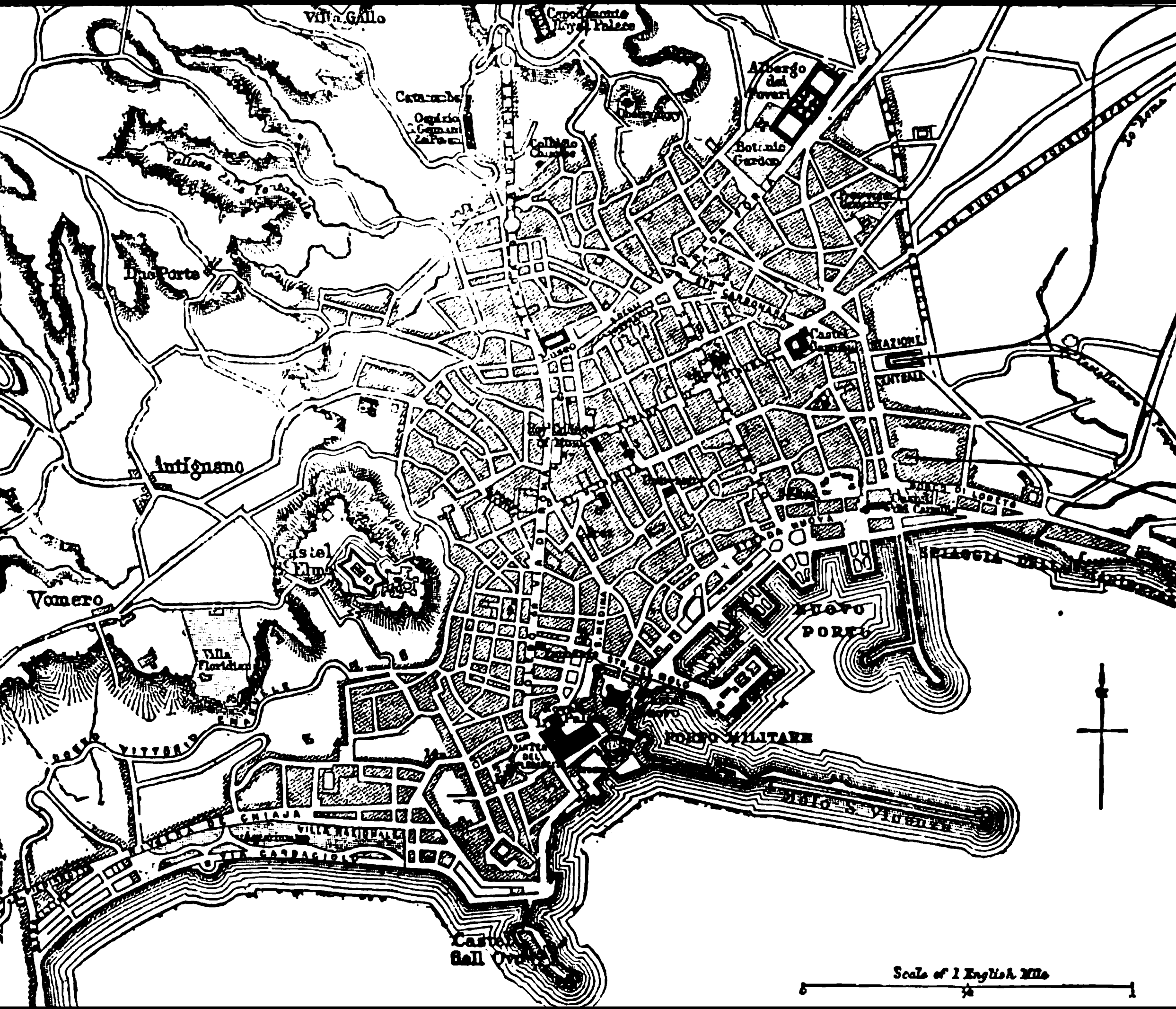

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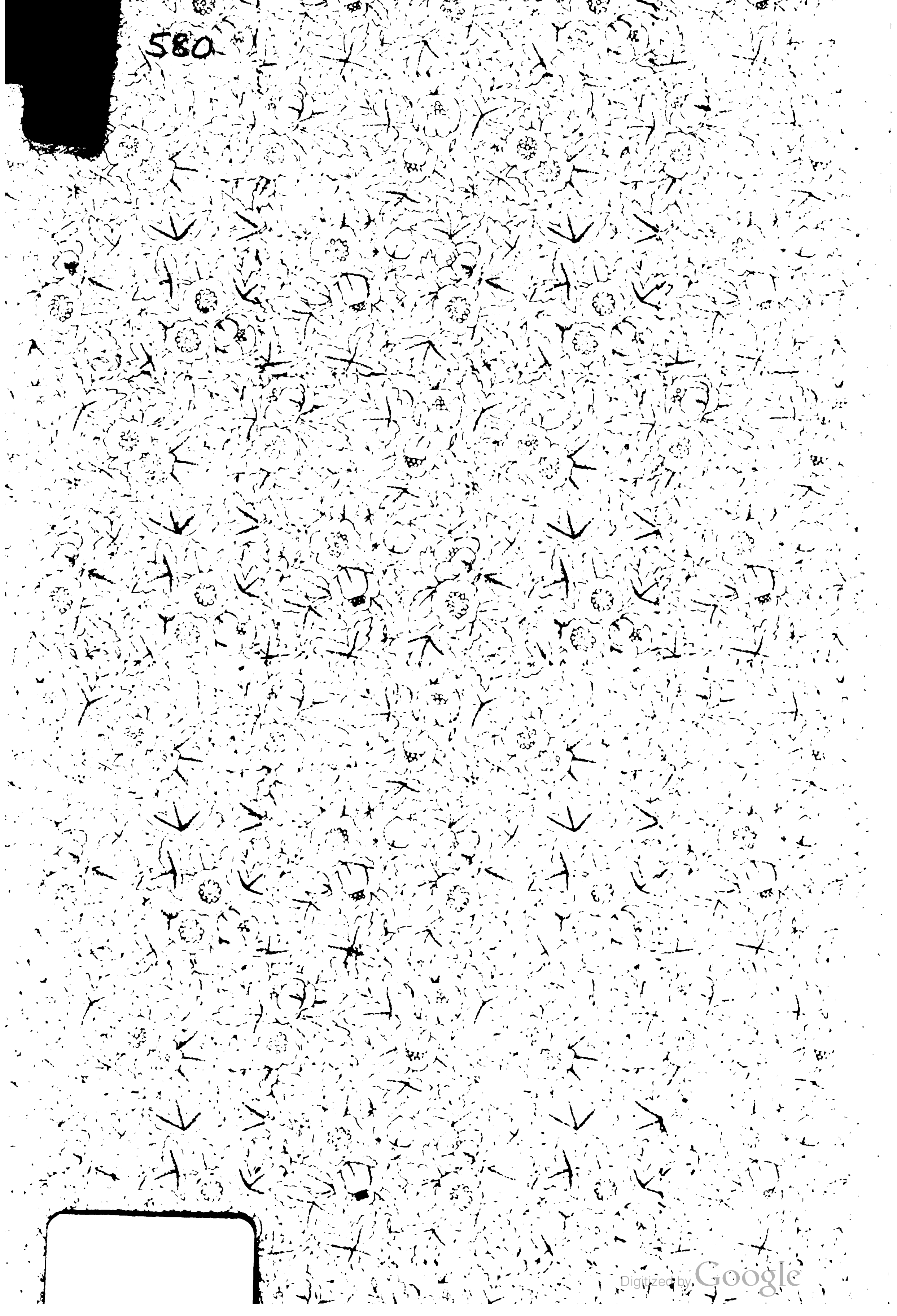

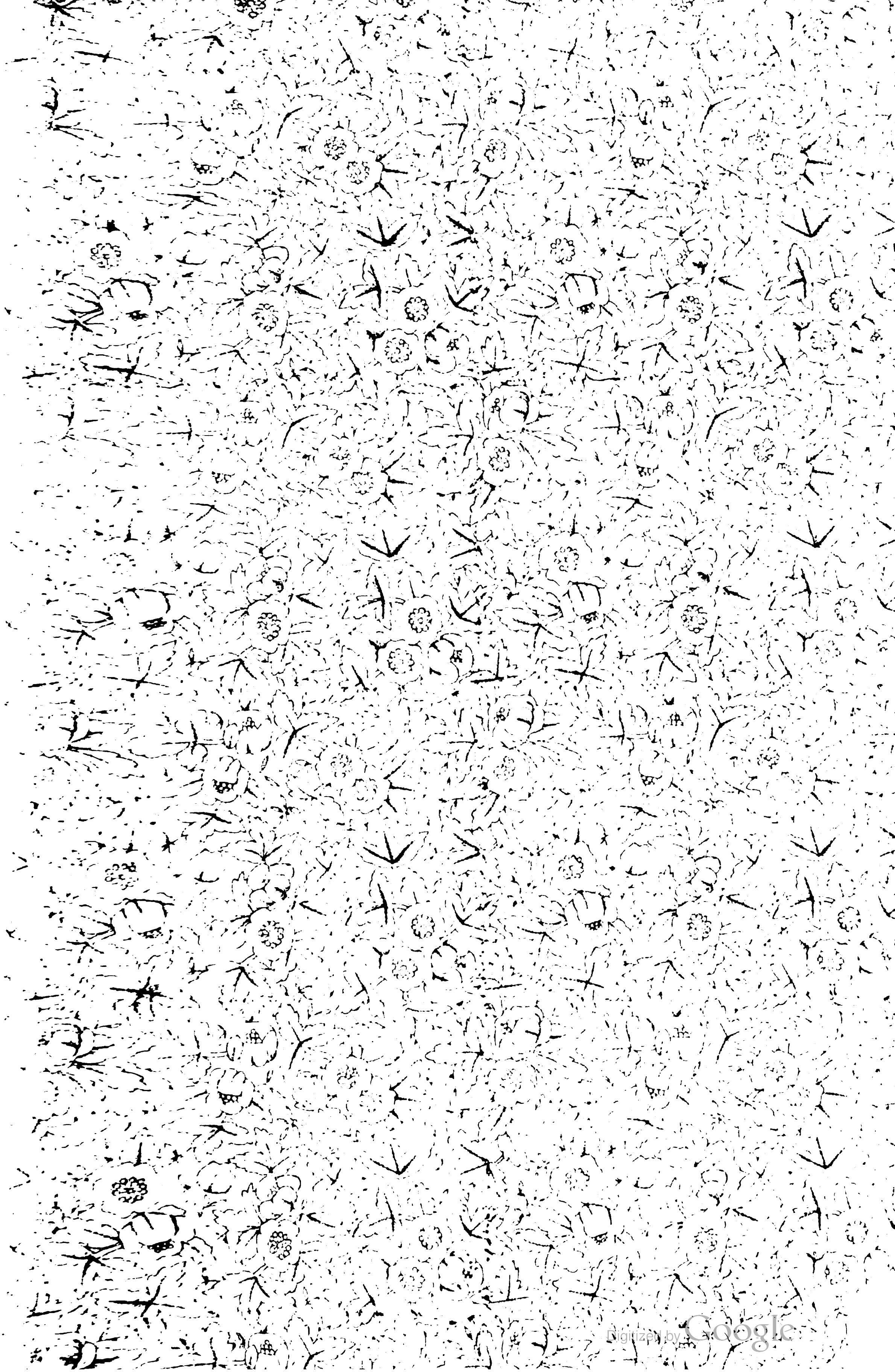

THE

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ENCYCLOPÆDIA BRITANNICA.

MOTANABBI, or MOTENEBBI. Abú 'l-Ṭayyib Aḥmed ibn al-Ḥosain of Cufa, called Al-Motanabbi (915/6-965), is the most famous representative of the last period of Arabic poetry, though some Eastern critics place him below Abú Tammám. He was the son of a water-carrier, and is said to have picked up much of the literary knowledge for which he was afterwards famous by haunting the bookstalls of his native city. He spent, too, some years of his youth among the nomads of the Syro-Arabian desert, learning their purer dialect and becoming imbued with their self-reliant spirit. Thus he grew up a brave proud man, a gallant warrior as well as a poet, full of ambition, not easily satisfied either with wealth or honours, indifferent to the Koran and to the fasts and prayers of Islam, but untainted by the looseness of morals common to the poets of those days. Such a character was not well fitted for the part of a courtier, the only career that then lay open to a poet; for, though no Arab poet deems himself humiliated by the most extravagant praises of a generous patron, and none has written in this vein more extravagantly than Abú 'l-Ṭayyib, he was as exacting of due acknowledgment as prodigal of adulation, and was too proud to endure a slight, even where it was dangerous to show resentment. At first he essayed a greater and more perilous road to distinction, appearing in the character of a prophet in the desert between the Euphrates and Syria, where he formed a considerable party, but was arrested by the governor of Emesa. A prison and the pillory cooled his enthusiasm; his prophetic pretensions indeed are hardly a proof of genuine religious fervour, for in the lands of Islam a revolutionary popular leader almost necessarily seeks a supernatural sanction for his attempt. The name of Al-Motanabbi (he who plays the prophet) clung to him, however, and is that by which he is still commonly known. Regaining his liberty, he had to struggle for a time with poverty and neglect. But his poetical talents at length found him patrons, and in 337 A.H. (948/9 A.D.) he became attached to the court of that famous warrior and patron of letters, Saif al-Dawla, prince of Aleppo, to whom many of the best fruits of his muse were dedicated, and by whose side he approved his valour in the field. But he had rivals who knew how to inspire jealousy between him and the prince, and an angry scene with the grammarian Khálawaih, in which the latter closed a philological dispute by striking Motanabbi on the face with a key which he had in his sleeve, in the very presence of the prince and without rebuke from him, led the poet to leave the court and seek a new career in the realm of the Ikhshídites. He now took as his patron and the object of his eulogies Káfúr, the regent of Egypt—a hideous black eunuch whom it was indeed a humiliation to praise, but who knew how to open the poet's lips by great gifts and honours. Motanabbi, however, sought a higher reward, the government of Sidon, and at length broke with Káfúr, wrote satires against him, and had to fly for his life to Cufa. A curious anecdote relating to this part of his career will be found in Lane's *Arabian Nights*, chap. viii. note 18. His next great patron was 'Aḍud al-Dawla of Shiráz, and on a journey from Shiráz to Cufa he was waylaid and slain, fighting bravely, by a chieftain of the Asad named Fátik, whose kinsfolk he had satirized (Sept. 965).

The poetry of Motanabbi is to European taste much less attractive than the verses of the ancient Arab poets, being essentially artificial and generally unreal, though it has great technical merits and displays lively fancy and considerable inventive power. It is mainly court poetry, but the poet has the credit of never losing his self-respect in the presence of his patrons. Oriental taste, on the other hand, places him on a very high pedestal, as may be judged from the fact that more than four hundred commentaries were written on his *Díwán* (H. Khal., iii. 306). Dieterici's edition of the poet, Berlin, 1858-61, gives the commentary of Wáḥidí; the Egyptian edition of 1870 has the commentary of 'Okbarí.

See Abulfeda, *Ann. Mosl.*, ii. 482 sq.; Ibn Khallikán, ed. De Slane, p. 51 sq., and the notes to De Slane's translation; De Sacy, *Chrest. Ar.*, vol. iii.; Bohlen, *Commentatio de Motenebbio*, Bonn, 1824; Dieterici, *Mutanabbi und Seifuddaula*, Leipsic, 1847.

MOTHER-OF-PEARL. The shells of many molluscous animals display a brilliant pearly and iridescent lustre, resulting from the peculiar manner in which the layers of calcareous matter of which they are composed have been successively formed. Such shells, even when small in size, form bright and, specially to the untutored eye, attractive ornaments, and as such are used for necklaces and similar purposes. When the shells are of sufficient size to cut and shape for purposes of utility, they become an article of some commercial importance under the name of Mother-of-Pearl. This term, though applicable to all pearly shells, is in commerce principally applied to the shells of the bivalve pearl-mussel *Meleagrina margaritifera*, which is the principal source of the commercial product. The *Meleagrina margaritifera* is a native of tropical seas, and is found around the coasts of all the lands within the tropics. The shells vary in size, the largest reaching to about the dimensions of a dessert plate, with a weight of from 1 to 1¼ lb. They also vary in colour to a considerable extent, some being dark and smoky round the outer edge with little iridescence, others dark but possessing a rich play of colours, and the greater part pearly white with varying iridescence. The principal sources of supply are the islands of the East Indian archipelago, the Pacific islands, the north-west Australian coast, the Persian and Red Seas, and the Gulf of Panama. The largest and steadiest consumption of mother-of-pearl is in the button trade, and much is also consumed by cutlers for handles of fruit and dessert knives and forks, pocket-knives, &c. It is also used in the inlaying of Japanese and Chinese lacquers, European lacquered papier-mâché work, trays, &c., and as an ornamental inlay generally. In an innumerable variety of small and fancy articles mother-of-pearl is also employed, its use being limited only by the moderate dimensions and thickness of material obtainable, and its rather brittle nature. The carving of pilgrim shells and the elaboration of crucifixes and ornamental work in mother-of-pearl is a distinctive industry of the monks and other inhabitants of Bethlehem. Among the South Sea Islands the shell is largely fashioned into fishing-hooks, a purpose for which its brilliant conspicuous appearance appears to render it suitable without the addition of any bait or other lure. Among shells other than those of *Meleagrina margaritifera* used as mother-of-pearl may be mentioned the Green Ear or Ormer shell (*Haliotis tuberculata*) and several other species of Haliotis, besides various species of Turbo.

The pearl-shell fishery is an important industry on the north and north-west coasts of Australia, producing about 800 tons yearly, valued at over £100,000, the Papuan islanders of Torres Straits being employed as divers under European supervision, with skilled appliances. The shell of the golden-tipped variety of Avicula found here is much more valuable than the dark-edged one of the South Seas. The value of the fisheries depends much more on the shell than on the occasional pearls found, which indeed are sometimes, along with the "fish," a perquisite of the diver; but on the west coast, about Shark's Bay, a smaller variety of the same mollusc produces valuable pearls, their exciting cause being possibly present there in greater abundance. That the pearl itself is not due to disease, or to the presence of any irritating cause, seems clear from the fact that the mollusc can reject it at will, and often does so when taken (for which reason the diver, in seizing him, at once places his hand over the opening so as to close the shell); but it is believed now that the pearl is secreted and held ready to be dissolved by the powerful acid of the sac, and spread in nacreous layers over the spot irritated by the borer (*Pholas* sp.). Accordingly pearls are seldom found in the young "fish," whose shells are much harder outside, and not susceptible to such attacks. A mass of nacreous layers formed round a point of irritation or "blister" can sometimes be cut out of the shell, and might easily be mistaken for (and sold as) a pearl, but it is never quite perfect all round and is always hollow. Sometimes, after having secured the loose pearls, the fishermen deposit the mollusc again, unharmed, in a secure and accessible locality, and repeat the process for three and four years successively.

MOTHERWELL, a police burgh of Lanarkshire, Scotland, is situated on the Caledonian Railway a short distance from the right bank of the Clyde, 2 miles north-east of Hamilton and 11 east-south-east of Glasgow. The village, which takes its name from an old well dedicated to the Virgin, contained only 900 inhabitants in 1851, and owes its rapid increase to the coal and iron mines in the neighbourhood. It possesses one of the largest ironworks in Scotland, and also extensive engineering works. Motherwell was erected into a police burgh in 1865. The population in 1871 was 5746, and in 1881 it was 12,904.

MOTHERWELL, William (1797-1835), poet, antiquary, and journalist, born in 1797, rendered service in the collection of fugitive border poetry and wrote one or two very touching songs in the Scotch dialect, dying before he had fulfilled the promise of his earlier work. His short life was diversified by few incidents. The son of an ironmonger in Glasgow, he was educated partly in Edinburgh and partly in Paisley. At the age of fifteen he was apprenticed in the office of the sheriff-clerk at Paisley, and appointed sheriff-clerk depute there in 1819. The impulse given by Scott to the pursuit of local ballads was still strongly in force, and the young law apprentice spent his leisure in collecting materials for a volume which he published in 1819 under the title of *The Harp of Renfrewshire*. In the course of the next eight years he extended his studies in the same field and published the results in 1827 in *Minstrelsy Ancient and Modern*, prefaced by a very thorough historical introduction. Meantime he made a reputation by casual poems in newspapers and magazines, of which *Jeanie Morrison*, *My Heid is like to break*, and *Wearie's Cauld Well* have taken a fixed place in Scotch literature. These poems are his best work, but he gave most of the energy of his vigorous intellect to writing ballads and songs in English; and he interpreted the martial spirit of the Norse sea-rovers with an enthusiasm and force which one would not expect from the plaintive character of his Scotch poems. His critical power and his learning were probably too great for his executive faculty; but, whatever may be thought of his promise as a poet, it was undoubtedly quenched by his entrance into journalism and the fatiguing work of newspaper editing. He became editor of the *Paisley Advertiser* in 1828, of the *Glasgow Courier* in 1830, and died suddenly of apoplexy in 1835. A trying examination before a Parliamentary Committee was thought to have hastened his end; but Conservative journalism at the time of the Reform Bill was exciting and uphill work, and it is a fair inference from the sad tone of some of his later poems that a baffled longing to achieve enduring fame added to the poet's worries and increased the strain on his constitution. A small volume of his poems was published in 1832, and a larger volume with a memoir in 1849.

MOTHS. See Butterflies.

MOTLEY, John Lothrop (1814-1877), the well-known historian of the Dutch Republic, was born on 15th April 1814 at Dorchester, now a part of Boston, Massachusetts, and from 1827 was educated at Harvard, where he graduated in 1831. He then studied for two years at Göttingen and Berlin, and after a period of European travel, chiefly in Italy, returned to America in 1834, where he became a student of law, and ultimately was called to the bar. In 1837 he married, and two years afterwards he published anonymously his earliest literary work, a two-volume novel, entitled *Morton's Hope, or the Memoirs of a Young Provincial*, which attained, and indeed deserved, only a moderate success. In 1841 he received his first diplomatic appointment, being made secretary of legation to the Russian mission, but, finding the atmosphere of St Petersburg uncongenial, he resigned his post within a few months and definitely resolved on a literary career. Besides contributing various historical and critical essays to the *North American Review*, he published in 1849, again anonymously, a second novel entitled *Merry Mount, a Romance of the Massachusetts Colony*. About the year 1846 the project of writing a history of Holland had begun to take shape in his mind, and he had already prepared a considerable quantity of MS., when, finding the materials at his disposal in the United States quite inadequate for the completion of his work, he resolved to migrate to Europe along with his family in 1851. The next five years were spent at Berlin, Dresden, Brussels, and the Hague in laborious investigation of the archives preserved in those capitals, and resulted in 1856 in the publication of *The Rise of* the Dutch Republic, a History (London and New York, 3 vols. 8vo). This work, which, after a large historical introduction, minutely follows the history of the Low Countries from the abdication of Charles in 1555 down to the assassination of William the Silent in 1584, immediately became highly popular by its graphic manner and the warm and sympathetic spirit in which it was written, while at the same time it was frankly recognized by scholars as a painstaking and conscientious piece of original work. It speedily passed through many English editions, was translated into French (with an introduction by Guizot) in 1859, and also into Dutch (with introduction and notes by Bakhuizen van den Brink, himself a distinguished historian), as well as into German and Russian. Pursuing his researches in England, France, Belgium, and Holland, Motley was able to publish in 1860 the first two volumes of the *History of the United Netherlands*, covering the period from the death of William the Silent in 1584 to shortly after the destruction of the Armada, by which the Spanish project for subjugating England and reconquering the Netherlands was finally defeated. This work, which was on a somewhat larger scale than the preceding, embodied the results of a still greater amount of original research, not only in the Dutch archives, in the copies of the Simancas archives, and in the portions of those archives still retained in Paris, but also in the London State Paper Office, and in the MS. department of the British Museum. By two new volumes published in 1868 the work was brought down to the twelve years' truce in 1609, and it was announced that the author was engaged in writing a continuation which should embrace the history of the Thirty Years' War. Meanwhile Motley from the close of 1861 to 1867 had held the post of United States minister at Vienna; in 1869 he was appointed to a similar position at the court of St James's, but was recalled in 1870. After a short visit to Holland he again took up his residence in England, where *The Life and Death of John Barneveld, Advocate of Holland, with a view of the primary Causes of the Thirty Years' War* (2 vols.) appeared in 1874. Ill health now began to interfere with sustained literary work, and, after a protracted period of failing vigour, he died at Kingston Russell House, near Dorchester, Dorsetshire, on 29th May 1877.

Motley was member of a number of learned societies in Europe and America, and held a variety of honorary degrees. Among other works not noticed above may be mentioned a pamphlet on the *Causes of the Civil War in America* (1861), which originally appeared in the correspondence columns of the *Times* newspaper, his *Democracy, a Historical Essay* (1869), originally delivered as an address to the New York Historical Society. The merits of Motley as an historian are undeniably great; he has told the story of a stirring period in the history of the world with full attention to the character of the actors and strict fidelity to the numerous minor details of the action. But it may safely be said that his tale is best where most unvarnished, and probably no writer of the same rank has owed less to the mere sparkle of highly polished literary style.

See *John Lothrop Motley, a Memoir*, by Oliver Wendell Holmes (1878).

MOTMOT, according to Hernandez in his *Historia Avium Novæ Hispaniæ* (p. 52), published at Rome in 1651, was the Mexican name of a bird which he described well enough to leave no doubt as to what he meant; but the word being soon after printed *Momot* by Nieremberg and others gave rise to the Latinized *Momotus*, invented by Brisson as a generic term, which has since been generally adopted by ornithologists,[1] though Motmot has been retained as the English form. Linnæus knew of only one species of Motmot, and referred it to his genus *Ramphastos* (properly *Rhamphastus*) under the name of *R. momota*. This is the *Momotus brasiliensis* of modern ornithologists, and from its geographical range cannot be the original *Motmot* of Hernandez, but is most likely the "*Guira guainumbi*" of Marcgrave.

The Motmots have been for many years recognized as forming a distinct family, *Momotidæ* or *Prionitidæ*, of the heterogeneous assemblage known as *Picariæ* or *Coccygomorphæ*; and the only question among systematists has been as to their position in that group. This has been discussed and illustrated with his usual assiduity by Dr Murie (*Ibis*, 1872, pp. 383-412, pls. xiii.-xv.), who conclusively showed that the TODY (*q.v.*) was the Motmot's nearest existing relative, while he believed that both *Momotidæ* and *Todidæ* might be placed in one section (*Serratirostres*) with the *Coraciidæ* (ROLLER, *q.v.*), *Meropidæ*, and *Alcedinidæ* (*cf.* KINGFISHER, vol. xiv. p. 81). To the latter allocation Garrod (*Proc. Zool. Society*, 1878, pp. 100-102) has since partly demurred, though admitting the Kingfisher affinity, while upholding the former, and even declaring that Motmots and Todies form but a single family. As the conclusions of both these investigators are based on the sure ground of anatomical structure, they are of incomparably greater value than most of those arrived at by prior systematists who judged from external characters alone.

In outward appearance the Motmots have an undoubted resemblance to Bee-eaters, but, though beautiful birds, various shades of blue and green predominating in their plumage, they do not exhibit such decided and brilliant colours; and, while the Bee-eaters are only found in the Old World, the Motmots are a purely Neotropical form, extending from southern Mexico to Paraguay, and the majority of species inhabit Central America. They are said to be solitary birds, or at most living in pairs, among the gloomy forests, where they sit on the underwood nearly motionless, or only jerking their long tail as the cry "houtou" (or something like it) is uttered. Their ordinary food is small reptiles, insects, and fruits. The nest of one species, as observed by Mr Robert Owen, is at the end of a hole bored in the bank of a watercourse, and the eggs are pure white and glossy (*Ibis*, 1861, p. 65). Little else has been recorded of their ways.

The *Momotidæ* form but a small group, containing, according to the latest enumeration of them in 1873 by Messrs Sclater and Salvin (*Nomenclator*, pp. 102, 103), but seventeen species,[2] distributed into six genera, of which last, however, Dr Murie (*l.c.*) would only recognize four—*Momotus*, *Baryphthengus*, *Hylomanes*, and *Eumomota*—the second including *Urospatha*, and the last *Prionorhynchus*. The distinctions between these groups would require more space to indicate than can here be allowed; but it may be stated that, while all have a general resemblance in the serrated edges of the bill and many other characters, *Momotus* has the normal number of twelve rectrices, while the rest have only ten, which in *Hylomanes* have the ordinary configuration, but in adult examples of all the others the shaft of the median pair is devoid of barbs for the space of about an inch a little above the extremity, so as to produce a spatulate appearance, such as is afforded by certain humming-birds known as "Racquet-tails" (HUMMING-BIRD, vol. xii. p. 357), Kingfishers of the genus *Tangsiptera* (KINGFISHER, vol. xiv. p. 82), and Parrots of the group *Prioniturus*. Waterton (*Wanderings*, Journey 2, chap. iii.), mentioning the species *M. brasiliensis* by its native name "Houtou," long ago asserted that this peculiarity was produced by the Motmot itself nibbling off the barbs, and this extraordinary statement, though for a while doubted, has since been shown by Mr Salvin (*Proc. Zool. Society*, 1873, pp. 429-433), on Mr Bartlett's authority, to be perfectly true. The object with which the operation is performed is wholly unknown. It is sometimes incompletely executed, and the tail has then an asymmetrical form. This must have been the case with the example that Hernandez described (*l.c.*), and brought on himself the criticism of Willughby (*Ornithologia*, p. 298) for so doing. Much of the bibliography of the family is given in Dr Murie's paper already quoted; and it may be remarked that in 1734 Seba, probably misled by wrong information, figured (*Rerum Nat. Thesaur.*, tab. 67, fig. 2) under the name of "Motmot" a bird which has been identified with a species of GUAN (vol. xi. p. 232), and is the *Ortalis motmot* of modern ornithology. (A. N.)

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[1] Its barbarous origin induced Illiger to substitute for it the word *Prionites*, and his example has been followed by some nomenclatural writers.

[2] The same number was recognized by the first-named of these gentlemen in his review of the Family (*Proc. Zool. Society*, 1857, pp. 248-260), where they are all diagnosed, a species, subsequently described by Dr Cabanis (*Mus. Heineanum*, ii. p. 115), not being admitted.

MOTRIL, a town of Spain in the province of Granada, is charmingly situated at the foot of an offshoot of the Sierra Nevada, on the edge of a rich alluvial plain about a mile from the Mediterranean and 40 miles south-south-east from Granada, with which it is connected by a good carriage road. The town has no buildings of special architectural or historical interest. The climate is semi-tropical, and the "vega" or plain of Motril has been found peculiarly adapted for the culture of the sugar-cane, of which the annual average yield has recently been estimated at 113,636 tons. In the district there are five sugar-factories,—two in the immediate vicinity of the town, and three at Salobreña, a village about 3 miles to the westward at the mouth of the Rio Grande (Guadalfeo). Some cotton is also grown and manufactured. This neighbourhood is rich in lead, chiefly wrought by companies having very limited capital; the ore is for the most part smelted on the spot and afterwards sent to Malaga, or direct to England. Zinc and copper are also found, but in smaller quantities. Esparto grass is exported. The population of Motril in 1878 was 16,665. The harbour (El Puerto de Motril) lies about 6½ miles to the south-eastward at the village of Calahonda.

MOTT, VALENTINE (1785-1865), an eminent American surgeon, was born at Long Island, New York, on the 20th August 1785. He graduated at Columbia College, studied under Sir Astley Cooper in London, and also spent a winter in Edinburgh. After acting as demonstrator of anatomy he was appointed professor of surgery in Columbia College in 1809. From 1811 to 1834 he was in very extensive practice as a surgeon, and most successful as a teacher and operator. He tied the innominate artery in 1818; the patient lived twenty-six days. He performed a similar operation on the carotid forty-six times with good results; and in 1827 he was also successful in the case of the common iliac. He is said to have performed one thousand amputations and one hundred and sixty-five lithotomies. After spending seven years in Europe (1834-1841) Mott returned to New York and founded the university medical college of that city. He translated Velpeau's *Operative Surgery*, and was foreign associate of the Imperial Academy of Medicine of Paris. His death occurred on the 26th of April 1865.

MOTTEVILLE, FRANÇOISE BERTAUT, MADAME DE (1621-1689), was born in 1621. She was of fair family (the poet-bishop Jean Bertaut being her kinsman), and by her mother of Spanish blood. This circumstance attracted Anne of Austria to Madame Bertaut, and the child Françoise was made a member of the queen's household and pensioned at seven years old. The influence of Richelieu, however, who constantly endeavoured to deprive the queen of confidantes, exiled mother and daughter to Normandy. There, at the age of eighteen, Françoise married Nicholas Langlois, Seigneur de Motteville, first president of the Chambre des Comptes. She was very soon a widow, but she had before that date (1641) visite court, renewed her relations with the queen, and rewarded by a pension increased from 600 to 2000 li No sooner did Anne of Austria become her own mi by the deaths of Richelieu and of her husband than summoned Madame de Motteville to court and made her most intimate friend. Through all the intrigues troubles of the Fronde, Madame de Motteville prese the honourable reputation of being devoted to her mi without any party ties or interests. She was also on intimate terms with Henrietta Maria of England du her residence in France. After Anne of Austria's d Madame de Motteville lived in retirement, but nc absolute seclusion, seeing especially Madame de Sév and Madame de la Fayette. She died on 29th Decei 1689. Some letters of hers are preserved, especial curious correspondence with "La Grande Mademois on marriage, but her chief work is her *Mémoires*, w are in effect a history of Anne of Austria, written br till the date of Madame de Motteville's return to c and then with fulness. The author is something partisan, but not an intentionally unfair one, and judgment and power of observation are very consider The style of her book is not of the most peculiar or a ing, but it is simple, easy, and good. The *Mémoires* be most conveniently read in Michaud and Poujou *Collection*, vol. xxviii.

MOUKDEN. See MANCHURIA, vol. xv. p. 466.

MOULINS, chief town of the French departmen Allier, is situated 195 miles by rail south-south-east Paris on the right bank of the Allier, which is crossed by a remarkable bridge about 1000 feet in len consisting of thirteen semicircular arches. The t which stands at an altitude of about 740 feet above level, is adorned with gardens and fine boulevards, still contains several buildings of historical interest many houses of the Middle Ages. The cathedral h very beautiful choir, with richly-painted windows of 15th and 16th centuries. The nave, in the Pointed s is of recent construction, as are the two towers with s spires rising to the height of 312 feet. The white s chiefly employed is happily contrasted with ornam columns of black basalt. The chapel of the lyceum, w occupies the site of an ancient convent of the Visita contains a richly-carved mausoleum to the memor Duke Henry of Montmorency, who was beheaded ir reign of Louis XIII. Among other objects of intere Moulins are some remains of the old chateau of the d of Bourbon, and the clock tower. The library of n 25,000 volumes contains a manuscript Bible of the century which was used at the council of Constanc 1415. There are no industries of importance, except manufacture of wire ropes for mines, and of sulpha barium. The population in 1881 was 21,126.

The history of Moulins does not go farther back than the century, and its importance dates from the 14th, when it be the residence of the dukes of Bourbon. After the constab Bourbon's desertion to Charles V. the town, along with Bou nais, fell into the hands of the king of France. In 1566 an asse of the states-general was held in the town by Charles IX. Catherine de Medici. Moulins has suffered frequently from epid and inundations, and the ducal palace was destroyed by fire in

MOULMEIN. See MAULMAIN.

MOUNTAINS. For mountains in general see GEO vol. x. p. 370 *sq.* The more important groups of moun are discussed under separate headings, as ALPS, HIMAL ANDES, &c.

MOUNT VERNON, a city of the United States, co seat of Knox county, Ohio, and a railway junction o Baltimore and Ohio and the Cleveland, Mount Ve and Columbus Railroads, 45 miles north-north-ea

Columbus. Settled in 1805, it had become a well-built flourishing place of 5249 inhabitants in 1880, engaged in various manufacturing industries.

MOURZUK, or **MURZUK**. See FEZZAN, vol. ix. p. 130.

MOUSE. The bright and active, though mischievous, little animal known to us by the name of Mouse and its close relative the Common Rat are the most familiar and also the most typical members of the *Murinæ*, a sub-family containing about 250 species assignable to no less than 18 distinct genera, all of which, however, are so superficially alike that one or other of the English names rat or mouse would be fairly appropriate to any of them. Together they form one, and that by far the largest and most important, of the 10 sub-families into which the Muridæ or Rat family (order *Rodentia*) are divisible. Their nearest neighbours are the Tree-mice (*Dendromyinæ*) and the Hamsters (*Cricetinæ*), from which they differ by various cranial and dental characters. Among themselves they have for the most part very strong resemblances; nearly all are of very rat-like exterior, of light and active build, with large ears, bright and well-developed eyes, long and scaly tails, and nearly always of dull and inconspicuous coloration, as is suitable to their usually burrowing and nocturnal habits. The more important characteristics of the group, their anatomical, cranial, and dental peculiarities, have already been touched upon in the article MAMMALIA (vol. xv. p. 415 *sq.*), and therefore we may now pass to the division of the sub-family into smaller groups.

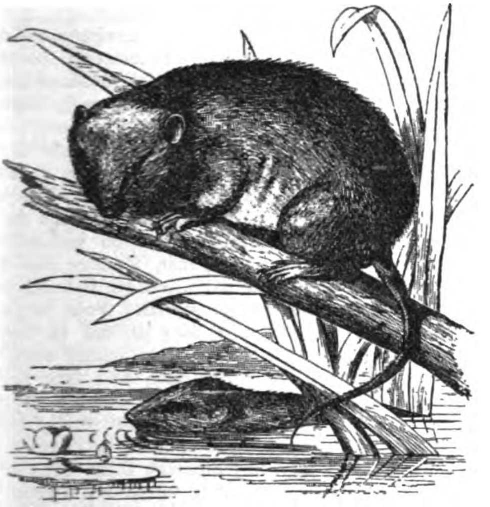

Fig. 1.—The Australian Brown-footed Rat (*Mus fuscipes*, Waterh.) (After Gould.)

Primarily the Murinæ are divisible into the Mures, or those with their molar teeth, as in the Common Rat, and the Sigmodontes, or those with their molars, like those of the Rice-rat of America. Fig. 2 will explain this: A represents the upper molars of a Mus, and B the corresponding teeth of a Sigmodont. It will thus be seen that Mus has molars composed essentially of cusps arranged triserially—that is to say, with three series of cusps across each tooth—while in the Sigmodontes the cusps are arranged biserially in pairs along the teeth. To the first of these groups, the Mures, belong the following genera:—

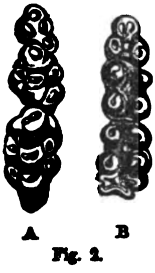

Fig. 2.

A. Upper molars of Mus. B. Upper molars of Sigmodont.

I. *Mus*, L. Incisors narrow, not grooved. Molars small, their structure as shown in fig. 2, A. Incisive foramina long. Coronoid process of lower jaw well developed. Eyes and ears large. Fur soft, though sometimes mixed with spines; pollex with a short nail instead of a claw. No cheek-pouches. Tail long, nearly naked, with rings of overlapping scales.

This, the typical genus of the family, is by far the largest of the order, and indeed of the whole class Mammalia, containing not less than 120 species spread over the whole of the Old World with the exception of Madagascar. Of these, about 30 belong to what is known as the Palæarctic zoological region, 40 to the Oriental, 30 to the Ethiopian, and 20 to the Australian, the number of species being on the whole much more considerable in tropical than in temperate regions, while but very few are found where the climate is excessively cold. It is an interesting fact in connexion with climate that many of the species living in hot countries have their fur more or less mixed with flattened spines, and that these spines appear to be shed during the winter and to be replaced by hairs, the latter naturally affording a warmer covering for the animal than the former.

The most important characters that have been used for the determination of the various species of *Mus* are the size and proportions of the body, limbs, ears, and tail, the number of mammæ, which ranges from 6 to 20, and various more or less important differences in the shape and proportions of the skull and teeth. Of the numerous species the following are those most worthy of note:—

Mus decumanus, Pall., the Common Brown or Norway Rat, distinguished by its large size, brownish grey colour, short tail and ears, powerful skull, and the possession of from 10 to 12 mammæ. It is extremely fierce and cunning, and easily overcomes in the struggle for existence all the other allied species with which it comes in contact. Its original home would seem to have been some part of Central Asia, an indigenous species recently described from China, *M. humiliatus*, being in fact so extremely like it that in all probability the latter is the original race from which it has sprung. Thence it has spread to all parts of the world, driving out the house-haunting species everywhere, as it has in England all but exterminated the next species.

M. rattus, L., the old English Black Rat, readily distinguishable from the Brown Rat by its smaller size, longer ears and tail, and glossy black colour. It shares the roving habits of *M. decumanus*, frequenting ships, and from them passing to the land in various parts of the world. On this account it, or its tropical representative *M. alexandrinus*, Geof., is extremely common in many places to which *M. decumanus* has not yet penetrated, for instance in South America, where it has had only the far less highly-organized Sigmodontes to compete with, and where it has therefore gained a firm footing. It is extremely interesting to observe that this long-tailed rat, originally a native of India, would seem to have first penetrated to all parts of the world and to have overcome and nearly or quite exterminated the indigenous rats, and that then *M. decumanus*, a more recent and powerful development of the House-rat type, has followed, and in its turn has overcome and nearly exterminated it.

M. musculus, Linn., the Common House-mouse, is, like the last species, originally a native of India, whence it has spread to all the inhabited parts of the globe. Its habits and appearance are too well known to need any description.

M. sylvaticus, L., the Wood or Long-tailed Field-mouse, is a species very common in many parts of England, often taking to barns and outhouses for shelter during the winter. It is of about the same size and proportions as *M. musculus*, but of a bright reddish grey colour, with a pure white belly.

M. minutus, Pall., the Harvest-mouse, is the smallest of the European mice, seldom exceeding 2½ or 3 inches in length. It is of a yellowish red colour, with comparatively short ears and tail. It lives entirely away from houses, commonly taking up its abode in wheat or hay fields, where it builds a round grass nest about the size of a cricket-ball, in which it brings up its young.

These five English species may be taken as types of the 120 species of *Mus*. None are much larger than *M. decumanus* or smaller than *M. minutus*, and they all have habits generally similar to those of one or other of the English species, although there are some which either live in trees like squirrels, or in the water like the English Water-voles, among which latter is the species shown in fig. 1, *M. fuscipes*, Waterh., the Brown-footed Rat of western and southern Australia.

II. *Nesokia*, like *Mus*, but with the incisors and molars very much broader, and the transverse laminæ of the latter more clearly defined.

This genus, so closely allied to *Mus* as to be barely worthy of separation, contains five or six species of clumsily-built rats spread over southern Asia from Palestine to Formosa, and from Cashmere to Ceylon. The most noteworthy member of the group is the Great Bandicoot or Pig-rat of the continent of India (*N. bandicota*, Bechs.), the largest of all the rat tribe, often considerably exceeding a foot in length. The other species vary in size between this and a brown rat. *N. bengalensis*, Gr., the common Field-rat of

India, has no less than eighteen mammæ, nearly the largest number found among the Muridæ.

III. *Golunda*, Gray, like *Mus*, but with a distinct groove down the front of the upper incisors. There are only two species, one from western India, and the other from eastern Africa.

IV. *Uromys*, Peters., differs from *Mus* in having the scales of the tail not overlapping, but set edge to edge, so as to form a sort of mosaic work. There are about six species of *Uromys*, spread over the northern part of the Australian region from the Aru Islands to Queensland.

V. *Hapalotis*, Licht. Hind-limbs elongated. Incisive foramina very large. No coronoid process to the lower jaw. This genus is confined to Australia, where there are about fifteen species known. They are pretty little animals, with long ears and tail, and in many respects resemble the Jerboas, whose place they seem to take on the sandy Australian deserts.

VI. *Mastacomys*, Thomas, like *Mus*, but with the molars remarkably broadened, and with only four mammæ. The single species in the genus is as yet only known from Tasmania, though it has been found fossil in New South Wales; it is somewhat similar in size and general appearance to the English Water-vole, but has much longer and softer fur.

VII. *Acanthomys*, Less. Fur almost entirely composed of flattened spines. Coronoid process very small. There are six species of Spiny-mice known, all of about the size of the Common Mouse. They are found in Syria, Palestine, and eastern Africa as far south as Mozambique.

VIII. *Echinothrix*, Gray, a very remarkable rat with an extremely elongated muzzle, all the bones of the face being much produced. The incisors are faintly grooved. The only species is *E. leucura*, an animal of about the size of the Common Rat, with its fur thickly mixed with spines. It is found in Celebes.

The remaining genera belong to the Sigmodontes; they are rather more numerous than those of the Mures, but, on the whole, present somewhat less strongly marked generic differences.

IX. *Hypogeomys*, Grand., a very peculiar form of large size, with long ears, feet, and tail. There is only one species, *H. antimena*, a fawn-coloured rat about 9 inches long.

X. *Nesomys*, Peters., contains two species of long-haired rats, more or less rufous in colour, about the size of the House-rat.

XI. *Brachytarsomys*, Günther, contains only *B. albicauda*, a pretty velvety-haired fawn-coloured rat, with short feet and a long tail.

XII. *Hallomys*, Jent. The only species, *H. audeberti*, is very like a *Nesomys*, but has much longer hind-feet. This and the last three genera are confined to Madagascar.

XIII. *Hesperomys*, Waterh. Molar structure as shown in fig. 2, B. The *Mus* of the New World, containing the great mass of the rats and mice of America, and having no very special generic characters common to all its members. This large genus is composed of at least seventy distinct species spread over all America from Canada to Cape Horn, of which none are quite as large as *Mus decumanus*, while several are considerably smaller than *Mus musculus*. They have been split up into ten sub-genera, of which perhaps the best marked is *Rhipidomys*, a small group containing about ten species, remarkably like Dormice in their habits and general appearance, having soft woolly fur and long hairy tails, and living entirely in trees, bushes, or in the roofs of houses. The other *Hesperomys* are all terrestrial in their habits, much as the Old-World rats and mice are. One only, *H. spinosus*, a native of Peru, has as yet been found with spines in its fur,—a rather remarkable circumstance when we remember how many of the tropical species of the allied genus *Mus* have more or less spiny fur.

XIV. *Holocheilus*, Brandt, like *Hesperomys*, but with the third upper molars proportionately larger and the skull more stoutly built. This genus, confined to Brazil, contains about six species, some of which are the largest indigenous rats of America. Two species are aquatic in their habits, and have therefore developed short webs between the toes of their hind-feet.

XV. *Sigmodon*, Say and Ord, differs from *Hesperomys* in the pattern of the molar teeth. It contains one species only, the Rice-rat, *S. hispidus*, which ranges from the United States to Ecuador.

XVI. and XVII. *Reithrodon*, Waterh., and *Ochetodon*, Coues., more or less like *Hesperomys*, but with grooved upper incisors. The first of these is a South-American genus, and contains four rat-like species, one from Venezuela and the other three from Patagonia. The second consists of three North American mice, of about the size and proportions of the English Wood-mouse, *Mus sylvaticus*.

XVIII. *Neotoma*, Say and Ord, a peculiar North-American group, in which the teeth have the prismatic appearance of those of the *Arvicolæ* (see VOLE). There are four species known as "Wood-rats," all of about the size of *Mus decumanus*, one of them, *N. cinerea*, having a tail almost as bushy as a Squirrel's; the other three with ordinary scaly rat-like tails.

From the ranges of the genera given above it will be
seen that all the first group, the Mures, are confi
the Old World, and that of the Sigmodontes four
are found in Madagascar and the rest in Americ
giving us a very remarkable instance of the peculiar
that the fauna of Madagascar has with that of the
World. This affinity is usually explained by the fac
those animals which show it belong as a rule to
formerly distributed over both the Old and New W
and that since the isolation of Madagascar these,
to the competition of more highly-organized forms,
been exterminated or strongly modified throughou
continents of the eastern hemisphere, while in the w
they have been preserved to the present time. Th
the present case it seems probable that the original
tors of the *Murinæ*, if not indeed of the whole f
Muridæ, were Sigmodontes having molars with their
biserially arranged,[1] and that these, being less power
the struggle for existence, as is shown by the mann
which roving members of the Mures rapidly multip
the expense of the indigenous Sigmodontes of any
they may be introduced into, have gradually succu
to the more recently developed Mures wherever the
were able to penetrate,—Madagascar having previ
become an island, and therefore inaccessible to t
Other groups, however, also probably descendants
Sigmodont Muridæ, have become so strongly mod
either as to structure or habits as to have been ab
avoid the rivalry of the Mures, and thus to exist sid
side with the latter; such probably are the Hams
(*Cricetus*) and the Voles (*Arvicola*), both of which
modifications of the biserial arrangement of the mo
As to the *Murines* from Australia—a region isolated f
the rest of the world far earlier than Madagascar—
their very various degrees of specialization, it seems p
able, as Mr Wallace has suggested,[2] that from very e
times individual rats and mice have drifted on floa
trees and other objects from island to island along
Indian archipelago down to Australia, and that the
scendants of the earliest arrivals have become the m
modified, and that others have been continually join
them, until we get the present state of affairs, namely,
or two genera very markedly different from Mus, oth
but slightly different, and finally numerous species
generically separable from the European and Asiatic r
and mice. (O. T.)

MOUSE-BIRD (Dutch *Muisvogel*), the name by whi
in Cape Colony and Natal the members of the gen
Colius[3] of Brisson are known—partly, it would seem, fr
their general coloration, but more probably from th
singular habit of creeping along the boughs of trees wi
the whole tarsus applied to the branch. By the earli
systematists, who had few opportunities of examining t
internal structure of exotic forms, *Colius* was placed amo
the *Fringillidæ*; but nearly all travellers who had se
one or another species of it in life demurred to that vie
Still its position was doubtful till Dr Murie, in an elab
rate treatise on its osteology (*Ibis*, 1872, pp. 262-280
showed that it was no Passerine, and subsequently (*Ib*
1873, p. 190) proposed *Pamprodactylæ* as the name of th
group of which the Family *Coliidæ* is the sole type—th
word being coined to indicate the obvious character of a
the toes being ordinarily directed forwards, but by n
means the only peculiar character these birds possess.
few years later most of Dr Murie's views were confirme

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[1] The teeth of the extinct genus Cricetodon from the Miocene o
France and Germany are in their essential structure quite similar t
those of Hesperomys.

[2] *Australasia*, p. 53, 1879.

[3] Some other generic divisions have been suggested, but on ground
so slender as hardly to merit consideration.

by Garrod (*Proc. Zool. Society*, 1876, pp. 416-419), who added considerably to our knowledge of the general anatomy of the Family, which he considered to be related on the one hand to the *Picidæ*, and on the other to the *Alcedinidæ* (see KINGFISHER, vol. xiv. p. 81) and *Bucerotidæ* (see HORNBILL, vol. xii. p. 169). The *Coliidæ* are small birds, with a rather Finch-like bill, a more or less crested head, a very long tail, and generally of a dun or slate-coloured plumage that sometimes brightens into blue or is pleasingly diversified with white or chestnut. They feed almost wholly on fruits, but occasionally take insects, in quest of which they pass in bands of fifteen or twenty from tree to tree, and hang in all attitudes from the branches as they feed. It is even said that they sleep suspended by their powerful and versatile toes. Seven species are believed to exist, all belonging to the Ethiopian Region (of which the Family is one of the most characteristic), and ranging from Abyssinia southwards. Three species inhabit Cape Colony. (A. N.)

Mouse-Bird.

MOVERS, FRANZ KARL (1806-1856), a German Orientalist, was born at Koesfeld 17th July 1806, studied at Münster, was consecrated priest in 1829, and was professor in the Catholic theological faculty at Breslau from 1839 to his death on 28th September 1856. He was one of the most learned Catholics of Germany, and his elaborate work on Phoenicia[1] attained a high and in some respects an exaggerated reputation. It is a monument of great industry but of little judgment, and the progress of epigraphic studies has superseded much of the author's material. The first volume in particular, which deals with the religion of the Phoenicians, may be viewed as quite out of date. Movers himself modified some of his views in his article "Phönizien" in Ersch and Gruber's *Encyklopädie*. Of his other writings two Biblical studies were of some importance, viz., his *Kritische Untersuchungen über die biblische Chronik* (1834) and Latin essay on the two recensions of the text of Jeremiah (1837).

MOZAMBIQUE, a colonial province of Portugal, extending for about 1200 miles along the east coast of Africa from Cape Delgado (10° 41′ S. lat.) to Lorenzo Marques on the south side of Delagoa Bay (25° 58′ S. lat.). On paper it forms an imposing territory of at least 38,000 square miles without any definite limit towards the interior; but in reality it consists of a few settlements and military posts feebly authoritative over the surrounding tribes. The Portuguese divide the province into the military districts of Mozambique, Cape Delgado, Angoche, Quilimane, Tete, Sofala, and Lorenzo Marques, with the presidential territory of Bazaruto. The small coral island of Mozambique, which gives its name to the province and contains the provincial capital, lies in 15° S. lat., about 3 miles off the coast of the peninsula Mossuril. It is defended by three forts, of which the principal, St Sebastian, is built entirely of stone brought from Portugal in 1510. The streets of the town (properly St Sebastian of Mozambique) are narrow and crooked, and the stone-built flat-roofed houses are for the most part dull and lifeless in spite of their being washed with pink, brown, and white. Its principal buildings are the palace of the governor-general, formerly a Jesuit college, the custom-house, the hospital, and three churches. The population includes, besides Portuguese and Africans, Banyans, Parsees, and Arabs. The district of Cape Delgado includes the archipelago of the Querimba Islands, and on the opposite mainland Mucimba, Pangane, Lumbo, Quissanga, Montepes, Arimba, besides the colony of Europeans founded in 1857 on the Bay of Pemba. The chief town is Ibo, with over 2000 inhabitants, situated on the island of the same name. Of the twenty-eight islands some are nearly deserted, although both their climate and that of the opposite coast is good. Ibo has a considerable trade,—the exports being sesame, calumba root, oil-seeds, ivory, and wax. Turtle fishing is carried on; but little has been done to develop the agricultural capabilities of the district. The district of Angoche extends nominally as far south as the Quirimbo river, and includes the Angoche and Primeira islands and a small settlement on the Angoche river. The trade is very limited. The district of Quilimane is the centre of the commerce of the Zambesi, and the town ranks next to Mozambique as a port. Near the village of St Marçal de Sena, the headquarters of the sub-military government of Sena, there are said to be very rich gold mines. Tete, to the north-west of Sena, is situated in the centre of an immense coal-basin. It includes a number of settlements on the Zambesi reaching as far as Zumbo, where a great native fair is held. The chief town is St Thiajo Major, about 250 miles from the mouth of the Zambesi. The climate is genial, and the soil is specially suitable for wheat, maize, tobacco, cotton, and sugar-cane. The chief town of the Sofala district is Sofala on the island of Chiloane in the estuary of the Sofala river. It was the original capital of the colony, and still possesses a good harbour, which, however, is not always easily accessible, and requires good piloting. The district is rich in gold mines, and is supposed by some to be the Ophir with which King Solomon traded. Inhambane, opposite Gasa, is very much encroached upon by the Zulu tribes. The natural products are similar to those in the Zambesi valley. A species of oil-plant is very abundant, as well as amber and sarsaparilla. The district of Lorenzo Marques is almost wholly confined to the town of that name (*q.v.*). The archipelago of Bazaruto comprises the islands of Bazaruto, Benguerua, Xegine, Bango, and Santa Carolina. The soil and climate are both excellent, and there are important pearl fisheries.

Before the 12th century this portion of the east coast of Africa had been partly colonized by Arabs from the Red Sea, who were in possession of the island of Mozambique and other districts when in 1498 the island was sighted by the Portuguese. From that time the Portuguese armadas were in the habit of frequently touching this coast on their way to India, and in 1505 Albuquerque erected a stockade at the mouth of the Sofala river and established the first Portuguese settlement under the name of the captaincy of Sofala. The fortunes of the Portuguese have been frequently chequered with disasters, and in the earlier years of their settlement they had great difficulty in withstanding successive attacks of the Kaffres, the Turks, and the Arabs. The Banyan traders began to frequent the Portuguese settlements in 1687, and were succeeded by the Battias from Hindustan. From Cape Delgado to Quilimane the native race on the coast is the Makua, who, notwithstanding the presence of Arabs, Banyans, and Battias, have preserved in a remarkable degree their purity of descent, although their language has undergone considerable change. The whole of the country between the Rovuma and the Zambesi is thickly populated by branches of this race governed by numerous petty independent despots. The Makua are divided into four families or groups—the Low Makua, the Lomwe or Upper Makua, the Maua, and the Medo. The Makololo, a powerful Basuto tribe who inhabited the valley of the Zambesi, were about twenty-five years ago not only conquered but almost annihilated by the Manganja and Makua races. South of the Zambesi are the Landeens or Northern Zulus, who under Umzeila subdued Gasa, and press closely on the coast settlements of the Portuguese, which again are bounded on the south by Usibepu's land.

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[1] *Die Phönizier*: vol. i., *Religion* (1840); vol. ii., *Das Phönizische Alterthum* (3 parts, 1849-50-56).

Natural Features and Resources.—Though the climate of the Mozambique country is subject to sudden and great alterations, the mean annual temperature is high. The cool season lasts from April to August. In the rainy season, which begins in December and sometimes continues to March, the heat when rain is not falling, which is scarcely ever, is almost insupportable. On the rivers and the coast the mangrove swamps cause fever to Europeans, but the climate is not dangerous if moderate care is taken.

The whole of the country south from the Rovuma to the Zambesi possesses naturally great fertility, the richest portion, however, being that between Angoche and Quilimane. The mountain ranges which flank Lake Shirwa are of great height and towards Quilimane extend almost to the coast. In the basin of the Zambesi the soil is fertilized by the inundations of the river, and yields abundantly with almost no labour. The low coast land of the Gasa country is almost equally fruitful. The whole region of Mozambique is intersected by numerous rivers, some of which are navigable, while at several of the estuaries there are admirable natural harbours. Ebony, the gum-copal tree, the india-rubber climber, sandal-wood, and a large number of valuable timber trees are found in the extensive forests. In the interior elephants, antelopes, and buffaloes abound, as well as lions and leopards, and the rhinoceros and hippopotamus frequent certain regions. Game in immense variety is plentiful, and the pearl and other fisheries are valuable. The mineral resources of the country are of exceptional importance. There are immense deposits of coal in the neighbourhood of the Zambesi and of Delagoa Bay, and adjoining the coalfields ironstone of the best quality is very plentiful. Malachite and copper are found in the interior, north-west of Mozambique. The gold-mines of Manica, about 120 miles west of Sofala, are supposed to be the richest on the east coast of Africa.

Industry and Commerce.—Almost nothing has been done to develop the resources of the country, and the Portuguese have scarcely carried their discoveries beyond the regions where they have settled. Journeys through the Makua country have lately been made by H. E. O'Neill and the Rev. Chauncey Maples.[1] The Zambesi valley and the districts round Lakes Nyassa and Shirwa have been explored by Kirk and Livingstone. The regions bordering on the Transvaal have been visited by Carl Mauch and St Vincent Erskine. Although a great part of the country is admirably adapted for the growth of cotton, coffee, and sugar, scarcely any attempt has been made to form plantations. The caju tree, which yields an intoxicating liquor, is, however, largely cultivated, and the cocoa-nut tree is also grown. The number of independent chiefs in the Makua country renders it almost inaccessible to traders, but ivory is sold in large quantities for the Indian market, the annual value being about £70,000. The other exports include bees-wax, corn, gums, india-rubber, and oil. The financial difficulties of the Portuguese Government have completely retarded the commercial enterprise of the settlements. The trade is almost entirely in the hands of the Banyans, who are supplied by French and Dutch houses with goods, chiefly cotton and silk cloths, brandy, wine, and old guns, which they barter for produce with the natives on the coast. The only river by which there is regular communication with the interior is the Zambesi. On the coast of Mozambique there are several native ports of call, between which and Madagascar a large surreptitious trade in slaves was carried on until 1877. With this island, and also with Zanzibar, there is a large general coasting trade. The British India Company's steamers from Zanzibar in connexion with steamers from Aden and Lisbon also call every twenty-eight days at Mozambique, and a monthly steamer from Natal calls at Delagoa Bay, Inhambane, Quilimane, and Mozambique. The general shipping trade is carried on by about 400 vessels, of which about one-half are coasters. English vessels in 1877 were said to number 79 of 30,000 tons, French 72 of 13,000 tons, Portuguese 41, Arab 19, Dutch 8, and German 9.

For the Portuguese settlements see the report by Consul Elton in *Accounts and Papers*, 1876, and L. de B., *Les Colonies Portugaises: court exposé de leur situation actuelle*, Lisbon, 1878. For the region in general see the works of the travellers referred to. (T. F. H.)

MOZARAB, Spanish *Mosárabe*, is a corruption of the Arabic *Mustaʿrib*, coll. *Mustaʿriba*, which denotes persons not Arab by race who have assimilated themselves to the Arabs. This name was applied by the Moslems in Spain to the Christian communities existing among them, in Cordova, Seville, Toledo, and other large cities, in the exercise of their own laws and religion. The ancient liturgy (see vol. xiv. p. 707) used by the Christians of Toledo, the first great body of this kind who were freed from the Moslem yoke, is commonly known as Mozarabic.

MOZART, **WOLFGANG AMADEUS**[2] (1756-1791), one of the greatest musicians the world has ever produced, was born at Salzburg, 27th January 1756. He was educated by his father, Leopold Mozart, a violinist of high repute, in the service of the archbishop of Salzburg. When only three years old he shared the harpsichord lessons of his sister Maria, five years his senior. A year later he played minuets, and composed little pieces, some of which are still preserved in Maria's music-book. Not long afterwards he attempted to write a concerto. This, his father said, was so difficult that no one could play it, whereupon Wolfgang replied that no one could be expected to play a great work like a concerto without having first diligently practised it. When five years old he performed in public, for the first time, in the hall of the university. In 1762 Leopold Mozart took Wolfgang and Maria on a musical tour, during the course of which they played before most of the sovereigns of Germany. The little "Wolferl's"[3] charming appearance and disposition endeared him to every one; and so innocent and natural were his manners that at Vienna he sprang upon the empress's lap and kissed her heartily. The emperor Francis I. sat by his side while he played, and called him his "little magician." When he slipped one day on the polished floor the archduchess Marie Antoinette, afterwards queen of France, lifted him up, whereupon he said, "You are very kind; when I grow up I will marry you." The favour shown to him at court was almost incredible; yet he remained as gentle and docile as ever, and so amenable to parental authority that he used to say, "Next after God comes my father." In 1763 the whole family started again. Wolferl now sang, composed, and played on the harpsichord, the organ, and the violin, winning golden opinions everywhere. At every court he visited he was loaded with caresses and presents; but the journeys were expensive, and the family terribly poor. In Paris they lodged at the Bavarian embassy, giving performances on a grand scale both there and at Versailles, where Wolferl's organ-playing was even more admired than his performance on the harpsichord. Here, also, he published his first compositions—two sets of sonatas for the harpsichord and violin.

On 10th April 1764 Leopold Mozart brought his family to England, engaging a lodging in Cecil Court, St Martin's Lane, whence he afterwards removed to Frith Street, Soho. On 27th April and 19th May Wolferl played before the royal family with immense success, accompanying the queen in a song and playing at sight anything that the king set before him. "Our treatment here," says Leopold Mozart in one of his letters, "exceeds all our previous experience. We could not believe ourselves in the presence of the king and queen of England, so friendly were their manners." Wolferl gave a public concert at the Great Room in Spring Gardens on 5th June, and on the 29th played a concerto at Ranelagh. He now made his first attempt at the composition of a symphony; published a third set of sonatas, dedicated to the queen; and wrote an anthem for four voices entitled *God is our Refuge*, for presentation to the British Museum.[1] In July 1764 he played at Tunbridge Wells, and soon afterwards Leopold Mozart caught a severe illness, during the continuance of which he stayed with Dr Randall in Five Fields Row, now Lower Ebury Street, Chelsea. On 12th February 1765 the children gave a concert at the Little Theatre in the Haymarket, and another on 13th May at Hickford's Room. After this they gave private performances at the Swan and Hoop Tavern, Cornhill; and on 17th September the family left England for the Hague, where they remained some time, and where in March 1766 the young composer made his first attempt at an oratorio, commanding in Holland a success as great as that he had already attained in London, and astonishing his hearers at Haarlem by performing on the then largest organ in the world. It would be impossible within the limits of a sketch like the present to follow the history of this gifted boy through all its extraordinary details. Towards the close of 1766 we find him at home in Salzburg, diligently studying Fux's *Gradus ad Parnassum*. In September 1767 he paid a second visit to Vienna, and at the suggestion of the emperor Joseph II. composed an opera buffa, *La Finta Semplice*, which, though acknowledged by the company for which it was written to be "an incomparable work," was suppressed by a miserable cabal. The archbishop of Salzburg hearing of this commanded a representation of the rejected work in his palace, and appointed the young composer his "maestro di capella." The office, however, was merely an honorary one, and, since it did not involve compulsory residence, Leopold Mozart determined to complete his son's education in Italy, to which country he himself accompanied him in December 1769.

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[1] See *Proc. Roy. Geog. Soc.*, 1882.

[2] In the baptismal register his name stands, *Joannes Chrysostomus Wolfgangus Theophilus* (Lat. *Amadeus*, Germ. *Gottlieb*).

[3] The German diminutive of Wolfgang.

Wolfgang, now nearly fourteen years old, was already an accomplished musician, needing experience rather than instruction, and gaining it every day. His talent was universally acknowledged. At Milan he received a commission to write an opera for the following Christmas. At Bologna he found firm friends in the venerable Padre Martini and the still more famous sopranist Farinelli. At Florence he became so tenderly attached to Thomas Linley, a boy of extraordinary promise and exactly his own age, that he parted from him with tears, which seemed almost prophetic—for Linley was drowned in England at the early age of twenty-two. Arriving in Rome on the Wednesday in Holy Week, he went at once to the Sistine Chapel to hear the celebrated *Miserere* of Gregorio Allegri, which, on returning to his hotel, he wrote down from memory note for note—a feat which created an immense sensation, for at that time the singers were forbidden to transcribe the music on pain of excommunication. In May he played at the Conservatorio della Pietà, in Naples, where the audience, attributing his power to the magical effect of a ring, insisted upon its removal from his finger. Returning to Rome towards the end of June, he was invested by the pope with the order of "The Golden Spur," of which he was made a cavaliere,[2] an honour which he prized the more highly because, not many years before, it had been conferred upon Gluck. In July he paid a second visit to Bologna, when the Accademia Filarmonica, after subjecting him to a severe examination, admitted him to the rank of "compositore," notwithstanding a statute restricting this preferment to candidates of at least twenty years old. The exercise which gained him this distinction is a four-part composition in strict counterpoint on the antiphon *Quærite primum*, writt in the severe ecclesiastical style of the 16th century a abounding in points of ingenious imitation and device.[3]

In October 1770 Wolfgang and his father returned Milan for the completion and production of the new oper The libretto, entitled *Mitridate, Re di Ponto*, was furnish by an obscure poet from Turin, to the great disappointme of the young maestro, who had hoped to set a drama Metastasio. The progress of the work was interrupt from time to time by the miserable intrigues which see inseparable from the lyric stage, exacerbated in th particular case by the jealousy of the resident professo who refused to believe either that an Italian opera cou be written by a native of Germany, or that a boy of fou teen could manage the orchestra of La Scala, at that ti the largest in Europe. Fortunately the detractors we effectively silenced at the first full rehearsal; and on t 26th of December Wolfgang took his seat at the harpsicho and directed his work amidst a storm of genuine applau The success of the piece was unprecedented. It had continuous run of twenty nights, and delighted even t most captious critics.

Wolfgang's triumph was now complete. After playi with his usual success in Turin, Verona, Venice, Padu and other Italian cities, he returned with his father Salzburg in March 1771, commissioned to compose grand dramatic serenata for the approaching marriage the archduke Ferdinand, and an opera for La Scala, to performed during the season of 1773. The weddi took place at Milan on 21st October; and the serena *Ascanio in Alba*, was produced with an effect which co pletely eclipsed Hasse's new opera, *Ruggiero*, compos for the same festivity. The empress Maria Theresa w so delighted with it that in addition to his fee she p sented Wolfgang with a watch set with diamonds a enamelled with her portrait; and Hasse, forgetful of own defeat, generously uttered the often-quoted proph "This boy will cause us all to be forgotten."[4]

During the absence of Wolfgang and his father good archbishop of Salzburg died; and in the sprin the year 1772 Hieronymus, count of Colloredo, was el in his stead, to the horror of all who were acquainted his real character. The Mozart family did their b propitiate their new lord, for whose installation Wolf after his return from Milan, composed an opera, *Il di Scipione*; but the newly-elected prelate had no ta art, and was utterly incapable of appreciating the of any intellectual pursuit whatever. For the p however, things went on smoothly. In Octo father and son once more visited Milan for the pre and production of the new opera, *Lucio Silla*, wh produced at Christmas with a success quite equal of *Mitridate*, and ran between twenty and thirt Unfortunately, however, these artistic triumphs from profitable in their pecuniary aspect. Th grew poorer and poorer; and the archbishop Hi was not the man to rescue them from penury.

In the meantime Wolfgang continued to pr works with incredible rapidity. In 1775 he an opera for Munich, *La Finta Giardiniera*, pr 13th January. In the following March he s Metastasio's dramatic cantata, *Il Re Pastore*. masses, symphonies, sonatas, and other impor both vocal and instrumental, followed each ot a pause. And this fertility of invention, in hausting his genius, seemed only to stimulate it to still more indefatigable exertions. But the pecuniary return was so inconsiderable that in 1777 Leopold Mozart asked the archbishop for leave of absence for the purpose of making a professional tour. This was refused on the ground of the prelate's dislike to "that system of begging." Wolfgang then requested permission to resign his appointment, which was only an honorary one, for the purpose of making the tour with his mother. The archbishop was furious; but the plan was carried out at last, and on the 23d September the mother and son started for Munich. The results were not encouraging. Leopold hoped that his son, now twenty-one years old, might obtain some profitable court appointment; but in this he was disappointed. And, worse still, poor Wolfgang fell in love at Mannheim with a promising young vocalist named Aloysia Weber, whose father, the prompter of the theatre, was very nearly penniless. On hearing of this Leopold ordered his wife and son to start instantly for Paris, where they arrived on 23d March 1778. Wolfgang's usual success, however, seemed on this occasion to have deserted him. His reception was a cold one; and, to add to his misery, his mother fell seriously ill. He wrote home in unspeakable distress; but the worst had not yet come. On 3d July the parent to whom he was so tenderly attached expired in his arms. Reduced almost to despair by this new trouble, he left Paris in September, rested for a while on his way home in Mannheim and Munich, was received by Aloysia Weber with coldness almost amounting to contempt; and in June 1779 he returned to Salzburg, hoping against hope that he might make some better terms with the archbishop, who relented so far as to attach a salary of 500 florins (about £50) to his "concertmeister's" appointment, with leave of absence in case he should be engaged to write an opera elsewhere.

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[1] The original autograph of this is now numbered "Select case C, 21, d."

[2] *Auratæ militiæ eques.*

[3] An exact copy of this most interesting producti from the original autograph still preserved among the Accademia, will be found in the appendix to Holmes's (London, 1845).

[4] "Questo ragazzo ci farà dimenticar tutti."

Two years later the desired opportunity presented itself. He was engaged to compose an opera for Munich for the carnival of 1781. The libretto was furnished by the abbate Varesco, court chaplain at Salzburg, a truly sympathetic collaborateur. On 29th January 1781 the work was produced under the title of *Idomeneo, Re di Creta* with triumphant success, and thenceforth Mozart's position as an artist was assured; for this was not only the finest work he had ever written but incontestably the finest opera that had ever yet been placed upon the stage in any age or country. It marked an era in the history of art, and raised the lyric drama to a level till then unknown.

And now the archbishop's character exhibited itself in its true colours. Art for its own sake he utterly disdained; but it flattered his vanity to retain a famous artist in his service with the power of insulting him at will. On hearing of the success of *Idomeneo* he instantly summoned the composer to Vienna, where he was spending the season. Mozart lost not a moment in presenting himself, but he soon found his position intolerable. That he should be condemned to dine with his patron's servants was the fault of the age, but the open disrespect with which the lowest menials treated him was due to the archbishop's example. Though received as an honoured guest in the houses of the *haute noblesse* of Vienna, he was uniformly addressed by the archbishop in the third person singular, a form used in Germany to express the utmost possible contempt. His salary was reduced from 500 to 400 florins, he was left to pay his own travelling expenses, and he was not permitted to add to his means by giving a concert on his own account or to play anywhere but at the archiepiscopal palace; indeed it was only at the instance of a large number of the nobility that he obtained leave to take part, gratuitously, in a concert given for the poor. Archbishop Hieronymus was hated at court, and most of all by the emperor Joseph, who, on retiring to Laxenburg for the summer, did not place his name on the list of invited guests. This offended him so deeply that he left Vienna in disgust. The household were sent on to Salzburg, but Mozart was left to find lodgings at his own expense. Thereupon he sent in his resignation; and for this act of contumacy was insulted by the archbishop in terms too vulgar for translation. He persevered, however, in his resolution, taking lodgings in a house rented by his old friends the Webers, and vainly hoping for pupils, since Vienna at this season was perfectly empty. Happily he had a sincere though not a generous well-wisher in the emperor, and a firm friend in the archduke Maximilian, who, in common with many noblemen of rank, were disgusted with the archbishop's behaviour. By the emperor's command he wrote a German opera, *Die Entführung aus dem Serail*, which on 16th July 1782 was received with acclamation, and not long afterwards was performed with equal success at Prague. This great work raised the national "singspiel" to a level commensurate with that which *Idomeneo* had already attained for the Italian "opera seria." Gluck's great reform of the lyric drama (based, not, as is sometimes erroneously supposed, on new principles invented by himself, but on those enunciated by Peri and his associates as early as the year 1600, when the first Italian opera was produced at Florence) had already attracted immense attention in Paris, and was everywhere producing good fruit. It was impossible that it should do otherwise, for it was founded on pure dramatic truth. But what Gluck worked out in obedience to a carefully-elaborated theory Mozart effected by simple force of natural dramatic instinct. Moreover, with all his love for graceful melody, his power of expression, and dramatic force, Gluck was not great as a constructive musician. On the other hand, the erudition which in 1770 had won Mozart's diploma from the Accademia at Bologna was no mere rusty exhibition of scholastic pedantry. It enabled him to cast his music into symmetrical and well-considered form, without sacrificing the demands of dramatic consistency; to enchant the unlearned hearer with an endless flow of melody, while satisfying the cultivated musician with the most ingenious part-writing that had ever been imagined in connexion with the stage; to construct the grand finales that have made his operas the finest in the world;—and all this with equal reverence for the claims of legitimate art on the one side and those of passionate expression on the other. For the finales are no dead forms, but living scenes developing the action of the drama. And the impassioned utterances are no poor passages of "sound and fury, signifying nothing," but well-constructed music, shapely and beautiful,—music which Gluck himself, with all his genius, could no more hope to rival than Hasse could hope to rival the choruses in *Israel in Egypt*. For Gluck, though his taste was as refined and his intellect as highly cultivated as Mozart's, was, as Handel justly observed, no contrapuntist; and works like Mozart's needed an intimate acquaintance with the mysteries of counterpoint, no less than purity of taste and intellectual culture. And so it comes to pass that Mozart's operas still retain a stronger hold upon the affections, both of the general public and the initiated worshipper of art, than any other dramatic music that has ever been written.

The next great event in Mozart's life was a disastrous one. Though Aloysia Weber had long since rejected him, his renewed intimacy with the family led to a most unfortunate marriage with her younger sister, Constance, a woman who, neither his equal in intellect nor his superior in prudence, added little to the happiness of his life and less than nothing to its prosperity. The wedding took place at St Stephen's on 16th August 1782. By the end of the year the thriftless pair were deeply in debt. Mozart composed incessantly, played at numberless concerts, and was in greater favour than ever at court and with the nobility; but to the last day of his life his purse was empty. He had, however, many kind friends, not the least affectionate of whom was the veteran Haydn, who was sincerely attached to him. With Gluck he was on terms of courteous intercourse only. Salieri detested him, and made no secret of his dislike.

Mozart's next dramatic venture was a German singspiel in one act, *Der Schauspieldirektor*, produced at Schönbrunn, 7th February 1786. Not quite three months later, on 1st May, he produced his marvellous *Le Nozze di Figaro*, the libretto for which was adapted from Beaumarchais by the abbé Da Ponte. The reception of this magnificent work was enthusiastic. But Vienna was a hotbed of intrigue. Everything that could be done by jealous plotters to mar the composer's success was done, and that so effectively that Mozart declared he would never bring out another opera in the city which treated him so meanly. Fortunately, *Figaro*, like *Die Entführung*, was repeated with brilliant success at Prague. Mozart went there to hear it, and received a commission to write an opera for the next season, with a fee of 100 ducats. Da Ponte furnished a libretto, founded on Tirso de Molina's tale, *El Convidado de Piedra*, and entitled *Il Don Giovanni*. By 28th October 1787 the whole was ready with the exception of the overture, not a note of which was written on the evening before the performance. This circumstance has led to the idea that it was composed in haste, but it is certain that Mozart knew it all by heart and transcribed it during the night from memory, while his wife told fairy tales to keep him awake. The opera was produced on 29th October with extraordinary effect, and the overture, though played without rehearsal, was as successful as the rest of the music.[1] Yet, when reproduced in Vienna, *Don Giovanni* pleased less than Salieri's comparatively worthless *Tarare*.

On returning to Vienna Mozart was appointed kammercompositor to the emperor with a salary of 800 gulden (£80). He also conducted Baron van Swieten's concerts, and composed great quantities both of sacred and secular music, but continued miserably poor, while his wife had become a confirmed invalid. In April 1789 he accompanied Prince Lichnowski to Berlin, where King Frederick William II. offered him the post of "kapellmeister" with a salary of 3000 thalers (£450). Though most unwilling to quit the emperor's service, he informed him of the offer and requested leave to resign his appointment in Vienna. "Are you going to desert me, then?" asked the emperor; and Mozart, wounded by the reproach, remained to starve. The emperor now commissioned Mozart to compose another Italian opera, which was produced 26th January 1790 under the title of *Così fan tutte*. Though the libretto by Da Ponte was too stupid for criticism, the music was delicious, and the opera would probably have had a long run but for the emperor's death on 7th February. The new emperor, Leopold II., was elected at Frankfort in September, and Mozart went thither in the hope of giving some concerts, but he was obliged to sell his plate to pay the expenses of the journey, and returned in December. In March 1791 Mozart consented to write a German opera upon an entirely new plan for Schikaneder, the manager of the little theatre in the Wieden suburb. The piece was addressed especially to the Freemasons and contained ceaseless allusions both in the words and music to the secrets of the brotherhood. Deeply interested in the affairs of a body of which he was himself a member,[2] Mozart excelled himself in this new work, for the overture of which he invented a new art-form, that of the "symphonic fugue." He was rewarded for his labours by a brilliant artistic success, but Schikaneder alone reaped the financial benefit of the speculation.

Before the completion of *Die Zauberflöte* a stranger called on Mozart, requesting him to compose a *Requiem* and offering to pay for it in advance. He began the work under the influence of superstitious fear, believing that the messenger had been sent from the other world to forewarn him of his own approaching death. Meanwhile he received a commission to compose an opera, *La Clemenza di Tito*, for the coronation of the emperor at Prague. He worked incessantly, and far beyond his strength. The coronation took place on 6th September, and its splendours threw the opera very much into the shade. *Die Zauberflöte* was produced on 30th September and had a splendid run. But the *Requiem* still remained unfinished; the stranger therefore made another appointment, paying a further sum in advance. Mozart worked at it unremittingly, hoping to make it his greatest work. His sacred music, though less florid than Haydn's, was even more voluptuously beautiful,—perfect in its kind, though showing no trace of the stern grandeur of Handel, or the devotional purity of Palestrina. In the *Requiem* he surpassed himself, but he was not permitted to finish it. When the stranger called the third time the composer was no more. The score of the *Requiem* was completed by Süssmayer, whose task, simplified by the instructions he had received from Mozart on his death-bed, was a purely mechanical one. It is now known that the work was commissioned by Count Walsegg, who wished to perform it as his own.

Mozart died 5th December 1791, apparently from fever, though he believed himself poisoned. His funeral was a disgrace to the court, the emperor, the public, society itself. On the afternoon of the 6th his body was hurried to a pauper's grave; and because it rained Van Swieten, Süssmayer, and three other "friends" turned back and left him to be carried to his last long home alone.

Mozart's compositions, whether for the church, the theatre, or the concert-room, are pervaded by an individuality of style which can never be mistaken. Of the truthful expression of his dramatic music we have already spoken. Apart from its innate beauty, its artistic strength consists in its perfect adaptation to the situation for which it is designed. The same great quality characterizes his symphonies, his concertos, and his sonatas for the pianoforte and other solo instruments. Each work presents us with the logical and consistent development of a noble idea, of which we never lose sight for a moment. No trace of indecision or inconsequence is discernible in any part of the composition. Every note is fitted into its place with a definite purpose, and takes its share in the arrangement of the design with a certainty which leaves no doubt as to the object for which it was introduced. The result of this well-considered symmetry is a degree of technical perfection which no composer, ancient or modern, has ever surpassed. But technical perfection does but supply the body into which true genius alone can breathe the living soul. And here it is that we must look for the inexpressible charm which Mozart's music never fails to exercise upon all who hear it. Its boundless wealth of melody is governed by a refinement of taste which excludes every subject, every phrase, every minutest cadence which is not both beautiful in itself and capable of enhancing the beauty of its fellow-phrases. Mozart himself has left us, in a letter to Baron V——, a memorable description of the loving care he exercised in the selection of his charming phrases. He tells us that his ideas flowed best when he was alone and feeling cheerful. Having once conceived an idea he subjected it to a process of mental elaboration which continued until the composition was complete. Then, and not till then, he committed it to paper; and hence it was that he was able to write out the overture to *Don Giovanni* on the day of its first performance.

Von Köchel's *Chronologischthematisches Verzeichniss*, 1862, contains a complete list of Mozart's works. (W. S. R.)

MOZDOK, a Russian town in the government of the Caucasus and province of Stavropol, lies on the left bank of the Terek, 465 feet above the level of the sea, in 43° 41′ N. lat. and 44° 39′ E. long., 58 miles north of Vladikavkas, with which it is connected by a highroad, and 36½ miles east of the Prochladnaya station on the Rostoff-Vladikavkas railway. Built on the site of an oak-wood (*mos*, *nos*, thick or dark, *dok*, wood, in Kabardine) in 1763 by Kogorko-Kontchukin, prince of Kabarda, it soon became an important point in the Russian line towards the Caucasus, and was fortified with earthen rampart and ditch. In 1840 it was attacked by Schamyl and 5000 mountaineers. The population (8760 in 1863) numbered 11,008 in 1877, 52 per cent. being "Orthodox" (with very few sectaries), 29 per cent. Armenians, 15 per cent. Mohammedans, and 2 per cent. Catholics. Gardening and agriculture are the main means of subsistence, scarcely fifty individuals living by trade. The melons and water-melons of Mozdok are widely famed; and, though vine-growing was only begun in 1873, by 1876 there was a production of 563 casks of wine or 1,416,000 bottles. An oil-mill, tanneries, and soapworks are among the industrial establishments. Three fairs are held in the year.

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[1] Michael Kelly, in his *Reminiscences*, has left a delightful account of the circumstances.

[2] Freemasonry did not at that time involve the censure of the Catholic Church, or Mozart would certainly have renounced it.

MOZLEY, James Bowling (1813-1878), English theologian, a native of Lincolnshire, born in 1813, was educated at Oriel College, Oxford, where he graduated in 1834. He was appointed to a fellowship at Magdalen College in 1837, was ordained deacon in 1838, priest in 1844, and became vicar of Shoreham in 1856. In 1869 he became canon of Worcester, and in 1871 regius professor of divinity at Oxford. He died at Shoreham on 4th January 1878.

He wrote *A Treatise on the Augustinian Doctrine of Predestination* (1855); *The Primitive Doctrine of Baptismal Regeneration* (1856); *A Review of the Baptismal Controversy* (1863); *Subscription to the Articles: a Letter* (1863); *Lectures on Miracles*, being the Bampton Lectures for 1865; *University Sermons*, 1876; and a volume on the Old Testament entitled *Ruling Ideas in Early Ages* (1877). In all these works he has advocated his views, those of a strongly-convinced English High-Churchman, with uprightness, learning, acuteness, and sagacity.

MTSENSK (popularly called *Amchensk*), a district town of Russia, situated in the government of Orel on the navigable Zusha river, 17 miles from its junction with the Oka, on the Moscow and Kursk railway, 32 miles to the north-east of Orel. It is mentioned in the Russian chronicles as early as 1147 as a town of the principality of Tchernigoff. Many battles were fought for its possession, and the plains around are dotted with grave-mounds. Though protected by a fort which occupied a strong position, the town was taken and plundered several times by the Tatars, the Russians, the Poles, and the Lithuanians. From 1320 to 1530 it was under the rule of Lithuania; in the latter year it was taken by Russia, and became one of her chief strongholds against the raids of the Tatars. It is now an important centre for trade in grain, hemp, hemp-seed oil, tobacco, and wine-spirit, shipped on the Zusha, Oka, and Volga to and from Moscow, Nijni-Novgorod, and St Petersburg, or forwarded by rail to Moscow, Libau, and Riga. Population, 15,000.

MUCILAGE, a term which denotes a viscid or glutinous mixture of water and any gummy vegetable substance. The principal sources of mucilaginous matters are enumerated under Gum (vol. xi. p. 276). A mucilage indicates a physical condition or property rather than any definite chemical constitution, and consequently it may possess various characters, but as a rule the term is restricted to the bodies which swell into a kind of jelly with water, having the insoluble gum bassorin as their principal constituent. Such mucilages are useful in medicine as emollients and demulcents, and in the arts as thickeners (in calico-printing, dyeing, &c.). A remarkable variety of mucilage has been recently obtained by Stanford of Glasgow from certain of the commoner kinds of *Algæ*, and called from its source algin. The *Laminariæ* yield it in abundance and in a comparatively colourless condition; it is also found in *Fuci*, but darkly coloured. It is a substance of considerable thickening character, and has the peculiar property of gelatizing on the addition of a dilute mineral acid. A solution containing only 2 per cent. of algin when thus treated sets into a solid jelly. Alcohol has the same effect upon it. It is extracted from the plants by sodium carbonate, and as it can be obtained in large quantity it may become useful in the dressing of fabrics, or as a thickener in calico-printing.

MUGGLETON, Lodowick (1610-1698), the founder of the sect of the Muggletonians, was born in Bishopsgate Street, London, about the year 1610. His father was a farrier, but he himself was bred to be a tailor. In 1651 he began to have revelations by "a motional voice," and to proclaim himself and a brother tailor, John Reeve, as the two witnesses mentioned in the Apocalypse, and as the "true prophets of the only high, immortal, glorious God, Jesus Christ." An exposition of their doctrines was published in 1656 under the title of *The Divine Looking-Glass*. Among other views (besides the doctrine of the divine mission of the authors) this work taught that the distinction of the three persons in the Trinity is merely nominal, that God has a real human body, and that He left Elijah as His vicegerent in heaven when He Himself descended to die on the cross. These opinions, strange to say, gained considerable currency, and naturally also called forth much opposition. William Penn's book, *The New Witnesses proved Old Heretics* (1672), was directed against them, and in 1676 Muggleton was tried at the Old Bailey and convicted of blasphemy. Reeve died in 1658, but Muggleton survived till 1698. His collected works, including the posthumous *Acts of the Witnesses*, were published in 1756; and in 1832 some sixty Muggletonians subscribed to bring out a new edition of *The Works of J. Reeve and L. Muggleton* (in 3 vols. 4to). Even as late as 1846 *The Divine Looking-Glass* was reprinted by members of the sect, which is now, however, believed to be extinct.

MÜHLHAUSEN, a busy manufacturing town of Thuringia in the district of Erfurt, Prussia, is situated on the right bank of the Unstrut, 25 miles to the north-west of Gotha. It consists of a new and an old town surrounded by five suburbs, and with its numerous old churches and towers presents a quaint and picturesque appearance. The most interesting churches are those of the Blessed Virgin and St Blasius, dating respectively from the 14th and from the 12th century; the town-house is also a fine mediæval structure. Mühlhausen contains a gymnasium, a "real school," a theatre, an orphanage, and two hospitals. Its chief industries are the spinning and weaving of woollens and cottons, in which about 50,000 spindles and 3000 looms are employed; but a list of its other manufactures includes the most varied articles, such as needles, machinery, cigars, soap, hosiery, and shoes. There are also numerous large establishments for dyeing, tanning, lime-burning, iron-making, brewing, and the preparation of liqueurs. The active trade of the town is mainly in grain, fruit, garden-stuff, wool, and cattle, and is fostered by the fertility of the surrounding country, which is remarkable for the abundance of its streams and water-courses. The great majority of the inhabitants, numbering 23,478 in 1880, are Protestants.

Mühlhausen is one of the oldest towns in Thuringia, and is said to have been fortified in 925. Its early importance is shown by the grant of imperial privileges made to it by the emperor Henry I., and by the diet held there in 1135. At the epoch of the Reformation Mühlhausen became notorious as one of the chief seats of the Anabaptists. Thomas Münzer, one of their leaders, was captured in the vicinity and executed in the town. Internal dissensions and injury received during the Thirty Years' War and the Seven Years' War afterwards reduced Mühlhausen to unimportance. In 1802 it lost its independence and passed to Prussia, in 1807 it was attached to the kingdom of Westphalia, and in 1815 it again became Prussian. The Teutonic Order established itself at Mühlhausen in 1200, and acquired considerable property there, which ultimately passed into the possession of the town.

MUIR, JOHN (1810-1882), Sanskrit scholar, was born on 5th February 1810 in Glasgow, where his father, William Muir, was a merchant. He was educated at the grammar school of Irvine, the university of Glasgow, and the East India Company's college at Haileybury. He went to India in 1828, and served with distinction in various offices, as assistant secretary to the board of revenue, Allahabad, as magistrate and collector at Azimgarh, as principal of the Victoria College, Benares, and as civil and session judge at Futtehpoor. He was throughout remarkable for his zeal in cultivating and encouraging the study of Sanskrit, in finding methods and furthering schemes for the enlightenment and amelioration of the Hindus. He was persuaded that the only way in which they could escape from the tyranny of caste, with all its attendant evils, was by being made to know how they had become what they were, and also how the freer and more civilized Western peoples believed and lived. He worked assiduously at the organization and development of the higher education of India, and endeavoured to stimulate the learned classes to the study of their own most ancient literature, and of the religious and philosophical literature of the West. He did while in India much work in both departments, and was the occasion of still more being done both by Hindus and Europeans. In 1853 he retired from the service and settled in Edinburgh, where he may be said to have continued under more favourable conditions his Indian labours. In 1862 he endowed the chair of Sanskrit in the university of Edinburgh, and was the main agent in founding the Shaw fellowship in mental philosophy. He was a D.C.L. of Oxford, LL.D. of Edinburgh, and Ph.D. of Bonn. He died 7th March 1882.

In 1858 appeared vol. i. of his *Original Sanskrit Texts* (2d ed. 1868); it was on the origin of caste, an inquiry intended to show that it did not exist in the Vedic age. Vol. ii. (1st ed. 1860, 2d 1871) was concerned with the origin and racial affinities of the Hindus, exhibiting all the then available evidences of their connexion, their linguistic, social, and political kinship, with the other branches of the Indo-European stock. Vol. iii. (1st ed. 1861, 2d 1868) was on the Vedas, a full and exhaustive inquiry as to the ideas of their origin, authority, and inspiration held both by the Vedic and later Indian writers. Vol. iv. (1st ed. 1863, 2d 1873) was a comparison of the Vedic with the later representations of the principal Indian deities, an exhibition of the process by which three gods hardly known to the Vedic hymns became the deities of the former Hindu Trimurti. Vol. v. (1870) was on the Vedic mythology These texts form still our most exhaustive work on the Vedic age, and show better than any others the point from which the peculiar religious and political development of India started. Dr Muir was also the author of a volume of *Metrical Translations from the Sanskrit*, an anonymous work on *Inspiration*, several works in Sanskrit, and many essays in the *Journal of the Royal Asiatic Society* and elsewhere.

MULA, a town of Spain, in the province of Murcia, is situated 22 miles to the westward of that town on the slope and summit of an eminence on the left bank of the Mula, a small tributary of the Segura, periodically liable to destructive floods. The Sierra Espuña rises on the south to a height of nearly 5200 feet. The usual public buildings, grouped round the central square of the town, present no features of special interest. The ground of the neighbourhood is somewhat broken, but of the cultivable portion about one-half is occupied with olives and vines. The industries and trade of the place are connected principally with agriculture. The population in 1877 was 10,597. About 3½ miles to the eastward are two groups of houses known as the Baños de Mula, with warm sulphurous springs of considerable local repute.

MULBERRY. The mulberry family (*Moraceæ*) is usually included, along with the closely-allied figs, bread-fruits, nettles, hops, planes, and elms, in one vast alliance of monochlamydeous Exogens, the order *Urticaceæ* (or *Ulmaceæ*, as Baillon prefers to call it). The *Moraceæ* include three sub-families, of which the typical genera are: *Dorstenia*, which is almost a Fig; *Broussonetia*, the Paper Mulberry of Japan, the East Indies, and the South Sea Islands; and *Morus*, the Mulberry proper, of which the ten or twelve species are all native to temperate regions in Asia and America, or to hill regions in their tropics, but are readily cultivated in similar climates in Europe, Africa, and Australia.

The Black Mulberry (*Morus nigra*, L.) is mainly cultivated for its purplish black compound fruit (a *sorosis* formed by the aggregated drupes of the whole female inflorescence), which is wholesome and palatable if eaten fresh from the tree before acetous fermentation has had time to set in. Save in syrup, and on account of its rich dark-red colouring matter, it has no longer any pharmaceutical uses. (See HORTICULTURE, vol. xii. p. 272.)

The White Mulberry (*M. alba*, L.), so called from its nearly white fruit, is the one mainly employed in sericulture. There are many varieties, among which the Philippine Mulberry (var. *multicaulis*) is perhaps most highly esteemed. The American and Indian species (*M. americana* and *M. indica*, the latter not to be confounded with *Morinda citrifolia*, a cinchonaceous tree, sometimes also called Indian Mulberry) are also cultivated for the same purpose.

For systematic and descriptive purposes see "Morus" in Baillon, *Hist. d. Plantes*, vi.; or Luerssen, *Med. Pharm. Botanik*, vol. ii. For history and economic uses see F. v. Muller, *Select Plants for Culture in Victoria*, Melbourne, 1876; and Hehn, *Kulturpflanzen*, &c., 3d ed., Berlin, 1877; also SILK.

MULE. Though this term is not unfrequently applied to the produce of two creatures of different species, and is synonymous with hybrid, yet in its ordinary acceptation it is employed to designate the offspring or "cross" between the equine and asinine species. There are two kinds of mule—the *Mule* proper (*Equus Asinus*, var. γ; *Mulus*; Fr., *Mulet* or *Grand Mulet*; Ger., *Grosser Maulesel*), which is the hybrid produce of a male ass with a mare, and the *Hinny* (*Equus Asinus*, var. δ; *Hinnus*; Fr., *Bardot* or *Petit Mulet*; Ger., *Kleiner Maulesel*), the offspring of the stallion and female ass. The mule is the more valuable of the two, and to its production the attention of breeders is entirely directed. Indeed, the hinny is so rarely produced, owing to the antipathy of the stallion to the female ass, that many authorities deny its existence.

Intercourse between the mare and male ass is very seldom voluntary; indeed, horses will not associate with asses, and combats between them are often serious. The male ass will freely mate with the mare, but the latter has a strong repugnance to him, as has also the stallion for the female ass. Hence in mule-breeding the mare has to be blindfolded and otherwise deceived, or secured in a travis or by ropes, before she will allow the ass to approach her. Fecundation is not so certain between the ass and horse species as between the male and female of either species, for, while of four mares three at least will be fecundated by the stallion, as a rule only two will be so by the ass.

Fecundation of the hybrid female by the male ass or the stallion is not very rare; but it is otherwise with the male hybrid, no instance being recorded in which he has been prolific, though physically the animal appears to be perfect, and often exhibits an intense ardour for the female. The female mule, when fecundated, seldom reaches the natural term of pregnancy, and rarely brings forth a living offspring. The duration of gestation in a mare impregnated by the ass is a little longer than in impregnation by the stallion,—the average being 375 days. Abortion readily occurs, and more care is necessary than in breeding horses or asses.

In breeding mules the choice in the male parent is limited so far as shape is concerned, as the best-formed asses have, relatively to their height, the head too large, short neck, sides too flat, low shoulders, narrow croup, thin arms and thighs, and very narrow hoofs. To obtain well-shaped mules, therefore, the selection of the mare is of the greatest importance in remedying the defects of the sire. Mares with a small head, round body, short back, wide chest and muscular croup, large thighs and arms, a long neck well set-on, and wide round hoofs are the best. Height is not of so much moment, but a mare measuring from 14 to 15 hands high is preferable. A good height for the male ass is between 13 and 14 hands. Mules inherit to an extraordinary degree the shape and peculiarities of the sire; from the mare they derive size, but rarely her bad shape or unsoundnesses. This is fortunate, for, though it is always desirable to breed from sound well-formed stock, yet mares so unsound or defective in shape as to be disqualified for horse-breeding may be utilized for mule-breeding.

The mule foal is not so strong on its limbs as the horse foal, and it does not grow so quickly. It is longer in reaching maturity, for it is of little use under four years of age; but it is useful for a longer period than the horse, often working until it is twenty, thirty, and even forty years of age. When full grown the mule is from 13 to 15, and sometimes 16 hands high; but those from 14 to 15 hands are generally preferred.

The mule is endowed with the chief characteristics of its parents. In its short thick head, long ears, thin limbs, small narrow hoofs, short mane, absence of chestnuts (horny growths) inside the hocks, and tail destitute of hair at the root it is asinine; while in height and body, shape of neck and croup, uniformity of coat, and in teeth it is equine. It has the voice neither of the ass nor of the horse, however, but emits a feeble hoarse noise. The most common colour of the mule is a brown or bay-brown,—bay, or bright bay, or piebald being rare; a chestnut tint is sometimes noticed. It possesses the sobriety, patience, endurance, and sure-footedness of the ass, and the vigour, strength, and courage of the horse. As a beast of burden it is preferable to the horse, being less impatient under the pressure of heavy weights, while the skin being harder and less sensitive renders it more capable of resisting sun and rain. It is very frugal, easily fed, and equally good for carrying as for drawing loads; it walks well and steadily, easily traverses the worst roads or paths, will climb or descend a steep mountain, or pick its steps by the side of a precipice, with the surety and safety of a goat. For hot and dry countries, especially those which are mountainous, it is well adapted, though cold and wet regions are not suitable for it.

The mule, like the ass, enjoys an extraordinary immunity from disease. After the campaign in Egypt in 1882 the English horses suffered most extensively and severely from a kind of malarious fever, but the mules were entirely exempt. A similar exemption has been noticed during the prevalence of epizootic maladies at other times. Nevertheless those diseases which attack the mule (and the asinine species) run their course with great rapidity; for example, glanders, which often appears in a chronic form in the horse, is most acute in the mule and ass. These are also very liable to tetanus from trifling injuries.

The mule has been in use from very early times; the inhabitants of Mysia and Paphlagonia are said to have been the first breeders. With the Greeks and Romans, the latter especially, the mule was much valued for its good qualities, being employed to draw carriages and carry loads. At the present day it is extensively used in nearly every part of the world, in some countries almost supplanting the horse, while for military purposes it is undoubtedly the best transport animal.

The principal mule countries in Europe are the south of France, Spain, Portugal, and Italy, where they are used for pack and draught. The French mules are most numerous on the borders of the Pyrenees, in Gascony, and in Poitou. In Spain mules are used in the Catalan provinces, in the mountainous districts of Andalusia, and in the province of Alicanta. Good draught-mules are bred in La Mancha and in the districts on the slopes of the Pyrenees, where they are employed to carry loads. But in Spain, Italy, and some other countries they are also extensively used in carriages; in Spain particularly, where large, fine mules are bred for this purpose, a pair of these animals will often cost more than a pair of horses. The mules of Asia Minor, Syria, Cyprus, Egypt, and Algeria, as well as those of the district between the Tigris and the Persian frontier and in North China, are good. In the Punjab provinces of British India many excellent mules are bred, breeding being largely promoted by the Government. Good mules are reared in North and South America, the principal districts for breeding them in the United States being Kentucky, Missouri, and Kansas. The Kentucky mules are well shaped and showy, being derived from nearly thoroughbred mares known as Kentucky trotters, while those reared in Missouri are hardy, and can endure much privation and hardship. The Mexican mule, bred by a male ass out of a mustang mare, is also a very hardy, strong, and useful animal.

France is perhaps the most important mule-raising country in Europe, four centres being more particularly devoted to this kind of industry: Poitou, the mountainous districts of central France, the Pyrenees, and Dauphiné. The mules of these different parts chiefly differ in height; those of Poitou are large, powerful, and long in the body, and are mainly exported to the departments of Languedoc and Provence, as well as to Spain, Italy, and America; those of Dauphiné are of medium height, with a short, thick body; while those of the centre and the Pyrenees are lighter and smaller, but more active.

Mule-breeding in Poitou is one of the most important branches of industry, and is supposed to date from the time of Philip V. of Spain, when the particular breeds of horses and asses were imported into that region and Gascony. But there is evidence to show that so early as the 10th century the mules of Poitou were of excellent quality. Though this industry has for a number of years been in a most flourishing condition, this has not always been the case; more than a century ago it was the object of violent attacks, and, had it not been for the great advantages the breeders derived from it and the comparatively small expense incurred in carrying it on, it must have languished or ceased altogether. The Government could not understand why so many mares should be lost to horse production and kept to breed mules alone; and in 1717 the intendant-general of the *haras* went so far as to prohibit male asses being put to mares measuring more than 12 hands from the withers to the top of the hoof under penalty of a fine and confiscation of the ass; and the minister Bertin issued a decree to the effect that all the male asses in Poitou were to be castrated. It was only at a recent period that the *haras* administration ceased to oppose mule-breeding, when it found that it could not be successfully suppressed; for, while in the one department of Deux-Sèvres 13,000 mares were employed in mule production in 1816, fifty years afterwards there were 23,000. Besides, it was discovered not only that this industry added largely to the national wealth but that mules were extremely useful in the army as pack animals, as well as for draught, especially for mountain artillery.

The Poitou mules are large, and strong enough to be used for heavy draught; those produced elsewhere in France, especially in Gascony, are light and better adapted for weight carrying. In Poitou at the present time about 50,000 mares are kept for mule production; of these it is estimated that 38,000 are bred from every year, and of the produce 18,000 are sold annually. In the fairs of Poitou some mules fetch the large price of 1300 to 1500 francs, and many are sold for 900 or 1000 francs. If the average price be fixed at only 600 francs, it will be seen that Poitou alone realizes annually from its mule-breeding no less than 10,800,000 francs. The statistics of 1840 give the number of mules in France at 373,841, of 1852 at 315,331, of 1862 at 330,987, and the census of 1866 at 345,243. The average price of a mule in 1840 was reckoned at 172 francs, in 1852 at 183 francs, and in 1862 at 278 francs. The total value of the mules in 1840 was estimated at 64,284,246 francs, in 1862 it had increased to 92,078,458 francs. The total amount of revenue derived from the trade in mules was: in 1840, 21,244,148 francs; in 1852, 87,548,310 francs; and in 1862, 162,341,162 francs. Since the last-mentioned date it is probable that there has been a further increase.

In the United Kingdom mules are seldom bred, and their services do not appear to be much appreciated; hence their importation is almost *nil*. After the war in Egypt in 1882 a large number of mules which had been purchased by the British Government for that campaign were brought to England and sold by public auction, but the average price realized was probably not more than one-half the amount they had cost in the countries in which they were originally purchased.

Mules have in recent times been largely employed in British campaigns, as in the Crimea, India, Abyssinia, South Africa, and Egypt. In the Abyssinian campaign more than 10,000 pack-mules were obtained from Cyprus, Brindisi, Malta, Smyrna, Gibraltar, Alicante, Valencia, Scanderoon, and Beyrout. The order in which these places are enumerated indicates the relative adaptability of the mules for pack transport during that campaign.

During the Zulu war, South-African or Colonial, South-American, North-American, and French mules were employed; but of these the South-African and South-American were found to be the most suitable.

In India mules form part of the permanent transport of the Punjab irregular force, and are used as pack animals in the mountain batteries. They have also been largely used for transport in the many expeditions which have taken place on the north-western frontier. During the recent Afghan war it was proved that for mountain warfare the mule was by far the best beast of burden; and the director of transport with the Indian division during the late Egyptian campaign reported highly of the work done by the Punjab mules, which are somewhat famed for undergoing a great amount of exertion on little food. The breeding of pack-mules, as also of those adapted for batteries of mountain artillery, too much neglected hitherto, is now much encouraged by the Government of India, which supplies many good male asses to different districts free of charge. These asses are chiefly Arab, Spanish, French, and Italian; but very good animals are at times obtained from Bokhara. By stimulating the breeding of improved asses an increasing supply of good sires and mules is obtained.

The experience of British and other European armies in favour of the mule has been corroborated by that of the United States. In the quartermaster-general's report for 1865 it is stated: "The experience of this (secession) war has convinced all officers of this department that for the army-trains mules are much superior to horses, and of late the horses have almost entirely disappeared from the trains, being transferred to the cavalry or artillery and replaced by mules."

Mules are well adapted for the sick or hospital transport of an army in the field as pack animals, being smaller, surer-footed, and shorter-paced than horses; but they should be specially selected and trained for this purpose, animals of sufficient strength and docility being necessary. A loaded mule will walk a little more than 3 miles an hour, though the pace will much depend upon the roads. The pace is slow moving down hill, quick up hill. Mules sleep from three to four hours in the twenty-four, the soundest sleep being towards dawn. The male mule can carry more weight than the female, though the latter is steadier for work, being more docile; male mules are often vicious and carry loads badly, so that to render them more tractable they are sometimes castrated. For saddle purposes those which more resemble the horse than the ass are preferable.

The carrying power of the mule varies according to a variety of circumstances from 100 lb to 300 lb, the average being about 200 lb including the pack-saddle. In a journey made in 1856 from the city of Del Norte to Chihuahua and Durango in Mexico, a distance of about 500 miles, it was found that out of a train of seventy-five mules the most it was possible for any mule to carry was 275 lb; not more than twenty mules could convey more than 250 lb, the average weight carried by the whole train being a little less than 200 lb. The distance per day was about 15 miles. In another journey it was noted that some of the very best mules, out of a very superior description specially selected, which were loaded with 300 lb, gave out completely at the end of two weeks. In the Abyssinian expedition the load had to be reduced to 100 lb, not including the pack-saddle. It has been stated that a good compact mule, when well trained, properly fitted and handled, will carry in ordinary field service 30 per cent. of its own weight. If the load is in proportion to the size of the animal, small mules have the advantage. A 600 lb mule is quite as good for a 200 lb load as a 900 lb mule is for a 270 lb load.

During the Peninsular War mules were hired by the commissariat for a Spanish dollar a day and rations for the driver. The weight of the load was fixed at 200 lb, and the length of journey in a mountainous country with bad roads was from 10 to 12 miles loaded, 15 to 16 unloaded. The maximum price paid for mules purchased for the Bhutan (India) expedition was 180 rupees; those purchased at Baghdad and Bushire for the Abyssinian expedition averaged 124 rupees 8 annas, in Syria about £20. The mules purchased in the Punjab for the same expedition cost 225 rupees each; those procured in Egypt about £26 10s. per animal. The mules purchased in New York for the Zulu war cost £42 per head, though good serviceable mules can be bought at St Louis for from £25 to £30. A firm in London at the same time tendered to supply mules from Spain at £35 each for pack, and £37 10s for draught. The South-African mules bought during the Zulu war cost on an average £23 each.

It has been observed that large mules are not so durable as medium-sized ones, especially for military service. In Algeria it was rare to find a mule over 14 hands more than fifteen years of age, and those approaching 15 hands died younger, while those between 13 and 14 hands were frequently more than twenty years old. The older animals were very often mares. (G. FL.)

MÜLHAUSEN (in French *Mulhouse*), the chief town of a circle and the industrial centre of Upper Alsace, Germany, lies between the Ill, an affluent of the Rhine, and the Rhine-Rhone Canal, about 56 miles to the south of Strasburg and 18 to the north-west of Basel. The old town, surrounded by arms of the Ill, has narrow and irregular streets, while to the south, on the canal, lie the handsome villas and fine promenades of the new town. Most of the older buildings have had to make way for manufactories, so that the town-house, dating from 1552, is an almost solitary witness to the town's mediæval prosperity. The Roman Catholic church of St Stephen, the new Protestant church, the building of the Société Industrielle, and the new Musée are the most prominent modern buildings. The educational institutions include a gymnasium, modern schools, technical schools for the various handicrafts, and an academy in which designers are trained for the textile industries of the town. The most important interest of Mülhausen centres in the making of cotton and muslin goods, and calico-printing. This industry was introduced in 1746, and has since steadily prospered in the hands of several wealthy families which are closely connected by intermarriage and lend each other a firm and powerful financial support. From 20,000 to 24,000 hands in the town and upwards of 60,000 in the neighbourhood are engaged in textile manufactures, the products of which are exported to all parts of the world. The manufactures of machinery, locomotives and railway plant, chemicals, and hardware are also important. A very noteworthy feature connected with the rise of the commercial prosperity of the town is the attention paid by the manufacturers to the wellbeing of their workpeople. In 1853 John Dollfuss, mayor of the town, founded the "workman's quarter" to the north-east of the old town, which now consists of about 1000 model buildings, with public bath-, wash-, and bake-houses, library, &c. The houses are let on a system by which the occupant becomes the owner after the payment of a certain number of monthly instalments. Besides this more prominent effort, which has been the model for similar attempts in many other towns, a "Société Industrielle" for the encouragement of original discovery and invention among the workmen has existed since 1825, and there are various benevolent societies, including a large institution with 250 beds for the reception of aged workmen. Mülhausen also carries on an active trade in grain, wine, colonial produce, and timber, which is much facilitated by its fine river harbour. After the annexation of Alsace to Germany in 1871 the French sympathies of the inhabitants were shown by the extraordinary decrease in the number of its inhabitants. The population has now, however, regained its full proportions, amounting in 1880 to 63,629, of whom 47,395 were Roman Catholics.

Mentioned as early as 717, Mülhausen was raised to the rank of a free town of the empire in 1198, and received very extensive privileges from Rudolph of Hapsburg in 1273. It suffered considerably in the various wars of the Middle Ages, but generally managed to maintain its independence. In 1446 it expelled its nobles and formed an alliance with Switzerland, and this became a permanent union in 1515. By the peace of Westphalia (1648) it was recognized as an independent ally of the Swiss League. In 1798 it sought incorporation with France from motives of commercial policy, and in 1871 it passed to Germany.

Compare Metzger, *La République de Mulhouse* 717-1798 (1876); and Schall, *Das Arbeiterquartier von Mülhausen* (1876).

MÜLHEIM-AM-RHEIN, the chief town of a circle in the district of Cologne, Prussia, lies on the right bank of the Rhine, 2 miles below Cologne. It is a pretty and well-built town, with important manufactures of silk, velvet, ribbons, sail-cloth, belting for machinery, leather articles, yarn, and chemicals. It also contains a rolling-mill, boiler-works, telegraph-works, malt manufactories, several breweries, and a shipbuilding yard. Mülheim carries on a brisk trade by rail and river, serving as an outlet for the manufactures of Bensberg and Gladbach, and for the wines of the upper Rhine, Nahe, and Moselle. Its educational institutions include a flourishing weaving school and a "real school" of the first class. The most striking building is the modern Gothic church. Though of ancient foundation, Mülheim did not receive a municipal charter till 1587. Its industrial prosperity is in great part due to the influx of Protestants expelled from Cologne at the beginning of the 17th century. The population in 1880 was 20,420.

MÜLHEIM-AN-DER-RUHR, the chief town of a circle in the district of Düsseldorf, Prussia, is situated on the Ruhr, an affluent of the Rhine, about 7 miles from Essen and at the intersection of several railways. Like most of the towns in this district, Mülheim finds its chief industry in iron-working, and contains numerous blast-furnaces, rolling-mills, foundries, and engine-works; it also carries on manufactures of leather, wool, cotton, calico, tobacco, paper, and other miscellaneous goods. About 6,000,000 tons of the Ruhr coal are annually forwarded by river and rail from Mülheim, which also carries on a considerable trade in timber and colonial produce. In the neighbourhood are important sandstone quarries, a large zinc foundry, glass-works, and a carpet manufactory. Mülheim, which possesses a church of the 12th century, was formerly included in the duchy of Berg, and became a town in 1508. In 1880 it contained 22,146 inhabitants, about two-thirds of whom were Protestants.

MULL, an island of Scotland, county of Argyll, and the largest of the Inner Hebrides, is bounded W. by the Atlantic, N. by Loch Sunart, N.E. by the Sound of Mull, and S.E. by the Firth of Lorn. Its area comprises about 235,000 acres, of which only about 13,000 are arable. It is triangular in shape, its greatest length being about 24 miles, and its greatest breadth about 30 miles. Lochs Na-Keal and Scridain form deep indentations on its western coast, and there are a large number of smaller inlets. The coast-line is rocky, and especially on the west there are numerous caverns and horizontal terraces of basalt. The prevailing rock is Old Red Sandstone, but the valleys are filled up with Miocene rocks, consisting chiefly of lava flows and ashes of great terrestrial volcanoes. There is an intrusion of granite towards the south, and also a narrow belt of limestone. The surface is for the most part rugged and mountainous, Ben More rising to the height of 3185 feet. Sheep and black cattle are kept, and barley, oats, and potatoes are grown. Herring fishing is prosecuted at Tobermory, where is one of the best and safest of the western harbours of Scotland. There are several ancient castles, the principal being those of Duart and Aros. The population of the island in 1881 was only 5229.

MÜLLER, JOHANN (1436-1476). See REGIOMONTANUS.

MÜLLER, JOHANN VON (1752-1809), an eminent Swiss historian, was born on 3d January 1752 at Schaffhausen, where his father was a clergyman and rector of the gymnasium. In 1769 he went to the university of Göttingen in order to study theology; but, under the influence of Schlözer, he devoted himself chiefly to historical research. Having passed his theological examination, he was made professor of Greek at the Schaffhausen gymnasium in 1772; and in the same year he published his first work, *Bellum Cimbricum*. By the advice of Bonstetten, his most intimate friend, he went in 1774 to Geneva, where he acted for some time as a tutor in the house of a councillor of state. At Schaffhausen he had begun to study carefully the sources of Swiss history, and at Geneva he continued his investigations with increasing ardour. Lectured on universal history which he delivered during this period formed the basis of his *Vierundzwanzig Bücher allgemeiner Geschichten*, one of his most brilliant writings. In 1780 appeared the first volume of his *Geschichte der Schweizer*, a work which placed him immediately in the front rank of the historical writers of his day. During a visit to Berlin he had an interview with Frederick the Great, from whom he hoped to receive an appointment worthy of his genius and reputation. Disappointed in this expectation, he accepted the professorship of the science of statistics at Cassel, where he wrote his *Reisen der Päpste*. In 1786, having spent two years partly at Bonstetten's country seat and partly in Bern, he entered the service of the elector of Mainz, by whom he was rapidly promoted to important offices in the state. He was also ennobled and made a knight of the empire (Reichsritter). At Mainz he issued several books, besides the second volume of his History of the Swiss Confederation. When Mainz was occupied by the French in 1792 Müller settled in Vienna, where he remained for twelve years, being connected with the imperial library from 1800. Failing to receive the promotion to which he thought he was entitled, and being forbidden after the appearance of the third volume of his Swiss History to continue the publication of the work, he went in 1804 to Berlin, where he became historiographer and a councillor of war. In Berlin he finished the fourth volume of his *Geschichte der Schweizer*, edited the works of Herder, and wrote various treatises for the Academy, including one *Über die Geschichte Friedrich's II.* Up to this time Müller had been an enthusiastic advocate of free institutions, but he now modified his convictions; and in 1807 he accepted from Napoleon the office of secretary of state in the kingdom of Westphalia. Early in 1808 he was transferred at his own request to the office of director-general of public instruction. On 29th May 1809 he died at Cassel.

The value of Müller's contributions to history is marred by the occasional extravagance and obscurity of his style, and by his inadequate appreciation of the tests of historic credibility; but his learning, his generous sympathies, his grasp of great principles, and his power of vividly presenting some aspects of character secure for his writings an enduring place in German literature. An edition of his *Sämmtliche Werke*, in 40 vols. (published originally in 27 vols. in 1810 to 1819) was issued in 1831 to 1835. Biographies of Müller were compiled by Döring and other writers.

MÜLLER, JOHANNES (1801-1858), one of the most distinguished physiologists of Germany, was born at Coblentz on 14th July 1801. He became a privat-docent in the university of Bonn in 1824. In 1826 he was appointed extraordinary professor of physiology in the same university, and he became the ordinary professor in 1830. In 1833 he was removed to the university of Berlin, where he filled the chair of anatomy and physiology with great distinction until his death on 28th April 1858. Müller made numerous researches in various departments of physiology, and in particular he extended knowledge as to the mechanism of voice and speech and of hearing, and as to the chemical and physical properties of lymph, chyle, and blood. It was, however, less as an original investigator than as a deep and far-seeing thinker that Müller made his mark on physiological science. From about 1740, when Haller flourished, numerous contributions to physiological science had been made by Whytt, Cullen, John Hunter, Spallanzani, Prochaska, Bichat, Charles Bell, Berzelius, Magendie, and others, but in 1830, when Müller may be said to have begun his labours, it was necessary to reduce these facts to order, to educe general principles, and to direct physiologists into new lines of research indicated by the brilliant discoveries made in physics and in chemistry since the beginning of the century. This Müller did, and he may therefore be regarded as the founder of modern physiology. The appearance of his *Elements of Physiology* between 1837 and 1840 (translated into English by Dr William Baly, and published in London in 1842) was the beginning of a new period. In this work Müller shows remarkable power both in marshalling facts and in philosophical reasoning. As a rule he not merely states and criticizes the labours of others but also contributes the results of his own observations. Whilst he is cautious in the acceptance of theories, he always places them before the reader in an original and suggestive light. The most important portion of the work is that dealing with nervous action and with the mechanism of the senses. Here he states the fruitful principle, not before recognized, that the kind of sensation following irritation of a sensory nerve does not depend on the mode of irritation but upon the nature of the sense-organ. Thus light, pressure, or mechanical irritation acting on the retina and optic nerve invariably produce luminous impressions. This is sometimes termed the law of specific nervous energy. As a teacher Müller exercised a powerful influence, and the great majority of the distinguished physiologists, such as Helmholtz, Du Bois Reymond, Ludwig, Volkmann, and Vierordt, who have made Germany famous in physiological science during the past thirty years, owe much to the germinating ideas of their great teacher.

Besides editing for many years a periodical entitled *Archiv f. Anatomie, Physiologie, u. wissenschaftl. Medicin*, to which he also contributed papers, he published the text-book on physiology above alluded to, and various important memoirs. For a list of these see Poggendorff, *Biog.-Litter. Handwörterbuch*, vol. ii.

Two men of the same name, Johannes Müller, have been celebrated in science: (1) JOHN MÜLLER (1699-1784), a professor of artillery and fortification at Woolwich, who wrote a mathematical treatise published in 1737; (2) JOHANNES MÜLLER (born 1806), a writer on pharmacy and physiological chemistry, who published many memoirs from 1840 to 1850.

MÜLLER, KARL OTFRIED (1797-1840), an eminent writer on ancient Greece, was born at Brieg in Silesia on 28th August 1797. His father was a chaplain in the Prussian army. Müller was educated partly in Breslau, partly in Berlin, where his enthusiasm in the study of Greek literature, art, and history was fostered by the influence of Boeckh. In 1817, after the publication of his first work, *Æginęticorum Liber*, he received an appointment at the Magdaleneum in Breslau; and in 1819 he was made a professor of the university of Göttingen, his subject being the archæology of art. His aim was to form a vivid conception of Greek life as a whole; and for this object he carried on a series of profound researches, setting forth the results in his lectures, which produced a great impression on his students, and in numerous works, which marked an epoch in the development of Hellenic studies. Müller's position at Göttingen being rendered unpleasant by the political troubles which followed the accession of Ernest Augustus to the throne of Hanover in 1837, he applied for permission to travel; and in 1839 he left Germany. In April of the following year he reached Greece, having spent the winter in Italy. He carefully investigated the remains of ancient Athens, visited many places of interest in the Peloponnesus, and finally went to Delphi, where he began with his usual zeal to conduct excavations. While engaged in this work he was attacked by intermittent fever, of which he died at Athens on 1st August 1840.

Müller combined with astonishing industry a penetrating critical judgment and an almost unrivalled power of appreciating Greek modes of thought and feeling. Among his historical works the foremost place belongs to his *Geschichte hellenischen Stämme und Staaten*, which includes *Orchomenos und die Minyer* (1820), and *Die Dorier* (1824). He wrote also *Über die Wohnsitze, Abstammung, und ältere Geschichte des macedonischen Volks* (1825); and by his maps he introduced a new standard of accuracy in the treatment of the geography of ancient Greece. In 1828 he published *Die Etrusker*. His *Prolegomenen zu einer wissenschaftlichen Mythologie* (1825) prepared the way for the scientific investigation of myths; and the study of ancient art he promoted by his *Handbuch der Archäologie der Kunst* (1830), and by *Denkmäler der alten Kunst* (1832), which he wrote in association with Österley. In 1840 appeared in England his *History of the Literature of Ancient Greece*, and the original German work from which it had been translated—*Geschichte der griechischen Literatur bis auf das Zeitalter Alexander's*—was issued in Germany by the author's brother in 1841. Amid the labours to which Müller especially devoted himself he found time to write an admirable translation of the *Eumenides* of Æschylus (1833), to prepare new editions of *Varro* (1833) and *Festus* (1839), and to contribute many articles to the *Commentationes societatis regiæ scientiarum Gottingensis*, the *Göttinger gelehrten Anzeigen*, and other periodicals. In 1841 the facts of his life were recorded by Lücke in *Erinnerungen an Otfried Müller*.

MÜLLER, WILLIAM JAMES (1812-1845), English landscape and figure painter, was born at Bristol on 28th June 1812, and was the son of a Prussian gentleman, a writer on scientific subjects and curator of the Bristol Museum. He received a careful education, being especially trained in botany and natural history, and it was intended that he should become an engineer; but his leanings towards art were too definite to be resisted, and he was placed under J. B. Pyne to receive his first instructions as a painter. His early subjects deal mainly with the scenery of Gloucestershire and Wales, and he learned much from his study of Claude, Ruysdael, and the other earlier landscape-painters. In 1833 he figured for the first time in the Royal Academy with his Destruction of Old London Bridge—Morning, and next year he made a tour through France, Switzerland, and Italy. Four years later he visited Athens, extending his travels to Egypt, and in the sketches executed during this period and the paintings produced from them the power and individuality of the artist are first apparent. Shortly after his return he left Bristol and settled in London, where he exhibited regularly, and found purchasers, at moderate sums, for his pictures. In 1840 he again visited France, where he executed a series of sketches of Renaissance architecture, twenty-five of which were lithographed and published in 1841, in a folio entitled *The Age of Francis I. of France*. He was anxious again to visit the East, and in 1843 he accompanied, at his own request and his own charges, the Government expedition to Lycia, where he produced an extensive collection of masterly sketches of scenes unfamiliar to the art of his time. They were exhibited in London; their merit was fully recognized by the British public, and the artist received numerous commissions for finished pictures. But his health was seriously impaired, he was suffering from heart-disease and from continued nasal hæmorrhage; and, returning to his native city, he died there on 8th September 1845.

The works of Müller are distinguished by much power and originality, by great speed and directness of execution, by the vigour and emphasis which mark the born sketcher, and by brilliant power of splendid and sharply-contrasting colour. The qualities of tenderness, gradation, and mystery, in which they are commonly wanting, might have been within the reach of the artist had his life been longer. Since his death, and especially since the Gillott sale of 1872, his works have commanded very large prices. The Chess-Players at Cairo, for which Müller received £25, has since sold for upwards of £4000. The print room of the British Museum possesses, through the bequest of Mr John Henderson, a very rich collection of Müller's sketches. His biography by N. Neal Solly was published in 1875.

MULLET. This name is applied to two very different kinds of fishes, which are distinguished as Red Mullets and Grey Mullets. Red Mullets (genus *Mullus*, the name given by the ancient Romans) are marine fishes, with two short dorsal fins remote from each other: the first is composed of feeble spines, the second of branched rays; the anal fin is similar to the second dorsal. The body is covered with large thin scales. The form of the head is quite peculiar and characteristic; its anterior profile slopes downwards to the small mouth, which has but very small and feeble teeth, and from which two cylindrical barbels are suspended. These organs of touch are generally laid backwards and hidden in a groove between the branches of the lower jaw, but can be erected and called into action independently of each other. About forty different species of Red Mullets are known, chiefly from the tropical and sub-tropical parts of the Indo-Pacific Ocean. In the Atlantic the species are much less numerous, the most celebrated being the European *Mullus barbatus* (see vol. xii. p. 638, fig. 10), which is abundant in the Mediterranean, and tolerably common on the coasts of England and Ireland. Formerly a second species, *Mullus surmuletus*, was believed to exist in the European seas, but ichthyologists now incline more and more to the belief that this is only the female of *M. barbatus*.

Red Mullets do not attain to any considerable size, the largest of the tropical species weighing only two or three pounds. They are ground-feeders, evidently using their barbels in discovering their food, which consists of animalcules, worms, and, in the larger species, of small fishes; that they feed on putrid flesh is not borne out by the evidence drawn from their feeble jaws and dentition, but it is very probable that they are attracted to a decomposing body by the presence of the small crustaceans which feast upon it. Although the colours of these fishes are very brilliant, they are simple and evanescent; only a few of the tropical species exhibit ornamentations in the form of black spots or bands. In many, as also in the European species, red colour prevails, and its preservation after death is considered to enhance the fitness of the fish for the table, and consequently its value for the market. To produce the intensity of this red colour, fishermen scale the red mullet immediately before its death, a process by which the red pigment-cells or chromatophores are excited to expand; fishes which are allowed to die in the water show but little red, and therefore red mullets caught by the trawl are less valuable than those obtained in a trammel-net, by which the majority of the fish are secured alive. All the species of Red Mullets seem to be esteemed as food; but none equal in this respect the European species, which was held in exaggerated esteem by the gourmands of the corrupt period of the Roman empire. They exhibited the living fish and allowed them to die at the table immediately before they were consigned to the cook; they kept them in large reservoirs until they were wanted, and paid fabulous prices for fishes somewhat above the average size. In our times red mullets have justly maintained their value as a delicacy for the table; and from a commercial point of view their cultivation in suitable enclosed waters cannot be too strongly recommended to pisciculturists. Unfortunately, very little is known about their habits; during the winter they retire into deep water, late in spring and during the summer they approach the coasts and enter even brackish water, but the state of their sexual organs shows clearly that these fishes do not come towards the shore in order to breed; in fact nothing is known of their propagation.

The Grey Mullets, like the Red Mullets, belong to the spiny-rayed fishes, but form a widely-different and distinct family, *Mugilidæ*. They are not exclusively marine, but freely enter brackish water, live always close to the shore, and some of the tropical forms inhabit the pure fresh water of streams and rivulets, without, however, penetrating far inland. Their body is elegantly formed, wedge-shaped, and covered with scales of moderate size, firmly adherent to the skin. The two short dorsal fins are remote from each other, and the anterior is composed of four stiff spines. The anal fin is similar to the second dorsal; the caudal fin strong and bilobed. The form of the snout is very peculiar and characteristic; the mouth narrow, transverse in the true *Mugil*, and without, or with but feeble, teeth.

About seventy different species are known, from almost every coast of the temperate and tropical zones; they swim in small schools and are abundant wherever they occur. Four species are found on the British coasts—*Mugil septentrionalis*, *Mugil capito*, *Mugil octoradiatus*, and *Mugil auratus*, the first two being about equally and generally distributed, whilst the others are scarcer. Some of the freshwater Grey Mullets of the tropics, especially those of the West Indian and Indo-Pacific islands, have the mouth more lateral or have distinct, though very minute, teeth; they therefore have been formed into separate genera, *Agonostoma* and *Myxus*.

Grey Mullets, at least some of the species, grow to a weight of 10 or 12 ℔; but the fish which usually come into the market rarely exceed half that weight. Those in which distinct teeth are developed feed principally on small aquatic animals, whilst the diet of those without teeth consists of animalcules or minute organic substances mixed with the mud or sand which they swallow in large quantities; also confervoid growths to which small shells adhere are freely taken. To prevent the gills from being clogged by sand or mud, a peculiar apparatus separates these organs from the pharynx. Each branchial arch is provided on each side, in its whole length, with a series of closely-set gill-rakers, each series fitting into the series of the adjoining arch; they constitute together a sieve admirably fitted to permit the passage of the water, and to retain at the same time every other substance in the cavity destined for mastication. Also the structure of the intestinal tract is adapted in a remarkable manner to the peculiar diet of these fishes. One portion of the stomach is globular and surrounded by a thick mass of muscles, the cavity being small and coated with a tough epithelium. In fact this structure reminds us of the stomach of birds, in which it also serves for the trituration of hard substances. The intestine itself is long, six or seven times as long as the fish. Grey Mullets are very plainly coloured, generally greenish on the upper parts and more or less silvery on the side. They are wholesome food, well flavoured when taken out of clean water. As young fish bear transport easily, and rapidly grow to a marketable size in suitable enclosed waters, their cultivation deserves every attention on the part of pisciculturists. Indeed, in the fish-farms of Western Italy, grey mullets, besides eels, red mullets, flat-fish, are the principal fish cultivated.

MULLINGAR, a market-town of Ireland, capital of Westmeath, is situated near the Brosna and on the Royal canal, 44 miles west by north of Dublin. The principal buildings are the parish church with tower and spire, the Roman Catholic church, the court-house, the barracks, and the infirmary. Tanning, brewing, and the manufacture of coarse woollens are carried on. The population in 1881 was 4787. Mullingar was one of the ancient palatinate towns. It possessed an Augustine convent founded in 1227, and a

Dominican convent founded in 1239, but both were dissolved by Elizabeth. The town was the headquarters of William III. before the siege of Athlone. It formerly returned two members to parliament, but was disfranchised at the Union.

MULREADY, WILLIAM (1786-1863), subject painter, was born at Ennis, county Clare, on 30th April 1786. When he was about five years old his father, a leather-breeches maker by trade, removed to London, where the son received a tolerable education, chiefly under Catholic priests. He was fond of reading, furtively studying Pope's *Homer* and other works at the book-stalls, and fonder still of drawing.[1] When eleven years old Mulready was employed by an artist named Graham as the model for a figure in his picture of Solomon Blessed by his Father David. The painter's interest in the lad did much to confirm his artistic proclivities; and, having studied at home for two years, Mulready applied for advice to Banks the sculptor, who sent him to a drawing-school and permitted him to work in his own studio. In 1800 he was admitted a student of the Academy, and two years later he gained the silver palette of the Society of Arts. About this time he was associated with John Varley, the eccentric water-colour painter and drawing-master, whom he assisted in the tuition of his band of talented pupils, which included Cox, Fielding, Linnell, William Hunt, and Turner of Oxford. At eighteen he married a sister of Varley's, and at twenty-four he was the father of four sons. The marriage was a singularly unhappy one, and the pair separated before many years. With all these "hostages to fortune" he had a hard struggle, but he was blessed with unfailing energy and the power of steady application. He "tried his hand at everything," as he said, "from a miniature to a panorama." He painted portraits, taught drawing, and up till 1809 designed illustrations to a long series of children's penny books. His first pictures were classical and religious subjects of no great merit, and the early works which he sent to the Academy were mainly landscapes; but he soon discovered his special aptitude for genre-painting, and in 1809 produced the Carpenter's Shop, and in 1811 the Barber's Shop, pictures influenced by the example of Wilkie and the Dutch painters. In 1813 he exhibited his Punch, a work more original and spontaneous in treatment, which brought the artist into notice, and two years later his Idle Boys procured his election as associate. Next year he received full academic honours, and the election was fully justified by the Fight Interrupted which he then exhibited. It was followed by the Wolf and the Lamb (1820), the Convalescent (1822), Interior of an English Cottage (1828), Dogs of Two Minds (1830), the Seven Ages (1838), and in 1839 and 1840 by the Sonnet and First Love, two of the most perfect and poetical of the artist's works. In 1840 he designed the well-known postal envelope for Rowland Hill, and a set of illustrations to the *Vicar of Wakefield*, which were succeeded by his paintings of the Whistonian Controversy (1844), Choosing the Wedding Gown (1846), and Sophia and Burchell Haymaking (1849). His later works, like the Bathers (1849), Mother teaching her Children (1859), and the Toy Seller (1862) show declining powers, mainly attributable to failing health. The last evening of his life was spent at a meeting of the Academy, of which, for nearly fifty years, he had been a most active and efficient member. He died of heart-disease on the 7th July 1863.

In his way of work Mulready was most painstaking and conscientious, executing for each picture very elaborate studies for the several parts, and many sketches for colour and effect. His productions are characterized by accuracy of drawing and richness of colouring; but they want something of the force and fire which come of less considered and elaborate, but more instinctive and inspired, workmanship.

MÚLTAN, or **MOOLTAN**, a district in the lieutenant-governorship of the Punjab, lying between 29° 22′ and 30° 45′ N. lat. and 71° 4′ and 72° 54′ E. long., is bounded on the N. by the Jhang district, on the E. by that of Montgomery, on the S. by the Sutlej, and on the N.W. by the Chenáb, and has an area of 5880 square miles. Along the banks of the Chenáb, Sutlej, and Rávi extend fringes of cultivation varying in width from 3 to 20 miles, but the interior uplands have the same barren character as the district of MONTGOMERY (*q.v.*). Midway between the boundary rivers, a high dorsal ridge enters from Montgomery, forming a part of the sterile region known as the *bár*. It dips into the lower plateau on either side by abrupt banks, which mark the ancient beds of the Rávi and the Beas (Biás). These two rivers once flowed much farther southward before joining the Chenáb and the Sutlej, and their original course may still be distinctly traced, not only by the signs of former fluvial action, but also by the existence of dried-up canals. At the present day the Beas (Biás) is totally lost to the district, the Rávi merely waters a small corner, and the only rich cultivation is that which stretches along the Chenáb and the Sutlej. The soil, though naturally good, requires abundant irrigation to bring it under efficient tillage. Numerous canals supply water from the Sutlej to the surrounding country, and pools or *jhíls* collect during the rainy weather in the hollows formed by the old watercourses.

The census of 1881 returned the population at 551,964 persons (males 304,517, females 247,447), Mohammedans numbering 435,901, Hindus 112,001, Sikhs 2085, Europeans 1709, Eurasians 110, native Christians 42, and "others" 116. Only one town had a population exceeding 10,000—Múltán, 68,674. Most of the people are grouped together in villages on the irrigated lowlands, only a scattered nomad population being found on the sterile upland tract. In 1878-79 the area under Government assessment was 3,763,200 acres, of which 799,360 were cultivated, 245,760 uncultivable waste, 2,618,080 cultivable, and 100,000 grazing lands. Cultivation is, however, spreading steadily, though the character of the agriculture remains slovenly, as the Ját tribes who comprise the mass of the rural population have not yet lost their predatory and pastoral propensities. Near the city, however, capitalist farmers have brought their land into a high state of cultivation. The areas under crop in 1881-82 were as follows:—rice 15,998, wheat 209,183, great millet 53,605, spiked millet 13,254, Italian millet 724, barley 7460, gram 8303, peas 24,443, and tobacco 1624. Indigo forms the most important commercial staple. The chief articles of trade are sugar and indigo from the lowlands, and wool and *ghí* from the pasture lands of the *bár*. Silk and fine cotton fabrics are produced at Múltán; coarse cotton cloth for home consumption is woven in every village. The Sind, Punjab, and Delhi Railway connects the city with the Northern Punjab and with the East Indian line at Delhi, and the Indus Valley State Railway runs through a portion of the district. The total length of roads is 907 miles and of railways 130.

The total imperial revenue of the district in 1880-81 was 953,408 rupees, of which 561,052 were derived from the land revenue. A small provincial and local revenue is also raised. Education, especially among the Mohammedans, is in a backward state, and in 1872-73 only 3062 children attended school, of whom the Hindus contributed 46 per cent., although they only form 18½ per cent. of the whole population. The climate is proverbial even among the hot and dusty Punjab plains for its heat and dust. The mean temperature in the shade for the six years ending 1876 was in January 54°·70 Fahr., in June 95°·78, in October 76°·68, the average annual rainfall for the same years being 7·27 inches; in 1881 it was only 3·7.

At the time of Alexander's invasion Múltán appears as the chief seat of the Malli; but the Greek power soon came to an end, and the country passed under the rule of the Gupta dynasty of Magadha. The early Arab geographers mention Múltán as forming part of the kingdom of Sind, which was conquered for the caliphate by Mohammed Kásim in the middle of the 8th century. The whole province was conquered by Mahmúd of Ghazní in 1005 A.D. It afterwards formed a part of the Mughal empire of Bábar, and continued so till the extinction of that power. The history of the district during the latter half of the 18th century is a story of alternate invasion by Marhattás, Afgháns, and Síkhs. At length, in 1779, Muzaffar Khán, of the Sadozai family, succeeded in obtaining the governorship of Múltán. Ranjít Sinh after a long siege carried the capital by storm in 1818, and put Muzaffar Khán and five of his sons to death. In 1829 he made over the administration of Múltán with five neighbouring districts to the famous Sáwan Mall, who raised the province to a state of prosperity by excavating canals and inducing new inhabitants to settle. After the establishment of the council of regency at Lahore, difficulties arose between Múlráj, son and successor of Sáwan Mall, and the British officials, which led to his rebellion, and culminated in the second war and the annexation of the whole of the Punjab. The city of Múltán, after a stubborn defence, was carried by storm in January 1849. The district at once passed under direct British rule, and order has not been disturbed since.

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[1] Some reproductions of his early attempts in this direction are given, along with details of his life, in a scarce volume for the young, entitled *The Looking Glass*, written by William Godwin under the *nom-de-plume* of Theophilus Marcliffe, and published in 1805.

MÚLTÁN, or **MOOLTAN**, city and headquarters of the above district, is situated 4 miles from the present left bank of the Chenáb (30° 12′ N. lat., 71° 30′ E. long.). The total population in 1881 was 68,674. The town is enclosed on three sides by a wall, but open towards the south, where the dry bed of the old Rávi intervenes between the town and citadel. Large and irregular suburbs have grown up outside the wall since the annexation in 1849. Within the city proper, narrow and tortuous streets, often ending in *culs-de-sac*, fill almost the whole space; but one broad bazaar runs from end to end. The principal buildings include the shrines of two Mohammedan saints and the remains of an ancient Hindu temple. The civil station contains a court-house and treasury, commissioner's offices, jail, post-office, telegraph-office, dispensary, and staging bungalow The Church Missionary Society maintains a station here. As a trade centre Múltán possesses great importance, its chief imports being cotton and other piece-goods, while the main staples of export are sugar, cotton, indigo, and wool. Trade continues to develop slowly but steadily. The value of the imports for 1879, 1880, 1881 was 75, 84, and 87 lakhs of rupees, and of the exports 36, 37, and 40 lakhs respectively. Lately there has been a great revival of the indigo trade.

MULTIPLEPOINDING is the technical term for a form of action in Scotch law by which conflicting claims to the same fund or property are determined. The action is brought either by the holder or by a claimant in his name. All who have any claims in the fund or property in question are ordered to appear and give in their claims; the court then prefers them according to their respective rights, and the holder of the fund or property in dispute on payment or delivery is absolved from any further claim in regard to it.

MUMMY. The origin of mummification in Egypt has given rise to much learned conjecture (see EMBALMING), now, however, superseded by positive knowledge,—a comparative study of sepulchral texts having furnished Egyptologists with convincing proof that the inviolate preservation of the body was deemed essential to the corporeal resurrection of the "justified" dead. The living man consisted of a body, a soul, an intelligence, and an appearance or *eidolon*,—in Egyptian, a *ka*. Death dissociated these four parts, which must ultimately be reunited for all eternity. Between death on earth and life everlasting there intervened, however, a period varying from 3000 to 10,000 years, during which the intelligence wandered, luminous, through space, while the soul performed a painful probationary pilgrimage through the mysterious under-world. The body, in order that it should await, intact, the return of the soul whose habitation it was, must meanwhile be guarded from corruption and every danger. Hence, and hence only, the extraordinary measures taken to ensure the preservation of the corpse and the inviolability of the sepulchre; hence the huge pyramid, the secret pit, and the subterraneous labyrinth. The shadowy and impalpable *ka* —the mere aspect, be it remembered, of the man—was supposed to dwell in the tomb with the mummied body. This fragile conception was not, however, indestructible, like the soul and the intelligence. Being an aspect, it must perforce be the aspect of something material; and, if the body which it represented were destroyed or damaged, the *ka* was liable to the like mischance. In view of this danger, the Egyptian, by stocking his sepulchre with portrait statues, sought to provide the *ka* with other chances of continuance, these statues being designed, in a strictly literal sense, to serve as *supports* or dummies for the *ka*. The funereal portrait statues of the ancient empire (Dynasties I. to VI.) are marvels of realistic art in basalt, diorite, limestone, and wood. As many as twenty duplicates have been found in a single tomb, and always secreted in hidden chambers constructed in the thickness of the walls of the sepulchre. The Bulak Museum is very rich in *ka* statues of the ancient empire; and the British Museum contains two in wood from the tomb of Seti I., of the period of Dynasty XIX.

Mummies.

For the processes of mummification, as narrated by Greek and Latin authors, see EMBALMING. The details which follow are taken from original Egyptian sources.

The embalmment of a man of wealth, done in the costliest manner, consisted of—(1) the "going into the good abode," (2) the *Teb*, (3) the *Kesau*. The first of these was the process of evisceration, cleansing, &c., which occupied 15 or 16 days; the second was the salting or bituminizing, and took 19 or 20 days; the third was the spicing and bandaging, and took 34 or 35 days,—making 70 or 72 days in all. There were four special "rituals" for the guidance of the priestly operators and assistants—(1) that of "going into the good abode," which was a kind of surgical manual for the use of the paraschists, enumerating the incisions to be made in the body; (2) that of "the *Kesau*," a corresponding manual for the use of the taricheutes, containing lists of the necessary gums, resins, spices, &c., directions as to the number and nature of the bandages, and prayers to be repeated while adjusting them; (3) the "water ritual" or service-book of litanies, to be recited during the transport of the mummy to the cemetery, which was almost always done by boat; (4) the funereal ritual, performed on consigning the mummy to the tomb. No copy of the first of these documents is known, but its substance is summarized in the Rhind papyrus. Of the other three, contemporary copies written on papyrus exist in various museums. Establishments for the reception and mummification of the dead were attached to all the great cemeteries. These mortuary suburbs, by the Greeks called "memnonia" (μεμνόνεια), were inhabited by a large population of embalmers, mummy-case makers, gilders, painters, scribes, priests, and the like;

and it has been calculated that from 500 to 800 corpses must always have been on hand in the workshops attached to the necropolis of Memphis. To prevent mistakes in delivering the mummies to their families, the bandagers were in the habit of marking the wrappings with the name and age of the deceased, sometimes adding the name and regnal year of the king in whose time he died. The ink in which these entries were written was made from nitrate of silver, like the marking-ink of the present day. The bandages were of linen only. The texture varied with the rank of the mummy, some being as fine as the finest India muslin, and some extremely coarse. The quantity used was enormous, and persons used to save their old linen for this purpose all their lives long. Each limb, finger, and toe was first separately swathed; and finally the whole body was enveloped in numberless convolutions, the contours of the shrunken form being skilfully restored by means of padding. From 700 to 1250 yards of bandages, in strips of 3 to 4 inches wide, have been found on mummies.

The processes of mummification varied in different parts of Egypt and at different periods. The mummies made at Memphis are black, dry, and brittle, whereas those of the best Theban epoch are yellowish, flexible, and so elastic that the flesh yields to the touch of the finger and the limbs may be bent without breaking. Champollion-Figeac attributes this exquisite softness and elasticity to the injection of costly chemical liquids into the veins, whereby the substance of the flesh was preserved. The natron process, on the contrary, destroyed the flesh, leaving only the skin and the bones. By some schools of embalmers the cavity of the skull, after the withdrawal of the brain, was washed out by an injection of refined bitumen, the effect of which was to preserve the membranous covering which has frequently been found inside the brain-pan, dried and unimpaired. Hair is constantly found on the heads of mummies, sometimes plaited, sometimes frizzled,—thus showing that the fashion of wearing wigs was by no means universal. The under bandages of mummies were laid on wet, having probably been dipped in spirits. They sometimes come off with the solidity of a pasteboard mask; and life-like portraits of the dead have been reproduced by simply casting plaster into these masks as into a mould. When Syrian turpentine came into use the Theban mummies ceased to maintain their supremacy, and became even blacker than those of Memphis, the corpse and its bandages forming one solid mass almost as hard as stone. In Memphite mummies, especially of the Ramesside and Saitic periods, the cavity of the chest is found filled with scarabæi and amulets in *pietra dura*. The Theban mummies, on the other hand, from Dynasty XI. to Dynasty XXIII., were adorned with rings, pectoral ornaments, collars, bracelets, &c., in exquisitely-wrought gold inlaid with lapis-lazuli, carnelian, green felspar, and other precious stones. Under the Greeks and Romans the art of mummification declined. Rudely-painted wooden coffins were substituted for the granite sarcophagi and richly-decorated mummy-cases of former times. The mummies became ashen-grey, or, being boiled in bitumen, were black, heavy, and shapeless. Those of Græco-Roman times are frequently found wrapped in painted shrouds, and sometimes with coarsely-daubed encaustic portraits on panel laid above the faces. Dr Birch gives 700 A.D. as the date at which mummification practically ceased. It was formerly supposed that the bodies of the dead were merely desiccated under the ancient empire, and that actual embalming was not practised before 2000 B.C. Recent explorations among the ruined pyramids of Sakkarah have, however, brought to light the mummied corpse of King Merenra, and part of the mummy of King Pepi, his father, both of Dynasty VI. Though denuded of its wrappings by ancient tomb-breakers, the mummy of Merenra is distinctly impressed in the usual manner with marks of its former bandages; and portions of the bandages and a "well-embalmed" hand were recovered from the *débris* of that of King Pepi. It is thus shown that mummification was an established rite towards the close of the ancient empire, and that the processes then in use were identical with those of later times, which compels us to ascribe a very early date (possibly 3800 or 4000 B.C.) to the beginnings of the art.

The styles of sarcophagi and mummy-cases vary according to periods and places as much as do the styles of mummification. At Gizeh, Sakkarah, and Meydûm, in tombs of the ancient empire (Dynasties I. to VI.), the dead are found in unpainted wooden coffins with carved human faces, these coffins being enclosed in massive rectangular sarcophagi of black basalt, red granite, and limestone. Interments of the earliest Theban period (Dynasty XI.) yield cases shaped like the mummy within, and carved out of solid tree-trunks. The masks are painted yellow, white, or black, and on the breast Isis and Nephthys are depicted as if overshadowing the mummy-case with their wings. These cases are sometimes found enclosed in large rectangular wooden coffers with flat lids. With Dynasty XVII. (Theban) there appears the mummy-case with hands carved in relief and crossed upon the breast. The ground-colour of these cases is generally white or black, painted with transverse bands of hieroglyphed inscriptions, the mask is red or gilded, and a vulture with extended wings is depicted on the breast. From Dynasty XIX. to Dynasty XXI. the coffins are highly ornamented in gay colours, figures being more abundant than inscriptions, and yellow varnishes much in favour. The mummy is frequently found enclosed in two, three, and even four such cases, each a size larger than the last. Cases with black grounds are succeeded by cases with brown grounds, and these again by white, resembling those of Dynasties XVII. and XVIII. The masks are now painted red, with richly-decorated head-dresses imitating wigs. Under the priest-king or Amenide domination these triple and quadruple "nests" of mummy-cases are found enclosed in gigantic rectangular outer sarcophagi of wood, highly painted and varnished. From Dynasty XXII. to Dynasty XXVI. the inscriptions are mostly painted in green on a white ground. At Memphis, meanwhile, the granite, basalt, or limestone sarcophagus—sometimes rectangular with rounded corners, sometimes mummy-shaped with sculptured hands and feet, sometimes resembling a long bath—continued to hold its ground. The Saitic period (Dynasties XXVI. to XXX.) is distinguished by the minute finish and artistic beauty of its sculptured sarcophagi in basalt and granite. Last of all, in the extreme decadence of the art, come squared wooden coffins, unpainted, unvarnished, and rudely scrawled in ink with hieroglyphed legends so corrupt as to be almost illegible. According to the religious law of ancient Egypt, the rites of mummification were universal and compulsory, being performed, not only for every native in a style consistent with his rank in life, but also for all strangers and foreigners who died in the land, for all slaves and captives, and even for outcasts, criminals, and lepers.

The most ancient mummified—or, at all events, desiccated—human remains, not being pre-historic, which are known to science are the fragments of the body of Menkara (Gr., Mycerinus), third king of Dynasty IV., and builder of the smallest of the three great pyramids of Gizeh. These fragments were found by Colonel Howard Vyse strewn on the floor of the upper chamber of that pyramid, together with the woollen wrappings and empty cedar-wood coffin of this pharaoh. All these are now in the British Museum. The fragments consist of the ribs and vertebræ and the bones of the legs and feet, the dried flesh upon the thighs being perfectly preserved. The date of these remains may be approximately assigned to 4000 B.C. Next in antiquity comes the mummy of King Merenra of Dynasty VI., now in the Bulak Museum, the date of which is about 3600 B.C. Most famous and most interesting of all, however, are the royal mummies of Dynasties XVII., XVIII., XIX., and XXI., found at Dair al-Bahari, near the great temple of Queen Hatshepsu, on the left bank of the Nile opposite Karnak, in July 1881. The circumstances of this, the most extraordinary archæological discovery of any age, are too remarkable to be passed over in silence.

The so-called "Theban Arabs" are the busiest treasure-seekers and antiquity-vendors in Egypt. But not often, apparently, have they lighted upon a royal interment. The royal sepulchres in the Valley of the Tombs of the Kings and the neighbourhood have tempted the cupidity of all ages; and we have the direct evidence of two legal documents of the time of Rameses IX., 7th pharaoh of Dynasty XX., to show that bands of organized tomb-breakers infested the cemeteries of Thebes at that comparatively early period.

It is now about twelve years since certain objects of great rarity and antiquity, mostly belonging to the period of the Amenide Dynasty (XXI.), began to find their way to Europe from Upper Egypt. Foremost in importance among the said relics were four funereal papyri (consisting of extracts from the *Ritual or Book of the Dead*) written for royal personages of the Amenide family. Concurrent testimony pointed to a family of Arab brothers named Abd er-Rasoul as the original holders of these papyri; it was therefore concluded that the tombs of Pinotem I. and of the Queens Notem-Maut and Hathor Hont-taui (for whom the papyri were written) had by them been discovered and pillaged. The eldest brother was ultimately induced to reveal the secret, and pointed out a lonely spot at the foot of the cliffs not far from the ruins of the great temple of Hatshepsu, on the western bank of the Nile, where the bottom of a hidden shaft opened into a short corridor leading to a gallery 74 metres in length, at the end of which was a sepulchral vault measuring 7 metres by 4. The whole of this gallery and vault were crowded with mummies and mortuary furniture, as sacred vessels, funereal statuettes, canopic and libation vases, and precious objects in alabaster, bronze, glass, acacia wood, and the like. The mummies were thirty-six in number, including upwards of twenty kings and queens from Dynasty XVII. to Dynasty XXI., besides princes, princesses, and high priests, all of which, together with four royal papyri and a miscellaneous treasure consisting of upwards of 6000 objects, are now in the Bulak Museum.

The door-jambs of the mortuary chamber at the end of this long gallery are inscribed with various attestations of burial. These entries refer to interments of members of the Amenide line only. It is also to be observed that only members of that line were found inside the chamber, so proving that the sepulchre was the family vault of the descendants of the first priest-king. All the other royal mummies, and all the objects appertaining to those mummies (that is to say, to the representatives of Dynasties XVII., XVIII., and XIX.) were found in the long gallery outside. When these earlier kings, queens, and princesses were brought out into the light of day, and conveyed to the museum of Bulak, it was discovered that the coffins of some, and the wrappings of others, were inscribed with short official entries written thereon at different times and in different places by successive inspectors of tombs. The dates of these visits of inspection are restricted to the period of Dynasty XXI., whence it is evident that the necessity for protecting the last homes of the illustrious dead was as urgent then as the "Amherst" and "Abbott" papyri prove it to have been in the reign of Rameses IX. The terms of these entries show that it was the duty of the said inspectors to enter the sepulchres of the "royal ancestors," to report upon the condition of the mummies, to repair their wrappings and mummy-cases when requisite, and, if expedient, to remove them from their own tombs into any others which might be regarded as more secure. The mummies and mummy-cases thus inscribed are five in number—namely, those of Amenhotep I., Thothmes II., Rameses I., Seti I., and Rameses II. Two entries on the coffin-lid of Amenhotep I. show his tomb to have been inspected and his wrappings renewed in the 6th year of Pinotem II., fourth of the priest-king line, and again in the 16th year of the pontificate of Masahirti, his son and successor. In the 6th year of Pinotem I. the same was done for the mummy of Thothmes II. The three pharaohs of Dynasty XIX.—Rameses I., Seti I., and Rameses II.—seem, however, to have been still more anxiously looked after. Either because their mummies were specially revered, or because their sepulchres had already been attacked by the tomb-breaking gangs of that period, we find them continually being removed from one tomb to another. In the 6th year of Her-Hor, the founder of the Amenide line, while they yet occupied their own splendid sepulchres in the Valley of the Tombs of the Kings, they were there examined by a Government inspector, who "renewed their funerary equipments" and made an entry of his visit on the coffins of Seti I. and Rameses II. After this Rameses I. and Rameses II. were removed to the tomb of Seti I. (the tomb known as Belzoni's), whence, in the 16th year of Her-Hor, all three mummies, father, son, and grandson, were transferred to the tomb of Queen Ansera. This act of transfer is written, dated, signed, and witnessed on all three coffins. Again, in the 10th year of Pinotem I., grandson of Her-Hor, occur more entries showing them to have been conveyed from the tomb of Queen Ansera to the tomb of one of the Amenhoteps. Finally, in bold hieratic characters, written with marking-ink upon the breast-bandages of Rameses II., we find the following memorandum recording how, ten years later still, the mummy of this illustrious pharaoh was again taken back to the tomb of his father Seti I.:—

"The year 16, the third month of Pert (*i.e.*, seed-time), the sixth day, being the day of carrying the defunct King Ra-user-Ma Sotep-en-Ra, for the renewal of his funerary appointments, into the tomb of the defunct King Ra-men-Ma Seti, by the first prophet of Amen, Pinotem."

At what precise date these and the earlier royal mummies were brought into the Dair al-Bahari vault does not appear; but, as that vault was finally closed on the burial of Queen Isi-em-Kheb, we may conclude that, as a last resource against possible depredation, the "royal ancestors" were deposited therein at or about that time. This would be in the reign of King Menkheperra (brother and successor of Masahirti, and husband of Isi-em-Kheb), whose seal, impressed on clay, was found upon the shattered door of the mortuary chamber. The condition of the various mummies and mummy-cases thus hospitably sheltered gives every indication that their original sepulchres had been previously violated. The coffins of Thothmes III. and Rameses I. are much damaged. That of Rameses II. was probably destroyed, since the one in which his mummy now reposes is of Dynasty XXI. workmanship. The mummy of Rameses I. is doubtful, that of Thothmes I. is missing, as are also the coffins of Queen Ansera, Queen Merit-Amen, and Queen Sitka. The mummy of Thothmes III.—greatest of all Egyptian pharaohs—greater than even Seti I. or Rameses II.—is broken in three pieces. All this is apparently the work of ancient marauders.

For these identifications, see especially two articles on Dynasty XXI. (Manethonian) in the *Zeit. f. Ægyp. Sp.*, 1882, by Dr R. Lepsius and Dr A. Wiedemann; also in *Recueil des Travaux*, vol. iii., 1883, an article on "Relics from the Tomb of the Priest-Kings at Dayr el-Baharee," by Amelia B. Edwards.

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MUMPS (syn. *Cynanche parotidæa*, *parotitis*, also "The Branks"), a contagious disease characterized by inflammatory swelling of the parotid and other salivary glands, frequently occurring as an epidemic, and affecting mostly young persons. The disease generally sets in with symptoms of a cold or catarrh accompanied with slight febrile disturbance, but soon the nature of the ailment is announced by the occurrence of swelling and stiffening in the region of the parotid gland in front of the ear. The swelling speedily increases in size and spreads downwards towards the neck and under the jaw, involving the numerous glands in that locality. The effect is to produce much disfigurement, which becomes still greater should the inflammation spread, as often happens, to the glands on the other side of the face and neck. Pain is present in the swollen parts, but it is seldom very severe, nor is there much redness or any tendency to suppuration. There is, however, considerable interference with the acts of mastication and swallowing. After continuing for four or five days the swelling and other symptoms abate, and the parts are soon restored to their normal condition. During the period of convalescence there occasionally occur some swelling and tenderness in other glands, such as the testicles in males, and the mammæ or ovaries in females, but these are of short duration and of no serious significance. That this complaint is highly contagious is shown by the readiness with which it spreads among children in schools, &c. The nature of the infecting agent is unknown, but the medium of communication is most probably the breath or secretions of the mouth. Mumps is in general a mild disease, and requires but little treatment beyond a gentle laxative, the application of warm fomentations to the swollen and painful parts, and the use of soft food.

MUNCHAUSEN, Baron, the modern Philopseudes, "of whom Ferdinand Mendez Pinto was but a type," is commonly identified with Hieronymus Karl Friedrich von Münchausen, of Bodenswerder in Hanover, who, having entered the Russian service and served in several campaigns against the Turks, amused himself in his retirement by relating extraordinary instances of his prowess as soldier and sportsman. He died in 1797. In 1785 a little book of 48 pages, *Baron Munchausen's Narrative of his Marvellous Travels and Campaigns in Russia*, was published in London. A second edition was printed at Oxford next year; an enlarged London edition speedily followed, and the book had gone through five editions before, in 1787, it was introduced to the German public in a translation, with a preface by the poet Bürger. Bürger very naturally passed in Germany for the writer; and it was not until 1824 that a communication from his editor Karl von Reinhard to the *Gesellschafter* fixed the authorship upon Rudolf Erich Raspe. Raspe, a man of versatile talent, the author of some works on natural history and painting and of a poem entitled *Hermin and Gunilde*, was born at Hanover in 1737, and had been professor of archæology and curator of the museum at Cassel, which appointments he lost upon a charge of stealing medals. He fled to England, where he had already been elected an honorary fellow of the Royal Society, though his name was subsequently expunged. From 1782 to about 1788 he was assay-master and storekeeper at Dolcoath mine in Cornwall, where his ingenuity was still remembered in the middle of the present century. In 1794 he accepted a similar situation at Muckross in Ireland, but died there before entering upon his post. His authorship of Munchausen rests entirely upon the testimony of Von Reinhard, but the fact was in all probability communicated to the latter by Bürger; it has never been disputed, and is confirmed by the appearance of the book in London during Raspe's residence in England. The father of Adolf Ellisen, a recent German editor, visited Baron Münchausen himself in 1795, two years before his death, and found him very uncommunicative. He was convinced, however, by the evidence of acquaintances that the baron had in his younger days fully entitled himself to the distinction thrust upon him by Herr Raspe.

It would be superfluous to descant on the qualities of a work so universally known, whose name has become a household word. It is to be observed, however, that the typical Munchausen is chiefly to be encountered in the 48 pages originally published by Raspe, and that the subsequent accessions, while quadrupling the dimensions of the book, are far from adding proportionably to its merit. There is hardly such another instance in literature of eleven buckram-men growing out of two. The most important of these additions is entitled "A Journey to the Moon and Dog Star," and is mainly borrowed from Lucian's *True History*. A very inferior appendix, published in 1793, represents the baron in conflict with the French revolutionists and Tippoo Saib; and there are several undisguised imitations. The family likeness of the stories published by Raspe himself renders it probable that they were actually derived by him from Münchausen, of whom he speaks respectfully in his preface, attributing to his inventions the moral purpose of "awakening and shaming the common sense of those who have lost it by prejudice or habit." It is nevertheless likely that Münchausen shone rather as a narrator than an inventor, some of his marvels having been traced to Bebel's *Facetiæ*, to Lange's *Mendacia Ridicula*, to Castiglione's *Cortegiano*, and even to a Portuguese magazine.

The best English edition is that by Teignmouth Shore (1872), with illustrations by Gustave Doré and additions by Théophile Gautier; the best German edition that by Ellisen (1849), to which is prefixed a valuable essay upon the literature of pseudology in general. The English edition of 1809 has plates by Rowlandson.

MUNCIE, a city of the United States, county seat of Delaware county, Indiana, 54 miles north-east of Indianapolis. It is a flourishing pleasant-looking place of 5219 inhabitants (census 1880), with city-hall, court-house, public library, and considerable industrial activity.

MUNDAY, Anthony (1553-1633), was one of the most versatile miscellaneous writers of the Shakespearean age. In the introduction to his comedy *John a Green and John a Cumber*, reprinted for the Shakespeare Society, Collier enumerates 47 works of which Munday was whole or part author, the subjects being very various—pastoral poems, journalistic tracts and pamphlets, translations of romances, plays, pageants. The most interesting remnant of this miscellaneous work is a pamphlet reprinted in the Harleian Miscellany, the *English Romayne Life*, a lively account of adventures among Roman Catholic refugees in France and Italy. Munday's experiences were the result of a youthful escapade. Born in 1553, and the son of a London citizen of the Drapers' Company, he had early shown a restless disposition: he took to the stage for some time, tried steady business for a year or two as apprentice to a stationer, tired of it, put all his wealth in his purse, and set out with a companion for the Continent, moved by "a desire to see strange countries as also affection to learn the languages." According to his own account, he was robbed on the way to Amiens, drifted into the company of Popish refugees, and was by them forwarded to Rome, where he obtained admission as a pope's scholar to the English seminary. Returning to England about 1581, and using the knowledge thus gained of designs against the English Government, he was a prominent witness in the trials of Campion and other English Jesuits; and, probably as a reward, was appointed one of the "Messengers of Her Majesty's Chamber." Thereafter he wrote steadily for the booksellers and the theatres, compiling religious publications, putting words to popular airs, translating French romances, and so forth. Webbe in 1586 praised him for his pastorals—only the title is now extant, *Sweet Sobs and Amorous Complaints of Shepherds and Nymphs*;—and in 1598 Meres mentioned him honourably among dramatic writers as "our best plotter." Critical Ben Jonson was less complimentary, and in *The Case is altered* ridiculed Munday severely as "Antonio Balladino, pageant poet." Judging from the plays on the subject of Robin Hood reprinted in Collier's *Supplement to Dodsley's Old Plays*, the joint work of Munday and Chettle, his literary faculty was of a very commonplace description, and deserved Jonson's taunts about "stale stuff" and want of character. Still Munday seems to have been in great request as a collaborator in the last years of Elizabeth's reign, and afterwards he wrote many of the city "pageants." He obtained repute also as an antiquary, and published an enlarged edition of Stow's *Survey of London* in 1618. This last work was the only literary achievement inscribed on his monument in St Stephen's church. He died 10th August 1633.

MUNGO, St. See Kentigern, vol. xiv. p. 40.

MUNGOOS, or **Mongoos**. See **Ichneumon**, vol. xii. p. 629.

MUNICH (in German, *München*), the capital of the kingdom of Bavaria and the fourth largest town in the German empire, is situated in an elevated and barren plain to the north of the Bavarian Alps, in 48° 8′ N. lat. and 11° 35′ E. long. Owing to its lofty site (1700 feet above the sea) and the proximity of the Alps the climate is rather changeable, and its mean annual temperature, 49° to 50° Fahr., is little higher than that of many places much farther to the north. The annual rainfall is stated at nearly 30 inches. The situation of Munich is devoid of physical advantages, and the surrounding district is in no way remarkable for its wealth, but the construction of roads and railways has counterbalanced the lack of natural highways, while the central position of the town makes it easy of access from all parts of Europe.

Munich is divided into nineteen municipal districts, fourteen of which, including the old town, lie on the left bank of the small river Isar, while the suburban districts of Au, Haidhausen, Giesing, and Ramersdorf are on the opposite bank. The old town, still containing many narrow and irregular streets, forms a semicircle with its diameter towards the river, while round its periphery has sprung up the greater part of modern Munich, including the handsome Maximilian and Ludwig districts. The wall with which Munich was formerly surrounded has been pulled down, but some of the gates have been left standing. The most interesting of these is the Isar Thor, restored in 1835 and adorned with modern frescos. The Sieges Thor or gate of victory is a modern imitation of the arch of Constantine at Rome, while the stately Propylæa is a reproduction of the gates of the Athenian Acropolis.

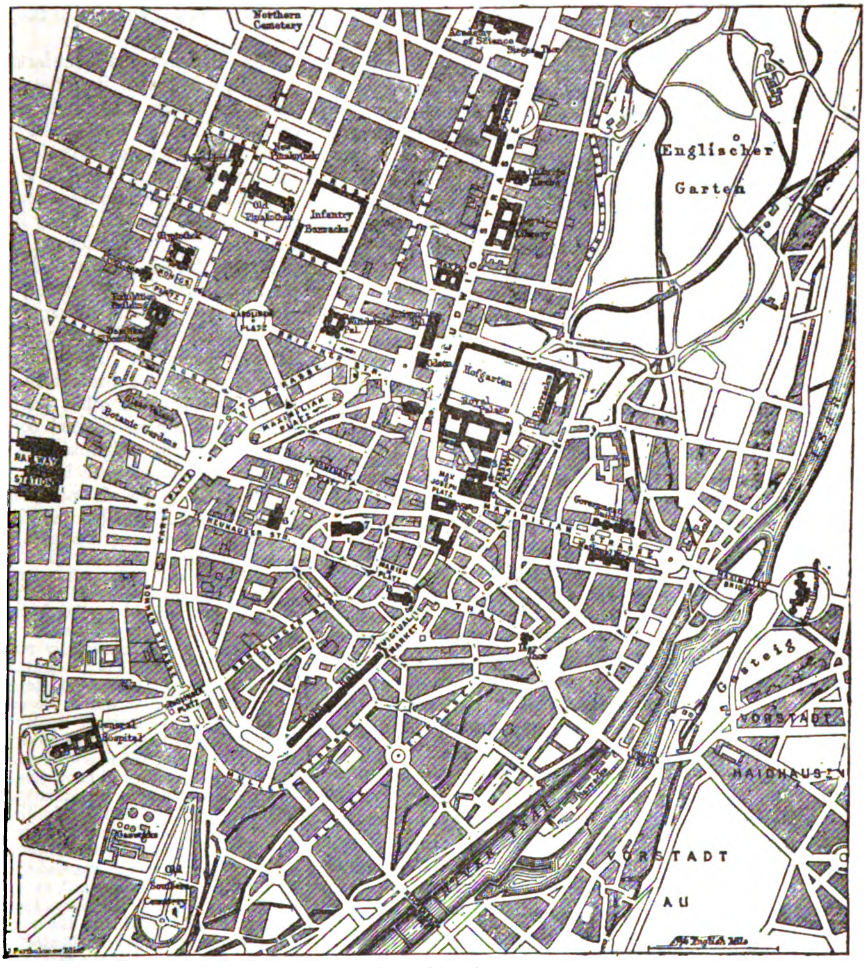
At the beginning of the present century Munich was in no way distinguishable from the crowd of second-rate German towns, but since the accession of Louis I. in 1825 it has undergone a metamorphosis of the most remarkable character. This splendour-loving prince devoted himself heart and soul to the embellishment of his "residence," and his successors have followed in his footsteps with such zeal that Munich is now almost unrivalled for architectural magnificence among the smaller capitals of Europe, while its collections of art entitle it to rank alongside of Dresden and Berlin. Most of the modern buildings have been erected after celebrated prototypes of other countries and eras, so that, as has been said by Carrière, a walk through Munich affords a picture of the architecture and art of two thousand years. The want of local colouring is perhaps a blemish in this "museum of architecture," and it has also been objected that the prevailing uniformity of surface in the buildings does not produce sufficient contrast of light and shade. In carrying out his plans Louis I. was ably seconded by the architect Klenze, while the external decorations of painting and sculpture were mainly designed by Cornelius, Kaulbach, and Schwanthaler.

A large proportion of the most notable buildings in Munich are in two streets, the Ludwigstrasse and the Maximilianstrasse, the creations of the monarchs whose names they bear. The former, three-quarters of a mile long and 60 yards wide, chiefly contains buildings in the Renaissance style by Gärtner. The most striking of these are the palaces of Duke Max and Prince Luitpold; the Odeon, a large building for concerts, adorned with frescos and marble busts; the war office; the royal library, in the Florentine Palatial style; the blind asylum; the Ludwigskirche, a successful reproduction of the Italian Romanesque style, containing a huge fresco of the Last Judgment by Cornelius; and, lastly, the university. At one end this street is terminated by the above-mentioned Sieges Thor, while at the other is the Feldherrnhalle or hall of the marshals, a copy of the Loggia dei Lanzi at Florence, containing statues of Tilly and Wrede. Adjacent is the church of the Theatines, an imposing though somewhat over-ornamented example of the Italian Rococo style; it contains the royal burial-vaults. In the Maximilianstrasse, which extends from Haidhausen on the right bank of the Isar to the Max-Joseph Platz, King Maximilian II. tried to introduce an entirely novel style of domestic architecture, formed by the combination of older forms. At the east end it is closed by the Maximilianeum, an extensive and imposing edifice for the instruction of civil servants, adorned externally with large sculptural groups and internally with huge paintings representing the chief scenes in the history of the world. Descending the street towards the west we pass in succession the national museum, the new gymnasium, the provincial government buildings for Upper Bavaria (in which the composite style of Maximilian has been most consistently carried out), and the mint. On the north side of the Max-Joseph Platz lies the royal palace, an extensive building, consisting of the Alte Residenz, the Königsbau, and the Festsaalbau. The old palace, dating from 1601 to 1616, was designed by Peter Candid, and was formerly considered a very fine building. The apartments are handsomely fitted up in the Rococo style, and the private chapel and the treasury contain numerous interesting and valuable objects. The Festsaalbau, erected by Klenze in the Italian Renaissance style, is profusely adorned with mural paintings and sculptures, while the Königsbau, a reduced copy of the Pitti Palace, contains a series of admirable frescos from the *Niebelungenlied* by Schnorr. Adjoining the palace are two theatres, the Residenz or private theatre, and the handsome Hoftheater, the largest theatre in Germany, accommodating 2500 spectators. The Allerheiligen-Hofkirche or court-church is a tasteful little edifice in the Byzantine style with a Romanesque façade, somewhat recalling St Mark's at Venice.

The Ludwigstrasse and the Maximilianstrasse both end at no great distance from the Marien Platz in the centre of the old town. Here stands the Frauenkirche, the cathedral-church of the archbishop of Munich-Freising, with its lofty cupola-capped towers dominating the whole town. Though scarcely a pleasing piece of architecture, it is imposing from its size, and interesting as one of the few examples of indigenous Munich art. On other sides of this square are the old town-house, restored in 1865, and the new town-house, the latter a handsome modern Gothic erection, freely embellished with statues, frescos, and stained-glass windows. The column in the centre of the square was erected to commemorate the defeat of the Protestants near Prague in the Thirty Years' War (1638).

Among the other churches of Munich—the town contains about forty in all—the chief place is perhaps due to St Boniface's, an admirable copy of an early Christian basilica. It is adorned with a cycle of religious paintings by Hess, and the dome is supported by sixty-four monoliths of grey Tyrolese marble. The new parish church of Au, in the Early Gothic style, contains gigantic stained-glass windows and some excellent wood-carving; and the church of St John in Haidhausen is another fine Gothic structure. St Michael's, in the Renaissance style, erected for the Jesuits in 1583 to 1595, contains the monument of Eugène Beauharnais by Thorwaldsen. The façade is divided into stories, and the general effect is by no means ecclesiastical. St Peter's is interesting as the oldest church in Munich (12th century), though no trace of the original basilica remains. One of the two Protestant churches is also a tasteful Gothic building.

The valuable collections of Munich, in virtue of which it ranks among the art-centres of Europe, are enshrined in handsome and appropriate buildings, most of them in the new Maximilian suburb on the north side of the town. The old Pinakothek, erected by Klenze in 1826-1836 and somewhat resembling the Vatican, is embellished externally with frescos by Cornelius and statues of twenty-four celebrated painters by Schwanthaler. It contains a very valuable and extensive collection of pictures by the earlier masters, the chief treasures being the early German and Flemish works and the unusually numerous examples of Rubens. It also affords accommodation to 300,000 engravings, 10,000 drawings, and a large collection of vases. Opposite stands the new Pinakothek, the frescos on which, designed by Kaulbach, already show the effects of wind and weather. It is devoted to works by painters of the present century, among which Rottmann's Greek landscapes are perhaps the most important. The Glyptothek, a building by Klenze in the Ionic style and adorned with several groups and single statues, contains a valuable series of sculptures, extending from Assyrian and Egyptian monuments down to works by Rauch, Thorwaldsen, and other modern masters. The celebrated Æginetan marbles preserved here, found in the island of Ægina in 1811, are perhaps the most important remains of archaic Greek sculpture. Opposite the Glyptothek stands the exhibition building, in the Corinthian style, used for periodic exhibitions of art. Munich also contains several important private galleries, among which is Count Schack's unequalled collection of modern German pictures. The Kaulbach museum contains a selection of the pictures and sketches left by the painter of that name; and a collection has also been made of the models of Schwanthaler's works.



Plan of Munich.

1. Theatinerkirche.
2. Feldherrnhalle.
3. Allerheiligen Church.
4. Residenztheater.
5. Hoftheater.
6. St Michael's Church.
7. Frauenkirche.
8. St Peter's Church.

The scientific collections of Munich are on a par with its galleries of art. The immense collection in the above-mentioned Bavarian national museum, illustrative of the march of progress from the Roman period down to the present day, is superior in completeness and proportion to the similar collections at South Kensington and the Hôtel de Cluny. On the walls is a series of well-executed frescos of scenes from Bavarian history, occupying a space of 16,000 square feet. The ethnographical museum, the museum of plaster casts, the cabinet of coins, and the collections of fossils, minerals, and physical and optical instruments are also worthy of mention. The art union, the oldest and most extensive in Germany, possesses good collections of modern works. The chief place among the scientific institutions is due to the Academy of Science, founded in 1759, to which some of the above-mentioned collections belong. The royal library, containing 1,000,000 printed volumes and numerous valuable manuscripts, occupies the third place among the libraries of the world. The antiquarium is a collection of Egyptian, Greek, and Roman antiquities in the old palace. The observatory is admirably equipped with fine instruments by the celebrated Fraunhofer.

At the head of the educational institutions of Munich stands the university, founded at Ingolstadt in 1472, removed to Landshut in 1800, and transferred thence to Munich in 1826. It has a staff of about 130 professors and lecturers, and in 1882 was attended by 2183 students. In addition to the four usual faculties there is a fifth, of political economy. In connexion with the university are medical and other schools, a priests' seminary, and a library of 200,000 volumes. The polytechnic institute, contained in a handsome brick edifice, adorned with medallions of celebrated architects, mathematicians, and naturalists, is also attended by a large number of students. Munich contains three gymnasia or grammar-schools, a real-gymnasium, a military academy, a veterinary college, two industrial schools, a commercial school, a school for architects and builders, several normal schools, a conservatory of music, a dramatic training school, and about twenty-five elementary schools. Among the numerous benevolent institutions the most prominent are the asylums for the blind, the deaf and dumb, and the insane, and the general hospital. The general prison in the suburb of Au is considered a model of its kind; and a large military prison has just been erected. Amongst the other public buildings which call for mention are the crystal palace, 765 feet in length, erected for the great exhibition of 1854; the slaughter-houses, covering 9 acres of ground; the Wittelsbach palace, in the Early English Pointed style; the post-office; the arsenal, containing a military museum; the new railway station, the art-industrial institution, the Maximilian barracks, the corn hall, and the aquarium. Among the numerous monuments with which the squares and streets are adorned, the most important are the colossal statue of Maximilian II. in the Maximilianstrasse, the equestrian statues of Louis I. and the elector Maximilian, and the obelisk erected to the 30,000 Bavarians who perished in Napoleon's expedition to Moscow.

Munich is well supplied with public parks. The English garden, to the north-east of the town, is 600 acres in extent, and was laid out by the celebrated Count Rumford in imitation of an English park. On the opposite bank of the Isar, above and below the Maximilianeum, extend the Gasteig promenades, commanding fine views of the town. To the south-west of the town is the Theresienwiese, a large common where the popular festivals are celebrated. Here is situated the Ruhmeshalle or hall of fame, a Doric colonnade containing busts of eminent Bavarians. In front of it is a colossal bronze statue of Bavaria, 170 feet high, designed by Schwanthaler. An admirable view is obtained from its summit. The finest of the cemeteries of Munich is the southern cemetery, outside the Sendlinger Thor. The dead-houses in the cemeteries are used for the strange custom of keeping the corpses several days before interment, dressed in their usual attire and exposed to public view. The botanical garden, with its large palm-house, and the Hofgarten, surrounded with arcades containing fine frescos of Greek landscapes by Rottmann, complete the list of public parks.

The population of Munich amounted at the census of 1880 to 230,023 inhabitants, of whom 110,033 were males and 119,990 females. These lived in 8791 dwelling-houses, and formed 53,457 households. The garrison numbers about 7000 men. Only 37 per cent. of the inhabitants are born in Munich, most of the remainder coming from the country districts of Bavaria (53 per cent.) and other parts of Germany (5½ per cent.). Another census was taken in 1882 to elicit the occupations of the inhabitants, when it was found that 148,913 persons, or considerably more than half the population (64 per cent.), were supported by trading and manufacturing, while of the remainder 27,592 (12 per cent.) belonged to the official, military, and professional classes, 30,038 (13 per cent.) had no profession, and 24,237 (10·5 per cent.) were engaged in domestic service. The population has been quintupled since 1801, when it was only 48,885. In 1680 it was 20,000, in 1783 it was 38,000. The annual death-rate is high, exceeding 30 per thousand. This is, however, mainly accounted for by the abnormal mortality among children, after allowance for which the rate is not over 20 per thousand. About 85 per cent. of the inhabitants are Roman Catholics, and many of Munich's most characteristic features are due to the fact that it is the centre of Roman Catholicism in southern Germany. Since the census of 1875 the number of Protestants in Munich has increased by 32 per cent., while the Roman Catholics have increased by 13½ per cent. only. Munich is the seat of the archbishop of Munich-Freisi and of the general Protestant consistory for Bavaria. Abo thirty newspapers are published here, including the pr cipal Ultramontane sheets of south Germany. Some the festivals of the Roman Church are celebrated with co siderable pomp; and the people also cling to vario national fêtes, such as the Metzgersprung, the Schäfflerta (occurring septennially), and the great October festival the Theresienwiese. The popular life of Munich may said to revolve round its breweries and beer-gardens, whe the manners and customs of the people may be convenient studied.

The commerce and manufactures of Munich are scarcel commensurate with its artistic importance, though it ha lately begun to take rank among the great industri centres. It has long been celebrated for its artisti handicrafts, such as bronze-founding, glass-staining, silve smith's work, and wood-carving, while the astronomica instruments of Fraunhofer and the mathematical instru ments of Ertl are also widely known. Lithography, whic was invented at Munich at the end of last century, i still extensively practised here. The other industria products include wall-paper, railway plant, machinery gloves, and artificial flowers. Perhaps the most charac teristic industry, however, is the preparation of the national beverage. In 1879 upwards of 28 million gallons of beer were brewed in Munich, only one-fifth of which was sent to other parts of Bavaria or exported. This represents an annual consumption of at least 125 gallons per head of population, while the rate in England is only 40 gallons per head. Trade, especially in grain and artistic goods, is now rapidly growing. Four important markets are held at Munich annually.

History.—The history of Munich, as distinct from that of Bavaria, has been very uneventful. The Villa Munichen or *Forum ad Monachos*, so called from the monkish owners of the ground on which it lay, was first called into prominence by Duke Henry the Lion, who established a mint here in 1158, and made it the emporium for the salt of Hallein and Reichenhall. The dukes of the Wittelsbach house occasionally resided at Munich, and in 1255 Louis the Severe made it his capital, having previously surrounded it with walls and a moat. The town was almost entirely destroyed by fire in 1327, after which the emperor Louis the Bavarian, in recognition of the devoted loyalty of the citizens, rebuilt it very much on the scale it retained down to the beginning of the present century. Among the following rulers those who did most for the town in the erection of handsome buildings and the foundation of schools and scientific institutions were Albert V. (1550-1579), William V. (1579-1596), Maximilian I. (1597-1651), Max Joseph (1745-1777), and Charles Theodore (1778-1799). In 1632 Munich was occupied by Gustavus Adolphus, and from 1705 to 1715, and again in 1742, it was in possession of the Austrians. In 1791 the fortifications were razed, and room thus made for the enormous development the city has since experienced. The modern history of Munich may be dated from the accession of King Louis I. in 1825, since which, as already indicated, nearly all the most handsome streets and buildings of the town have been constructed. Like the Bavarians in general, the citizens of Munich are naturally inclined to adhere to the traditionary both in politics and in religion, but of late the population has become permeated with more advanced ideas.

Munich's importance in the history of art is entirely of modern growth, and may be dated from the acquisition of the Æginetan marbles by Louis I., then crown prince, in 1812. Among the eminent artists of this period whose names are more or less identified with Munich were Klenze, Ohlmüller, Gärtner, and Ziebland, the architects; Cornelius, Kaulbach, Schnorr, and Rottmann, the painters; and Schwanthaler, the sculptor. The art of fresco-painting may be said to have been resuscitated in Munich during this reign, and the artistic handicrafts of bronze-founding and glass-staining were also practised with a success previously unknown in modern days. Munich is still the leading school of painting in Germany, but the romanticism of the earlier masters has been abandoned for drawing and colouring of a thoroughly realistic character. Piloty and W. Diez stand at the head of this school.

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MUNICIPALITY. A municipality is an organization for the self-government of a city or town by means of a corporation empowered generally to maintain peace and order, and to manage the affairs of the inhabitants. Such a corporation consists of a head as a mayor or provost, and of superior members as aldermen and councillors, together with the simple corporators who are represented by the governing body; it acts as a person by its common seal and has a perpetual succession with power to hold lands subject to the restrictions of the Mortmain Laws, and it can sue or be sued or be indicted, although there are of course many personal matters which do not come within the functions and liabilities of such bodies politic. Where necessary for its primary objects, every corporation has power to make byelaws and to enforce them by penalties, provided they are not unjust or unreasonable or otherwise inconsistent with the objects of the incorporation or charter or other instrument of foundation; and in the case of a municipality such byelaws will be binding even upon strangers within the district.

Great Britain has no general system of self-government. A certain number of cities and towns have been from time to time incorporated by the crown, or have successfully claimed the privilege as existing from time immemorial, either because in fact they have governed themselves from very ancient times, or because they have had such a representation in parliament as led to a presumption of their having been incorporated like the rest. The other urban districts have been regarded as mere "upland towns" or populous townships, with nothing but a parochial organization, or the faint semblance of municipal institutions which grew out of the administration of fairs and markets. These are now comprised in the various local government districts existing under the Public Health Acts, "lighting and watching districts" constituted under an Act passed for the purpose in 1833, and improvement districts governed under the powers given by a number of local Acts. Provision has been made by the Acts which regulate these corporations for the grant of powers of self-government to new municipal boroughs subject to the approval of the committee of the privy council. The making of corporations, however, is regarded as one of the highest prerogatives of the crown, and the legislature has always been careful to avoid unnecessary interference with the right; the functions of the committee are therefore confined to the allowance or refusal of municipal powers as constituted by statute, the right of the crown to make corporations of other kinds being left in theory untouched.

The term "municipal borough" was introduced when the larger corporations were reformed in 1835 to denote a place to which the new powers of self-government were applied, whether such a place were a parliamentary borough or not. It has now become nearly equivalent to "municipality" owing to the provisions of the Act of 1883 for extinguishing the less important of the small unreformed municipalities, and for bringing the rest within the purview of the Municipal Corporations Act, 1882, by which the provisions of the statute of 1835 and its forty-two amending Acts were consolidated. The meaning of the word "borough" has undergone many changes. It seems at first to have denoted a walled town or city, but it was soon applied especially to such of them as possessed some kind of organization for the transaction of the local business. At a later period the term implied the right to be represented in parliament. This may be illustrated by the proceedings in the case of Torrington in the reign of Edward III. This place, whether a "burgh" or a mere "vill," had in fact sent burgesses to parliament, but after it was determined that such representation was improper the town was omitted from the category of boroughs. In summoning the commons to parliament each sheriff was directed to procure the election of two citizens from every city and two burgesses from every borough in his bailiwick. But it soon became the practice to omit places which had been represented, and to include others with no title to the privilege except their situation on the royal demesnes, or their political or commercial importance. It resulted that the word "borough" came to denote only those places which were usually represented in parliament, whether they were walled towns or not, and whether they had or had not received charters of incorporation; and in course of time it was taken for granted that every parliamentary borough must have been incorporated at some ancient time, or in other words was entitled to the privileges of a borough by prescription. The first Reform Act changed the meaning of the word again by depriving the smaller boroughs of their parliamentary functions and reducing them to the same position as those districts which were known as boroughs in a popular sense, as having originally had a representation which had been lost, or as being important places enjoying municipal rights under charters like those which had been granted to the parliamentary boroughs.

We shall now proceed to describe the ordinary constitution of an English municipal borough, omitting the small municipalities which are now in course of extinguishment, and for other reasons omitting the city of London, which, on account of its singular importance and its peculiar circumstances, will probably become without much delay the subject of separate legislation (see LONDON).

These boroughs are governed by corporations composed in each case of a mayor, aldermen, and burgesses, acting by a council elected by the general body of qualified corporators. If the borough is a city, the burgesses are described as the "citizens." With a few exceptions arising under local Acts, the following description applies to all the municipal boroughs in England and Wales, similar provisions having been made for the boroughs of Scotland and Ireland (see vol. iv. p. 63) by Acts of Parliament passed for those parts of the United Kingdom. The powers and duties of the council are defined by the Municipal Corporations Act, 1882, which forms a complete municipal code. The number of councillors varies from twelve to forty-eight according to the size of the borough, and in the case of a new incorporation the number is fixed by a provision in the charter. The qualification of a councillor is to be an enrolled resident burgess, or, if not resident within the district, residing within 15 miles of the borough and having in either case the property qualification required by the Act, provided that he is not a clergyman or a regular dissenting minister, or interested in any office, place, or contract with which the corporation is concerned. The qualification of a burgess is to be enrolled on the burgess-roll as the rate-paying occupier of a house or other building in the borough or within 7 miles distance from it. Women may be burgesses, but are not qualified for corporate office. In many boroughs there are ancient classes of freemen qualified as such by birth, servitude, or marriage (and formerly in many cases qualified by gift or purchase); but these freemen as such have not the rights of burgesses, though they are entitled to the parliamentary franchise and to their share in the charities and corporation property under titles accruing to their class before the reform of 1835. The qualification of an alderman is the same as that of a councillor, and the mayor is chosen from the aldermen, or councillors, or persons qualified for such positions.

The councillors hold office for three years, one-third of their number being annually renewed by ballot. If the borough is divided into wards, an alderman acts as returning-officer for the elections in each ward; if not, the mayor acts as the returning-officer for the borough. Municipal elections fall within the provisions of the Corrupt Practices Act, 1883. The aldermen hold office for six years, one-half of their number retiring every three years in rotation. The mayor holds office for one year. His election is the first business at the quarterly meeting held on the 9th day of November, when the amount of his remuneration is fixed by the council. He is the only member of the corporation who receives a salary. The council chooses the mayor and aldermen and appoints the officers of the corporation, as the town-clerk and treasurer, the sheriff when the borough is a county of itself, and the coroner and clerk of the peace when it has separate quarter-sessions. The council appoints such general and special committees as may be required, and has the general management of the corporate property, subject to the supervision of the treasury; it makes all necessary byelaws, subject to disallowance by the privy council if necessary. With exceptions arising from the provisions of local Acts, the council regulates the police force, the lighting and watching of the borough, the management of markets and burial-grounds, and the execution of the laws relating to public health. The expenses are defrayed out of the borough fund, which includes the income of the general corporate estate, supplemented by a borough-rate paid out of the poor-rate or assessed upon a similar basis. A watch-rate, if required, may be levied on the whole borough or on a selected portion of the district. When expenditure is required for objects of a permanent character, the council is empowered to raise the amount by loans, charged on the rates and repayable by instalments, subject to the approval of the treasury or other public department entrusted with the control of the matter, according to the nature of the improvement required. The whole of the accounts are audited by borough auditors, of whom one must be a councillor appointed by the mayor, and the other two elected by the burgesses from persons qualified to be councillors. A return is made to the Local Government Board of the receipts and expenditure for the year, and an abstract of all these returns is laid every year before parliament. Some control over the expenditure is also reserved to the High Court of Justice by a provision that all orders for payment must be signed by three councillors and the town-clerk, and that any such order may be moved by *certiorari* into the Queen's Bench Division. The aldermen have no greater powers than other councillors, excepting that they may act as the returning-officers for wards as above mentioned, and that an alderman may act for the mayor if he is temporarily unable to discharge his duty and has not appointed a deputy. The mayor is the head of the corporation, and is *ex officio* a magistrate for the borough and a member of the watch committee. He is the returning-officer at parliamentary elections, and acts with two elected revising assessors as the revising officer if the borough is not represented in parliament. His office is vacated by death or bankruptcy, and must be filled up with all convenient speed after any such vacancy occurs. The last ex-mayor is also *ex officio* a magistrate for the borough.

Where the borough has a separate commission of the peace, the borough justices, with the last-mentioned exceptions, are appointed by the crown. A separate commission does not of itself exempt the borough from the concurrent jurisdiction of the county justices. A stipendiary magistrate may be appointed by a secretary of state on the application of the council, and when appointed he is *ex officio* a justice for the borough. When the borough has a separate court of quarter-sessions the recorder is the judge, but in certain cases may appoint an assistant or deputy; the recorder must be a barrister of five years' standing, and is appointed by the crown on the recommendation of the home secretary; the recorder is also *ex officio* a justice for the borough. When the borough has such a court it ceases to be liable to the county-rate, but must contribute to the expenses arising from prosecution and conviction of prisoners from the borough at the assizes. In the case of boroughs which were liable before 1832 to contribute to the county-rate, a contribution to the expenses of the county is still required. Subject to an exception as to judges and assessors appointed before 1835, and to the provisions of various local Acts, the recorder is the judge of any civil court existing in the borough by prescription.

We shall now discuss more generally the origin of these municipalities upon the Continent as well as in the United Kingdom. The conception of the borough as it now exists has obviously been copied from the Roman *municipium*. As to England, however, the coincidence is in one sense accidental, inasmuch as it had a municipal system before the lawyers adopted the notion of a corporation from the civilians, though it may be true that no such system could grow up without being influenced by ideas which were familiar to the churchmen. In some parts of the West the Roman system appears to have lived on without an actual breach of continuity. The "curia" seems to have continued in the cities of Provence until the outbreak of the great revolution. At Treves and Cologne "the Roman language perished, but the institutions survived;" and the *libertas Romana* or full body of municipal privileges was extended gradually to other cities on the Rhine and the trading communities of Holland and Brabant. It is possible also that some relics of the imperial administration may have continued in southern Italy and in a few of the Lombard cities. One element at least in the corporation of Paris can be traced back to the *Nautæ Parisiaci*, a college of merchants established in the first period of the empire. But the English municipalities are in no sense a legacy from the imperial times, or a continuation of the system which prevailed in the cities of Britain, even in the few instances, as in London, York, and Exeter, where there may have been an unbroken succession of occupancy. Almost all the towns were destroyed in the course of the English conquest, and some which became important again, as Bath, Cambridge, and Chester, are known to have lain waste for centuries. In other instances the English kings soon learned to hold their courts in the fortresses, and to set up their farmsteads in the desolated palaces, or elsewhere a Roman camp may have been taken as a convenient point for a garrison, which in time became a "civil centre" and the site of a municipal borough.

The French municipalities can be traced to several distinct sources of origin. The chief activity was in the north; the southern cities kept their Roman traditions or imitated the Italian model, as those in the east endeavoured to secure the same privileges as the mercantile communities on the Rhine; in the central provinces the towns for the most part retained the organization of the parish, and were rather *bourgeoisies* or privileged market-towns than *communes* with powers of self-government. The rise of the communes began under Philip I., and they became general in the 13th century. The first charter was granted to Le Mans in 1072, and another to Cambray in 1076; these were followed by grants to Laon, Beauvais, Amiens, Soissons, and many other places; and similar privileges were granted in the 12th century by the counts of Flanders, the dukes of Burgundy, and other princes,—the general effect of the grants being to fix the lord's rent or tribute, to commute the military service, and to give jurisdiction to magistrates either freely elected or chosen by the townsmen in conjunction with their feudal lords. Specimens of these charters can be seen in the *Ordonnances des Rois*, Kemble's *Anglo-Saxons*, and Bouthors's *Coutumes locales du Baillage d'Amiens*. They show us a political revolution directed against the feudal lord by townsmen associated in merchant-guilds or sworn into a new sort of brotherhood. To break the oath of loyalty to the commune is a crime of the gravest kind. "If any of us aid or comfort our enemies he is guilty of *lèse-commune*, and we will pull down his house, if we can. . . . Whoever wounds with weapon any of his fellows shall lose his fist or pay nine livres" (Amiens). "The men shall take what wives they please, first asking leave; if their lord refuse, and a man take a wife from another lordship, he shall pay but five sous for a fine. Every one living within the district shall take the communal oath or answer with house or goods" (Soissons). These charters are important because the *communa* of London was founded under Richard I. in direct imitation of the French example, and soon became the type of the independence which the other boroughs continually struggled to attain; and, as in France, the great men deplored the revolt as *tumor plebis, timor regis, tepor sacerdotii*, while the kings for their own purposes encouraged the popular movement. And in the same way Philip Augustus and his successors were so ready to protect the communes that they eventually claimed and obtained an immediate seigniory over all the chartered boroughs to the exclusion of any private lords to whom the towns had formerly belonged. Another point of importance lies in the fact that the lords not only settled the local laws of inheritance and other customs "running with the land," but sometimes changed them at the townsmen's request, as if it were merely an affair between lord and tenant. There are English examples of the same practice, which seems to have been not entirely discontinued until the reign of Edward I. A prerogative of this nature was exercised by the archbishop in Kent, and Simon de Montfort in 1255, at the request of his burgesses of Leicester, abolished the custom of descent to the youngest son. Fitzosberne appears by Domesday Book to have granted a separate set of customs to his "Frenchmen" in Hereford, and a difference of the same kind which existed at Stafford and Nottingham must have been caused by similar grants; in the latter place it was found on a trial in the reign of Edward III. that there were two districts in the town, the one called the "French borough" and the other the "English borough," where descent was to the youngest son, a circumstance which gave its name to the custom of "borough-English."

Municipal freedom was granted in Spain at an earlier date and on an ampler scale, as beseemed the poverty of the kings, the weakness of the nobles, and the constant danger from the Moors. The Visigothic laws were imbued with the principles of the Theodosian code, and it was easy for the Spaniards to regard the incorporated cities as bodies politic of the highest importance. The first instance of the erection of such a community was the grant in 1020 of a code of privileges to Leon. Such grants were treaties between the king and the chartered towns, by which the latter obtained fixed laws, extensive territories, and the choice of their own magistrates in return for a tribute and universal service in the militia. The king appointed a governor to take charge of the fortified places, but in almost every other respect the inhabitants governed themselves. This democratic constitution was after a time impaired by the claims of the knights or "caballeros" to a monopoly of office; but what actually led to its destruction was the increase in the power of the crown. The disorders inseparable from popular elections were declared, as in England under the Tudors, to be a reason for vesting the government in a small and close corporation, which was soon found to be quite amenable to the influence and dictation of the court.

The municipalities of every country have a separate history of their own, and it is difficult to find any general law for determining their methods of development. According to their opportunities the oppressed wear out their conquerors' patience and too often become oppressors in their turn: as the state becomes more complex the old confederacies are broken up, and the scattered communities are reduced to order by a central government, and as privilege begins to disappear the towns are regulated by a common set of rules, or the whole country, as in France, is parcelled out again into a new series of communes or corporate districts. In Spain, as we have seen, the needs of the state gave immediate freedom to its defenders. In Italy the cities grew too soon into a crowd of independent republics. The history of Lincoln and Exeter and the cities of the Danelagh shows that "the tendency of the great cities of England was towards a more than municipal independence" (Freeman, *Engl. Towns*, p. 206). If these movements had not been checked by the Norman Conquest, English history might have been "like that of the imperial kingdoms." But, as this event turned out, there is little in the record of the German cities which bears upon that of English municipalities, excepting some slight resemblances between the powers acquired by the city of London and those of the Hanse towns and the mercantile principalities of Nuremberg and Augsburg. The free cities of Germany were at first divided between the emperors and their immediate vassals, the former ruling through the bishops as imperial vicars; in the 12th century the citizens began to elect councils and to administer a concurrent jurisdiction; in the next century they either purchased full powers or drove out the vicars and bailiffs by force; the revolutions which followed the fall of the Hohenstauffen family enabled the cities to free themselves from the mediate lords and to hold directly of the empire, and they were soon afterwards admitted to the diet on equal terms with the rest of its sovereign constituents.

The borough when it appears in English history is essentially a place of defence, and the definition includes the powerful city which formed the metropolis of an ancient kingdom, the border-fortress, the walled seaport, the "burh" erected in a disaffected province, and the fortified village on the private demesne of the king. There is another sense of the word "borough," as used in Kent and the neighbouring counties, to denote the small rural division which is elsewhere called a "tithing," the constable or tithing-man being the same officer as the "borsholder" or "borough-elder" of the eastern counties; but the verbal similarity is accidental, the rural "borough" having been the district of the "frank-pledges" or neighbours under a pledge or "borh" to act as bail for each other. The borough or "burh" was confined to the precinct of the walls, though the town or city might extend to a greater distance, or the burgesses might be joint-owners of estates outside the lines of defence. There might even be two "burhs" side by side if the nature of the locality required it. We read in the Chronicle, for instance, of the construction of the "northern burh" at Hertford in 913, and of "burhs" being built five years later on both sides of the river at Buckingham; and many other examples will be found collected in Kemble's list of the towns.

Little is known of the civil constitution of the boroughs before the Norman Conquest, and even the Domesday survey fails to give much information as to their internal affairs where the king's rights were not immediately concerned. It appears indeed that Lincoln and the other cities of the Danelagh were almost independent; an aristocratic commonwealth in each case was governed by twelve hereditary judges, and the same kind of organization, but with a less degree of independence, appeared at Chester and Ipswich. The size and the wealth or power of places like Canterbury, Taunton, and Sandwich entitled them to be treated as separate "hundreds," and the constitution of London must have been based on that of a shire; but, speaking generally, it may be said that the ordinary boroughs were without any powers of self-government. Each borough was administered as if it were a township or cluster of townships, intersected in most cases by a number of separate jurisdictions and subject to the obligations of tenure which bound many of the burgesses to lordships outside the walls. The borough-courts were held by the reeve or bailiff, who may have been in many cases elected, but was always answerable to an external authority. If the place was of mercantile importance it was called a port (from "porta," the city-gate), and the court and its president, as in London, Canterbury, and Bath, were styled the "port-mote" and "port-reeve." In the smaller boroughs the reeve's functions must have resembled those of the steward in the ordinary manorial courts. When municipal rights were granted by the Plantagenet kings this officer was replaced by the "mayor," whose appearance is always the sign of the establishment of an independent commune. The first steps toward self-government were taken when the burgesses became the owners, as at Oxford and Colchester, of property which they managed in common. But a more important source of municipal privilege is to be found in the institution of the guilds, which in time acquired the control and monopoly of the local commerce, so that in the reign of Henry II. the possession of a merchant-guild, or "hanse" as it was called in the north, became "the token of municipal independence," the guild being in fact (if not in theory) the governing body of the town. The courts in later times have accordingly held, as in the case of Totnes, that the grant of *gilda mercatoria* implies the incorporation of the borough. The guilds appear first in a religious form, and date in all probability from the times when the neighbours met to drink at the pagan festivals or the feasts in honour of the dead. Other voluntary associations of the same kind were formed as clubs and friendly societies for mutual insurance and defence. The "frith-gild" of London, as it existed in the reign of Athelstane, and the later "knighten-guild," the "thanes' guild" at Cambridge, and the guilds of Canterbury and Exeter were all fraternities of this kind. The "chapman-guild" ("hanse"- or merchant-guild) was an association on the same model but on a larger scale, comprising all the traders in the town, and assuming the power to make bylaws to regulate all the local business which did not fall within the jurisdiction of the regular courts. The London knighten-guild, until it was suppressed by Henry I., had a legal jurisdiction in the district of Portsoken Ward. The ancient descriptions of Winchester mention two knighten-guilds where the "probi homines" were wont to drink their guild ("potabant gildam suam"). The "gild-halla" of the men of Dover is mentioned in Domesday Book. When the boroughs were enfranchised as communes upon the French model care was taken to confirm and establish these trading fraternities as forming the most important members of the new corporations. Thus in 1200 King John granted to the burgesses of Nottingham "a merchant-guild with all the liberties and free customs which ought to pertain thereto," and the grant to Ipswich in the same reign, besides preserving and extending the jurisdiction of the twelve "portmen" or capital burgesses, provides that the common council shall elect a fit man to be alderman of the merchant-guild. The same king granted to Dublin the right of having guilds "as in Bristol." York and Beverley had the right to have a "hans-hus" some time before, in the latter case by the grant of Archbishop Thurstan in the reign of Henry I.

Another valuable franchise was obtained when the boroughs procured a separate assessment of their dues to the crown. Except in the case of the most important cities, the boroughs were regarded as parts of the counties in which they were situate and as answerable accordingly to the sheriff. It was of the highest importance to the burgesses that their share of the county-dues should be ascertained, and even before the Norman Conquest it became the practice for the borough to answer for its own dues under the name of *firma burgi*. The Domesday survey shows that Dover, Sandwich, Bath, Huntingdon, and many other boroughs had obtained a privilege of this kind. A borough paying its fixed assessment to the king or other lord, through the reeve or alderman of the merchant-guild, was regarded as a single tenant holding the borough for years or at will or in perpetuity, according to the nature of the contract. When its dues and services were assessed in perpetuity the borough was said to be "affirmed," or held in fee-farm, and the burgesses were thenceforth treated as freeholders by a burgage tenure. The only rights remaining to complete their municipal independence were attained when the sheriff's jurisdiction was ousted and the burgesses were allowed to elect their own magistrates to administer justice in the local courts. In the reign of Henry III. the great lords began to enfranchise their boroughs in imitation of the royal example. The statute of *Quo Warranto* in 1290 led to the confirmation of these charters by the crown, and the doctrine was soon established that none but the king had authority to erect a commune. The Scottish boroughs obtained complete self-government at an earlier date, King David I. (1124-1153) having been anxious to attract commerce, and the walled towns having soon been filled with "a crowd of willing settlers from southern Britain and Flanders." Edinburgh, Stirling, Roxburgh, and Berwick formed an important commercial league, "to which the other burghs conformed as they came into existence" (Robertson, *Early Kings*, i. 298). Both in England and Scotland the boroughs, whether founded by the crown or by private lords, were important elements in the state, and in England both classes were summoned to parliament indifferently; in 1298 a writ was issued for Northallerton, which belonged to the bishop of Durham, though by a curious anomaly his city of Durham only acquired the franchise by an Act passed in 1673. The introduction of the metaphysical idea of a corporation may be ascribed to the influence of Bracton, who wrote under Henry III. (*De Legibus*, 57; *Fleta*, vi. 13). We find Edward I. in 1284 granting franchises to the burgesses and community of Nottingham and their "successors," the old form being "to the burgesses and their heirs." The practice varied according as the feudal or the ecclesiastical way of regarding such grants prevailed, until in 1440 the town of Kingston-upon-Hull was incorporated as a body politic according to the modern form. The government of the boroughs soon fell to close governing bodies, constituted by restraining ordinances, and the Stuarts made incessant attempts to obtain the nomination even of these smaller bodies. After the fall of the corporation of London in 1681 the provincial boroughs lost or surrendered their privileges; and, though the charters were revived at the Revolution, the narrow and corrupt system remained. The commissioners of 1835 reported a general and just dissatisfaction with the state of the municipal institutions, great distrust of the self-elected councils, and discontent under the burden of local taxation for purposes which were regarded with suspicion. The reform in England followed swiftly on the famous report, and by Acts passed soon afterwards the Scotch and Irish boroughs, which had long been subject to the same evils, were reconstructed under similar schemes.

The privileges of the cities in the United States illustrate the proposition that the history of every country must determine the type of its municipalities. In almost all parts of Europe the civic franchises arose out of some treaty or contract between the lord and his dependents; in France, however, the character of the corporations was gradually modified as the communal system was extended to the rural districts. In the United States the French model has been followed with the addition of many improvements; and where self-government has been impartially granted to the county, the township, and the village the purely municipal organization has lost its special significance. It is regarded in the American courts as a revocable agency established by the State (without contract or consideration for the grant) for the purpose of carrying out the necessary details of civil government among the inhabitants of an urban district. It is considered to have no vested right to any of its powers or franchises, which are only allowed to exist in furtherance of the design for which the municipality was constituted, that object being the exercise in subordination to the legislature of certain minor powers of government over part of the territory of the State (see Philadelphia *v.* Fox, *Supreme Court of Pennsylvania Rep.*, vol. xiv.). Each city has the general powers of a corporation and no others, in the absence of special laws. It has executive functions and powers of legislation for civic purposes, which are vested in the mayor and his subordinate officers, but it is not in any other way entrusted with judicial authority (see *The Political Code of New York*, titles 4, 5, ss. 947-8).

Besides the authors cited above and the ordinary historical text-books, see Gneist, *Self-Government*; and the work on *Local Government* by M. D. Chalmers, and the *Memoranda* by R. S. Wright there cited. For France, see Thierry, *Lettres sur l'histoire de France*; Leber, *Pouvoir municipal*, 1829; Clos, *Régime municipal dans le Midi*, 1853; Rivière, *Biens communaux, &c.*, 1856; Béchard, *Droit municipal*; Savary, *Origines du droit municipal*, 1868. For Spain, consult Marina, *Teoria de las Cortes*, and *Ensayo historico-critico*, and compare the review on the latter work, *Edinb. Rev.*, No. 48. For Germany and Italy, see Wilda, *Gildenwesen*, 1831; Hullmann, *Städtewesen*, 1828; Bethmann-Hollweg, *Ursprung der Lombard. Städtefreiheit*, 1846; Lambert, *Die Entwickelung der Deutschen Städteverfassung*, 1865; Gaupp, *Deutsche Stadtrechte*, 1851; Homeyer, *Stadtbücher des Mittelalters*, 1860; Gengler, *Codex Juris Municipalis*, 1867; and Maurer, *Gesch. der Städteverfassung in Deutschland*, 1870-1871. (C. I. E.)

MUNSTER. See IRELAND.

MÜNSTER, the chief town of the province of Westphalia in Prussia and formerly the capital of the important bishopric of its own name, lies in a sandy plain about halfway between Cologne and Bremen on the Aa, an insignificant affluent of the Ems. It is one of the best-preserved old towns in Germany, its quaint mediæval character being most strongly impressed on the "prinzipal-markt," with its lofty gabled houses, its arcades, the town-house, a fine Gothic building of the 14th century, and many churches. Of the latter the most important is the cathedral, one of the most original and striking structures in Germany, though much disfigured by modern decoration, rebuilt after a fire in the 13th and 14th centuries, and exhibiting a combination of Romanesque and Gothic forms; the church of St Ludgerus, originally erected in the Romanesque style in 1170, was extended in the Gothic style in 1383, with a tower terminating in a picturesque lantern; the Liebfrauenkirche is of the 14th century; the old church of St Maurice, founded about 1070, was rebuilt in 1859-1862. The room in the town-house in which the peace of Westphalia was signed in 1648 contains portraits of the ambassadors present at the ceremony. On the tower of St Lambert's church (14th century), the upper part of which has recently been pulled down as insecure, were hung three iron cages in which the bodies of John of Leyden and two of his followers were exposed in 1536 (see ANABAPTISTS). The old Stadtkeller contains a collection of early German paintings. The university of Münster, founded after the Seven Years' War and closed at the beginning of this century, is now represented by an academy with the rank of a university, possessing faculties of philosophy and theology (Roman Catholic). In connexion with it are botanical and zoological gardens, several scientific collections, and a library. The private houses of Münster afford an admirable picture of German domestic architecture in the 16th, 17th, and 18th centuries,—Gothic, Renaissance, and Rococo.

Münster is the seat of a Roman Catholic bishop, of the headquarters of an army corps, and of the administrative and judicial authorities of Westphalia. The Westphalian Society of Antiquaries and several other learned bodies also have their headquarters here. The population in 1880 was 40,434, including about 6000 Protestants. The relative industrial importance of Münster is no longer maintained, but manufactures of cotton, linen, and woollens, candles, leather, &c., are still carried on, and it is the centre of a tolerably brisk trade in these products, as well as in cattle, Westphalian hams, grain, and books.

History.—The first historical mention of Münster takes us back to the close of the 8th century, when Charlemagne fixed "Mimegardevoord" as the residence of the newly-appointed bishop of the Saxons. The growth of the settlement round the "Monasterium" was slow, owing to its distance from any navigable river or important highway, and it was not till 1180 that it received a municipal charter. The name Münster had supplanted the original one about a century earlier. During the 13th century Münster was one of the most important members of the Hanseatic League. At the time of the Reformation the citizens were inclined to adopt Protestantism, but the excesses of the ANABAPTISTS (*q.v.*) led to the armed intervention of the bishop and the forcible suppression of all divergence from the ancient faith. The Thirty Years' War, during which Münster suffered most from the Protestant armies, was terminated by the peace of Westphalia or Münster, signed in the town-hall here on 24th October 1648. The authority of the bishops, who seldom resided at Münster, was usually somewhat limited, but in 1661 Bishop Bernhard von Galen took the town by force, built a citadel, and deprived the citizens of most of their privileges. In the Seven Years' War Münster was occupied both by the French and by the allied troops. Towards the close of last century Münster was recognized as one of the intellectual centres of Germany, being the home of Hemsterhuis, Princess Gallitzin, F. von Stolberg, Fürstenberg, and other notabilities.

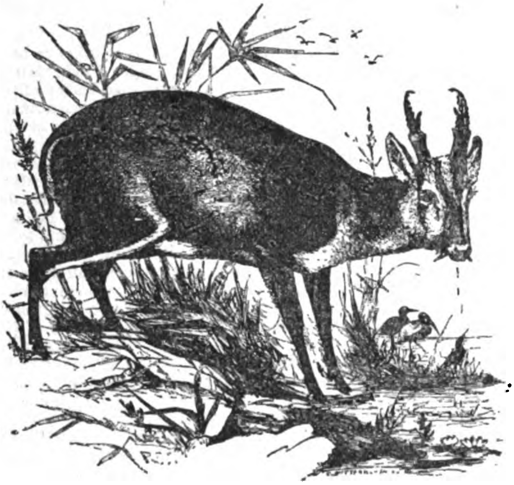
The bishopric of Münster, which possessed the freedom of the empire, embraced an area of 2500 square miles and contained about 350,000 inhabitants. In the 17th century Bishop Galen was of such importance—he supported an army of 20,000 men—that his alliance was sought by the English in 1665 in the war against Holland. The bishopric was secularized and annexed to Prussia in 1803.

Comp. Geisberg, *Merkwürdigkeiten der Stadt Münster* (6th ed., 1877); Erhard, *Geschichte Münsters* (1837).

MÜNSTER, SEBASTIAN (1489-1552), Hebraist, geographer, and mathematician, was born at Ingelheim in the Palatinate in 1489. After studying at Heidelberg and Tübingen, he entered the Franciscan order, but abandoned it for Lutheranism about 1529. Shortly afterwards he was appointed court preacher at Heidelberg, where also he lectured in Hebrew and Old Testament exegesis. From 1536 he taught at Basel, where he died of the plague on 23d May 1552. He was described on his tombstone as the Ezra and the Strabo of the Germans.

Münster, a disciple of Elias Levita, was the first German to edit the Hebrew Bible (2 vols. fol., Basel, 1534-1535); this edition was accompanied by a new Latin translation and a large number of annotations. He published more than one Hebrew grammar, and was the first to prepare a *Grammatica Chaldaica* (Basel, 1527). His lexicographical labours included a *Dictionarium Chaldaicum* (1527) and a *Dictionarium Trilingue* (Latin, Greek, and Hebrew, 1530). One of Münster's best-known works was a geography book (*Cosmographia Universalis*, fol., Basel, 1544), which was often reprinted in Latin and frequently translated into German. Among his other writings (for which see the *Biogr. Générale*) are a treatise on dialling (*Horologiographia*, Basel, 1531), one on the planetary motions (*Organum Uranicum*, 1536), and a volume entitled *Rudimenta Mathematica* (Basel, 1551). The notes on the Old Testament are incorporated in the *Critici Sacri*.

MUNTJAK, one of the native names, now generally adopted in European languages, for a small group of Deer, the members of which are indigenous to the southern and eastern parts of Asia and the adjacent islands, and which are separated by very marked characters from all their allies. They are also called "Kijang" or "Kidjang," and constitute the genus *Cervulus* of Blainville and most zoologists, *Stylocerus* of Hamilton Smith, and *Prox* of Ogilby. They are all of small size compared with the majority of Deer, and have long bodies and rather short limbs and neck. The antlers, which as in most Deer are present in the male only, are small and simple, and the main stem or beam after giving off a very short brow-antler inclines backwards and upwards, is unbranched and pointed, and when fully developed curves inwards and somewhat downwards at the tip. These small antlers are supported upon pedicles or permanent processes of the frontal bones, longer than in any other Deer, and the front edges of which are continued downwards as strong ridges passing along the sides of the face above the orbits, and serving to protect the large frontal cutaneous glands which lie on their inner sides. The lacrymal pit of the skull, in which is lodged the large anteorbital gland or crumen, is of great depth and extent. The upper canine teeth of the males are strongly developed and sharp, curving downwards, backwards, and outwards, projecting visibly outside the mouth as tusks, and loosely implanted in their sockets. In the females they are very much smaller. The limbs exhibit several structural peculiarities not found in other Deer. The lateral digits of both fore and hind feet are very little developed, the hoofs alone being present and their bony supports (found in all other Deer) wanting. In the tarsus the navicular, cuboid, and ectocuneiform bones are united.



Muntjak

The Muntjaks are solitary animals, very rarely even two being seen together. They are fond of hilly ground covered with forests, in the dense thickets of which they pass most of their time, only coming to the skirts of the woods at morning and evening to graze. They carry the head and neck low and the hind-quarters high, their action in running being peculiar and not very elegant, somewhat resembling the pace of a sheep, hence in southern India they bear the popular but erroneous name of "jungle sheep." Though with no power of sustained speed or extensive leap, they are remarkable for flexibility of body and facility of creeping through tangled underwood. Another popular name with Indian sportsmen is "barking deer," which is given on account of their alarm-cry, a kind of short shrill bark, like that of a fox but louder, which may often be heard in the jungles they frequent both by day and by night. When attacked by dogs the males us their sharp canine teeth with great vigour, inflicting upon their opponents deep and even dangerous wounds.

There is some difference of opinion among zoologists as to the number of species of the genus *Cervulus*. Sir Victor Brooke, who investigated this question in 1878 (see *Proceedings of the Zoological Society of London* for that year, p. 898), came to the conclusion that there are certainly three which are quite well marked.

1. *C. muntjac*, found in British India, Burmah, the Malay Peninsula, Sumatra, Java, Hainan, Banca, and Borneo. The general colour is a bright yellowish red, darker in the upper parts of the back; the fore-legs from the shoulder downwards and the lower part of the hind legs, dark bluish brown; anterior parts of the face from the muzzle to between the eyes, brown—a blackish line running up the inside of each frontal pedestal; chin, throat, inside of hind legs, and under surface of tail, white. The female has a black bristly tuft of hair on the spot from which the pedicles of the antlers of the male grow. The average length of the male, according to Jerdon, is 3½ feet, tail 7 inches, height 26 to 28 inches. The female is a little smaller. The specimens from Java, Sumatra, and Borneo are of larger size than those from the mainland, and may possibly be of distinct species or race.

2. *C. lacrymans* of Milne-Edwards, or Sclater's Muntjak of Swinhoe, from Moupin, and near Hangchow, China.

3. *C. reevesi*, a very small species from southern China.

Although the limbs of the modern genus *Cervulus* have attained a considerable degree of specialization, the characters of the cranium, antlers, and teeth are primitive, and almost exactly reproduce those of an extinct deer of the middle Miocene period, the remains of which are found abundantly at Sansan in the south of France and Steinheim in Würtemberg, which has been described under the names of *Dicrocerus elegans* and *Cervus furcatus* (see *Die Fauna von Steinheim*, by Oscar Fraas, Stuttgart, 1870).

MÜNZER, THOMAS (1490-1525), was born of poor parents at Stolberg in the Harz in 1490, was educated at Halle and Leipsic, where he graduated in 1515, was a teacher in the Martini gymnasium in Brunswick in 1517, and was appointed in the beginning of 1520 preacher in the church of St Mary at Zwickau. There he became the opponent of the friars on the one hand and of the humanist reformers on the other, while his eloquence, combined with his Christian socialism, gave him great power over the people. The weavers in Zwickau, who formed the most important trade in the town, were greatly influenced by Nicolas Storch, a man whose views were not unlike those of Münzer, and who had been in close communication with those various communities in Bohemia who represented the Taborites, the Waldenses, and the Bohemian Brethren. Along with Storch, Münzer formed a society governed by twelve apostles and seventy-two disciples, and in secret conventicles proclaimed the revelations of the Holy Spirit which he and some of his disciples claimed to possess. When the society became known conflicts arose with the civil and ecclesiastical authorities, but Münzer and Storch seem to have maintained their position. In September 1521 Münzer and several of his disciples began making preaching tours. Storch went to Wittenberg (see LUTHER), while Münzer went through Bohemia, then by Silesia to Brandenburg and Saxony. He and his followers were fiercely opposed by Luther, who often asked the princes of the lands in which they appeared to banish them from their territories. In 1524 Münzer was in Thuringia and in south Germany. Wherever he went his Christian socialism was welcomed by the oppressed peasantry, who were encouraged to rise in the insurrection (Peasants' War) which ended so disastrously for them at Mühlhausen, 1525. After the battle Münzer was taken prisoner and executed.

Münzer was a successor in the 16th century of those enthusiastic sectaries the mediæval disciples of St Francis of Assisi, who combined intense sympathy with the lot of the poor with strange semi-pantheist notions and ideas of a visible theocracy.

See Seidemann, *Thomas Münzer, eine Biographie*, Dresden, 1842; Ranke, *Deutsche Geschichte im Zeitalter der Reformation*, ii.; Jörg, *Deutschland in der Revolutionsperiode von 1522-26*.

MUNZINGER, Werner (1832-1875), African traveller and linguist, was born at Olten in Switzerland, 4th April 1832. After studying at Bern, Munich, and Paris, he went to Egypt in 1852 and spent a year in Cairo studying the language. Entering a French mercantile house, he went as leader of a trading expedition to various parts of the Red Sea, fixing his quarters at Massowah in 1854 to 1855, where he acted as French consul. In 1855 he removed to Keren, the chief town of the Bogos, in the north of Abyssinia, which country he explored in all directions during the next six years. In 1861 he joined the expedition under Heuglin to Central Africa, but separated from it in November in northern Abyssinia, proceeding along the Gash and Atbara to Khartúm, and thence in 1862 to Kordofán, failing, however, in his attempt to reach Darfur and Wadai, having meantime succeeded Heuglin as leader of the German African expedition. After a short stay in Europe in 1863, Munzinger returned to the north and north-east borderlands of Abyssinia, and in 1865 was appointed British consul at Massowah, rendering valuable aid to the English Abyssinian expedition in 1867, among other things exploring the almost unknown Afar country. In acknowledgment of his services he received the honour of C.B. In 1868 he was appointed French consul, and in 1871 by the khedive governor of Massowah with the title of "bey." In 1870, with Captain Miles, Munzinger visited the interior of southern Arabia. As governor of Massowah he annexed to Egypt a part of northern Abyssinia, and in 1872 was made pasha and governor-general of the eastern Sudan. In an expedition from Tajurra Bay to the kingdom of Shoa, Munzinger was killed, along with his wife and many of his companions, in an attack by a body of Gallas on 14th November 1875, in the neighbourhood of Lake Assal.

Munzinger's contributions to our knowledge of the country, people, and languages of north-eastern Africa are of solid value. See *Proc. R. G. S.*, vol. xiii.; *Jl. R. G. S.*, vols. xxxix., xli., and xlvi. (obituary notice); *Petermann's Mittheilungen* for 1858, 1867, 1872, *et seq.*; Dietschi and Weber, *Werner Munzinger, ein Lebensbild* (1875). Munzinger published the following works:—*Sitten und Recht der Bogos* (1859); *Ostafrikanische Studien* (1864); *Die deutsche Expedition in Ostafrika* (1865); *Vocabulaire de la Langue de Tigré* (1865), besides papers in the geographical serials referred to, and a memoir on the northern borders of Abyssinia in the *Zeitschrift für allgemeine Erdkunde*, new series, iii.

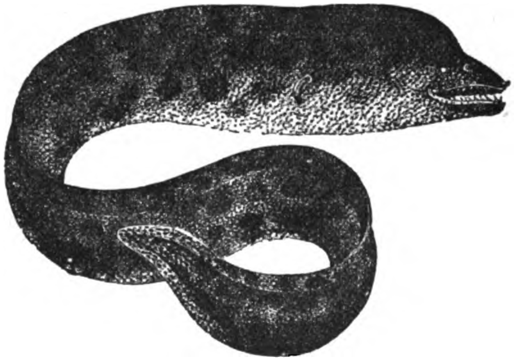
MURÁDÁBÁD, or Moradabad, a district in the lieutenant-governorship of the North-Western Provinces of India, lying between 28° 13′ and 29° 15′ N. lat. and 78° 7′ and 79° 2′ E. long., is bounded on the N. by Bijnaur and the Tarái, on the E. by Rámpur state, on the S. by Budáun, and on the W. by the Ganges. The area is 2284 square miles. It lies within the great Gangetic plain, and is demarcated into three subdivisions by the rivers Rámgangá and Sót. The eastern tract consists of a submontane country, with an elevation slightly greater than the plain below, and is traversed by numerous streams descending from the Himálayas. The central portion consists of a level central plain descending at each end into the valleys of the Rámgangá and Sót. The western section has a gentle slope towards the Ganges, with a rapid dip into the lowlands a few miles from the bank of the great river. The district is well wooded throughout, and mango groves abound in the neighbourhood of the flourishing villages which cluster thickly over its whole surface. Cultivation has spread over almost every part, patches of jungle rarely occurring, and only a few stray pieces of sandy soil or *usar* waste being found among the uplands. Shallow lakes (*jhíls*) are found at intervals, and are in every case utilized for irrigation. The district as a whole consists of a well-tilled and somewhat monotonous alluvial plain, unrelieved by any striking natural features.

The census of 1881 returned the population of the district, exclusive of non-Asiatics, at 1,155,173 (males 610,291, females 544,862), Hindus numbering 767,844, Mohammedans 384,718, and native Christians 1877. Murádábád contains five municipal towns, viz., Murádábád, 67,387; Amroha, 36,145; Sambhal, 35,196; Chandausi, 27,521; Dhanaura, 5204. The total area under cultivation in 1881-82 amounted to 1291 square miles, the staple crops being millets, wheat, pulses, and sugar-cane. As a whole the people are well off and live better than the peasantry in other districts. The labourers too have prospered, wages having risen considerably of late years. About two-sevenths of the cultivators possess hereditary rights, the remainder hold as tenants-at-will. Floods upon the Ganges and Rámgangá cause much damage to the crops, and the district is liable to famine caused by drought. The last famine in 1868-69 was due to the failure of the rainfall, but with the aid of Government relief the difficulty was tided over without serious losses. The chief exports are grain and sugar-cane. The main line of the Oudh and Rohilkhand railway crosses the district; there are also 654 miles of good road. The total revenue of Murádábád in 1881-82 amounted to 1,775,308 rupees, of which 1,399,450 were derived from the land-tax. Education was carried on in 1881 by means of 181 schools, with an aggregate of 5496 pupils. The climate is generally healthy, except in the submontane tract bordering on the Tarái and in the lowlands of the Ganges and Sót. The average annual rainfall in the ten years ending 1870 was 37·6 inches. The annual mean temperature is 74°·5 Fahr., the lowest monthly mean being 56° in January, and the highest 86° in June.

For the early history of Murádábád see Bareli. It passed into the possession of the British in 1801, and in 1857 joined in the general rebellion of that year. Order was restored early in May 1858.

Murádábád, town and headquarters of the above district, is situated on the right bank of the Rámgangá river (28° 49′ N. lat., 78° 49′ E. long.), with a population in 1881 of 67,387, of whom 34,584 were males, and 32,803 females. It was founded in 1625 by Rustám Khan, who built the fort which overhangs the river bank. The town forms a large centre of trade in country produce. The engraved metal-ware of Murádábád has lately attracted much attention, the total value of the annual output being about 3½ lakhs of rupees.

MURÆNA is the name of an eel common in the Mediterranean, and highly esteemed by the ancient Romans; it was afterwards applied to the whole genus of fishes to which the Mediterranean species belongs, and which is abundantly represented in tropical and subtropical seas, especially in rocky parts or on coral reefs. Some ninety species are known. In the majority a long fin runs from the head along the back, round the tail to the vent, but all are destitute of pectoral and ventral fins. The skin is scaleless and perfectly smooth, in many species ornamented with a pretty pattern of very varied and bright colours, so that these fishes are frequently mistaken for snakes. The mouth is wide, the jaws strong and armed with formidable, generally sharply-pointed, teeth, which enable the Muræna not only to seize its prey (which chiefly consists of other fishes) but also to inflict serious, and even sometimes dangerous, wounds on its enemies. It readily attacks persons who approach its places of concealment in shallow water, and is therefore justly feared by fishermen.



Muræna picta, from the Indo-Pacific.

Some of the tropical Murænas exceed a length of 10 feet, but most of the species, among them the Mediterranean species, attain to only half that length. The latter, the "Morena" of the Italians and the *Muræna helena* of ichthyologists, was considered by the ancient Romans to be one of the greatest delicacies, and was kept in large ponds and aquaria. It is not confined to the coasts of southern Europe, but is spread over the Indian Ocean, and is not uncommon on the coasts of Australia. Its body is generally of a rich brown, beautifully marked with large yellowish spots, each of which contains smaller brown spots.

MURAL DECORATION

THERE is scarcely one of the numerous branches of decorative art which has not at some time or other been applied to the ornamenting of wall-surfaces. It will be convenient to classify the various methods under different heads.[1]

1. *Reliefs sculptured in Marble or Stone.*—This is the oldest method of wall-decoration, of which numerous examples still exist. The tombs and temples of Egypt are very rich in this kind of mural ornament of various dates, extending over the enormous period of nearly 5000 years. These sculptures are, as a rule, carved in very low relief; in many cases they are "counter-sunk," that is, the most projecting parts of the figures do not extend beyond the flat surface of the ground. Some unfinished reliefs discovered in the rock-cut tombs of Thebes show the manner in which the sculptor set to work. The plain surface of the stone was marked out by red lines into a number of squares of equal size. The use of this was probably twofold: first, as a guide in enlarging the design from a small drawing, a method still commonly practised; second, to help the artist to draw his figures with just proportions, following the very strict canons which were laid down by the Egyptians. No excessive realism or individuality of style arising from a careful study of the life-model was permitted.[2] When the surface had been covered with these squares, the artist drew with a brush dipped in red the outlines of his relief, and then cut round them with his chisel.

When the relief was finished, it was, as a rule, entirely painted over with much minuteness and great variety of colours. More rarely the ground was left the natural tint of the stone or marble, and only the figures and hieroglyphs painted. In the case of sculpture in hard basalt or granite the painting appears often to have been omitted altogether. The utter absence of perspective effects and the severe self-restraint of the sculptors in the matter of composition show a keen sense of artistic fitness in this kind of decoration. That the stern rigidity of these sculptured pictures did not in any way arise from want of skill or observation of nature on the part of the artists is at once apparent when we examine their representations of birds and animals; with the most unerring skill and precision the special characteristics of each creature and species were caught by the ancient Egyptian and reproduced in stone or colour, not literally, but in a half-symbolic way, suggesting exactly those peculiarities of form, plumage, or movement which are the essence and "differentia" of each, all other ideas bearing less directly on the point being carefully eliminated.

The subjects of these great mural sculptures are endless in their variety; almost every possible incident in man's life here or beyond the grave is reproduced with the closest attention to detail. The tomb of Tîh at Sakkarah (about 4500 B.C.) has some of the finest and earliest specimens of these mural sculptures, especially rich in illustrations of the every-day domestic life and occupations of the Egyptians. The later tombs, as a rule, have sculptures depicting the religious ritual and belief of the people, and the temples combine these hieratic subjects with the history of the reigns and victories of the Egyptian kings.

The above remarks as to style and manner of execution may be applied also to the wall-sculptures from the royal palaces of Nineveh and Babylon, the finest of which are shown by inscriptions to date from the time of Sennacherib to that of Sardanapalus (from 705 to 625 B.C.). These are carved in very low relief with almost gem-like delicacy of detail on enormous slabs of white marble. The sacred subjects, generally representing the king worshipping one of the numerous Assyrian gods, are mostly large, often colossal in scale. The other subjects, illustrating the life and amusements of the king, his prowess in war or hunting, or long processions of prisoners and tribute-bearers coming to do him homage, are generally smaller and in some cases very minute in scale (fig. 1). The arrangement of these reliefs in long horizontal bands, and their reserved conventional treatment are somewhat similar to those of ancient Egypt, but they show a closer attention to anatomical truth and a greater love for strong dramatic effect than any of the Egyptian reliefs. As in the art of Egypt, birds and animals are treated with far greater realism than human figures. The plastic art of no period or country has ever surpassed in skill and life-like truth the Assyrian reliefs of horses, mules, hounds, goats, lions, and many other animals. A relief in the British Museum, representing a lioness wounded by an arrow in her spine and dragging helplessly her paralysed hind legs, affords an example of wonderful truth and pathos. Very remarkable technical skill is shown in all these sculptures by the way in which the sculptors have obtained the utmost amount of effect with the smallest possible amount of relief (see BABYLONIA, vol. iii. p. 190), in this respect calling strongly

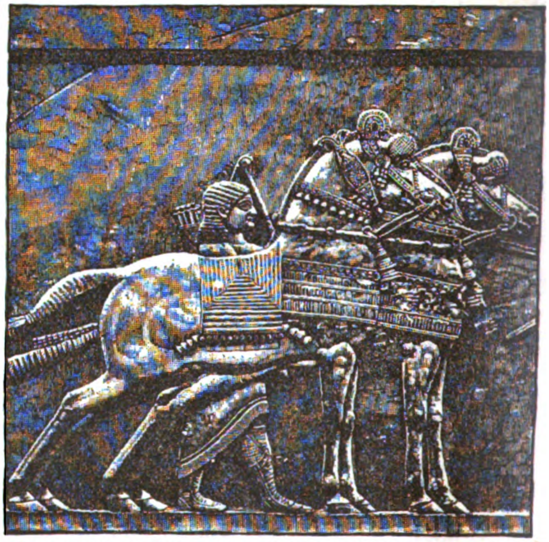


FIG. 1.—Assyrian Relief, on a marble Wall-slab from the Palace of Sardanapalus at Nineveh.

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[1] See also FRESCO, MOSAIC, KÁSHÍ, and TAPESTRY.

[2] During the earliest times—more than 4000 years before our era—there appear to have been exceptions to this rule.

to mind a similar peculiarity in the work of the Florentine Donatello.

The palace at Mashita on the hajj road in Moab, built by the Sassanian Chosroes II. (614-627 A.D.), is ornamented on the exterior with very beautiful surface sculpture in stone. The designs of this are of peculiar interest as forming an evident link between Assyrian and Byzantine art, and they are not remotely connected with the decoration on Moslem buildings of comparatively modern date.[1]

Especially in Italy during the Middle Ages a similar treatment of marble in low relief was frequently used for wall-decoration. The most notable example is the beautiful series of reliefs on the west front of Orvieto cathedral, the work of Giovanni Pisano and his pupils in the early part of the 14th century. These are small reliefs, illustrative of the Old and New Testaments, of most graceful design and skilful execution. A growth of branching foliage serves to unite and frame the tiers of subjects.

Of a widely different class, but of considerable importance in the history of mural decoration, are the very beautiful reliefs, sculptured in stone and marble, with which Moslem buildings in many parts of the world are ornamented. These are mostly geometrical patterns of great intricacy and beauty, which cover large surfaces, frequently broken up into panels by bands of more flowing ornament or Arabic inscriptions. The mosques of Cairo, India, and Persia, and the domestic Moslem buildings of Spain are extremely rich in this magnificent method of decoration. In western Europe, especially during the 15th century, stone panelled-work with rich tracery formed a large part of the scheme of decoration in all the more splendid buildings. Akin to this, though without actual relief, is the very sumptuous stone tracery,—inlaid flush into rough flint walls,—which was a mode of ornament largely used for enriching the exteriors of churches in the counties of Norfolk and Suffolk. It is almost peculiar to that district, and is an admirable example of the skill and taste with which the mediæval builders adapted their method of ornamentation to the materials which came naturally to hand.[2]

2. *Marble Veneer.*—Another widely-used method of mural decoration has been the application of thin marble linings to wall-surfaces, the decorative effect being produced by the natural beauty of the marble itself and not by sculptured reliefs. One of the oldest buildings in the world, the so-called "Temple of the Sphinx" among the Gizeh pyramids, is built of great blocks of granite, the inside of the rooms being lined with slabs of beautiful semi-transparent African alabaster about 3 inches thick. In the 1st century very thin veneers of richly-coloured marbles were largely used by the Romans to decorate brick and stone walls. Pliny (*H. N.*, xxxvi. 6) speaks of this practice as being a new and degenerate invention in his time. Many examples exist at Pompeii and in other Roman buildings. Numerous Byzantine churches, such as St Saviour's at Constantinople, and St George's, Thessalonica, have the lower part of the internal walls richly ornamented in this way. It was commonly used to form a dado, the upper part of the building being covered with mosaic. The cathedral of Monreale and other Siculo-Norman buildings owe a great deal of their splendour to these linings of richly-variegated marbles. In most cases the main surface is of light-coloured marble or alabaster, inlaid bands of darker tint or coloured mosaic being used to divide the surface into panels. The peculiar Italian-Gothic of northern and central Italy during the 14th and 15th centuries, and at Venice some centuries earlier, relied greatly for its effects on this treatment of marble. St Mark's at Venice and the cathedral of Florence are magnificent examples of this work used externally. It is in every case a mere skin, and is in no way connected with the stability of the structure. Both inside and out most of the richest examples of Moslem architecture owe much to this method of decoration; the mosques and palaces of India and Persia are in many cases completely lined with the most lustrous and brilliant sorts of marble, of contrasting tints arranged and fitted together with consummate skill and knowledge of harmony.

3. *Wall-Linings of Glazed Bricks or Tiles.*—This is a very important class of decoration, and from its almost imperishable nature, its richness of colour, and its brilliance of surface is capable of producing a splendour of effect that can only be rivalled by glass mosaics. In the less important form—that of bricks modelled or stamped in relief with figures and inscriptions, and then coated with a brilliant colour in siliceous enamel—it was largely used by the ancient Egyptians and Assyrians as well as by the later Sasanians of Persia. In the 11th and 12th centuries the Moslems of Persia brought this art to great perfection, and used it on a large scale, chiefly, though not invariably, for internal walls. The main surfaces were covered by thick earthenware tiles, overlaid with a white enamel. These were not rectangular, but of various shapes, mostly some form of a star, arranged so as to fit closely together. Very delicate and minute patterns were then painted on the tiles, after the first firing, in a copper-like colour with strong metallic lustre, produced by the deoxidization of a metallic salt in the process of the second firing. Bands and friezes with Arabic inscriptions, modelled boldly in high relief, were used to break up the monotony of the surface. In these, as a rule, the projecting letters were painted blue, and the flat ground enriched with very minute patterns in the lustre-colour. This combination of bold relief and delicate painting produces great vigour and richness of effect, equally telling whether viewed in the mass or closely examined tile by tile. In the 15th century lustre-colours, though still largely employed for plates, vases, and other vessels, especially in Spain, were but little used for tiles; and another class of ware, rich in the variety and brilliance of its colours, was extensively used by Moslem builders all over the Mohammedan world. The most sumptuous sorts of tiles used for wall coverings are those of the so-called "Rhodian" and Damascus wares, the work of Persian potters at many places. Those made at Rhodes are coarsely executed in comparison with the produce of the older potteries at Ispahan and Damascus (see POTTERY). These are rectangular tiles of earthenware, covered with a white "slip" and painted in the most brilliant colours with slightly conventionalized representations of various flowers, especially the rose, the hyacinth, and the carnation. The red used is a very rich harmonious colour, applied in considerable body, so as to stand out in slight relief. Another class of design is more geometrical, forming regular repeats; but the most beautiful compositions are those in which the natural growth of trees and flowers is imitated, the branches and blossoms spreading freely over a large surface covered by hundreds of tiles

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[1] Among the Mashita carvings occurs that oldest and most widely spread of all forms of Aryan ornament—the sacred tree between two animals. The sculptured slab over the "lion-gate" at Mycenæ has the other common variety of this motive—the fire-altar between the beasts. These designs, occasionally varied by figures of human worshippers instead of the beasts, survived in a most extraordinary way long after their meaning had been forgotten; even down to the present day in some form or other they frequently appear on carpets and other textiles of Oriental manufacture.

[2] Wilkinson, *Anc. Egypt.* (1847); *Descr. de l'Égypte* (Paris, 1809, *et sq.*); Layard, *Monuments of Nineveh* (1849-53); Botta, *Mon. de Ninive* (1847-50); Texier, *L'Arménie, la Perse, &c.* (1840-52); Gruner, *Die Bas-reliefs . . . zu Orvieto* (1858); Champollion, *Mon. de l'Égypte* (1835-45); Mariette, *Descr. de Denderah* (1873-75); Rossellino, *Monumenti d'Egitto*, 1826.

without any repetition. One of the finest examples is the "Mecca wall" in the mosque of Ibráhím Agha, Cairo; and other Egyptian mosques are adorned in the same magnificent way (fig. 2). Another variety, the special production of Damascus, has the design almost entirely executed in blue. It was about the year 1600 A.D., in the reign of Shah Abbas I., that this class of pottery was brought to greatest perfection, and it is in Persia that the most magnificent examples of its use are to be found. Nothing can surpass the splendour of effect produced by these tile-coverings, varieties of which, dating from the 12th to the 17th centuries, were largely used in all the chief buildings of Persia. The most remarkable examples for beauty of design and extent of surface covered by these tiles are the mosque at Tabríz, built by Ali Khoja in the 12th century, the ruined tomb of Sultan Khodabend (1303-1316 A.D.) at Sultanieh, the palace of Shah Abbas I. and the tomb of Abbas II. (*ob.* 1666 A.D.) at Ispahan, all of which buildings are covered almost entirely inside and out with this magnificent sort of decoration.

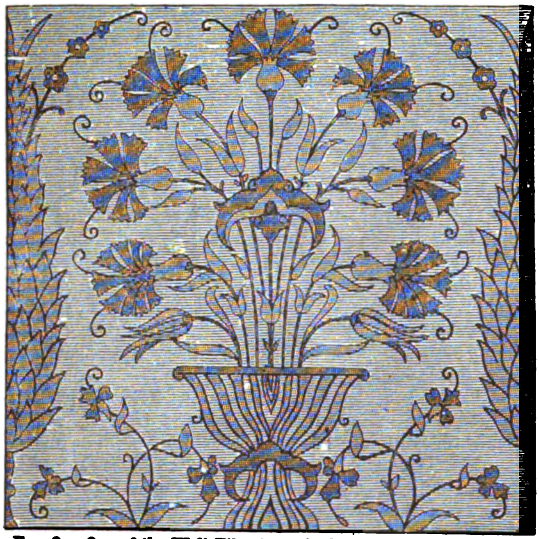

FIG. 2.—One of the Wall-Tiles from the Mosque of Ibrahim Agha, Cairo. 10 inches square.

Another important class of wall-tiles are those manufactured by the Spanish Moors, called "azulejos," especially during the 14th century. These are in a very different style, being designed to suggest or imitate mosaic. They have intricate interlacing geometrical patterns marked out by lines in slight relief; brilliant enamel colours were then burned into the tile, the projecting lines forming boundaries for the pigments. A very rich effect is produced by this combination of relief and colour. They are mainly used for dados about 4 feet high, often surmounted by a band of tiles with painted inscriptions. The Alhambra and Generalife palaces at Granada, begun in the 13th century, but mainly built and decorated by Yúsuf I. and Mohammed V. (1333-1391 A.D.), and the Alcazar at Seville have the most beautiful examples of these "azulejos." The latter building chiefly owes its decorations to Pedro the Cruel (1364 A.D.), who employed Moorish workmen for its tile-coverings and other ornaments. Many other buildings in southern Spain are enriched in the same way, some as late as the 16th century.

Almost peculiar to Spain are a variety of wall-tile the work of Italians in the 16th and 17th centuries. These are effective, though rather coarsely painted, and have a rich yellow as the predominant colour. The Casa de Pilatos and Isabel's chapel in the Alcazar palace, both at Seville, have the best specimens of these, dating about the year 1500. In other Western countries tiles have been used more for pavements than for wall-decoration.[1]

4. *Wall-Coverings of Hard Stucco, frequently enriched with Reliefs.*—The Greeks and Romans possessed the secret of making a very beautiful hard kind of stucco, creamy in colour, and capable of receiving a polish like that of marble; it would stand exposure to the weather. Those of the early Greek temples which were built, not of marble, but of stone, such as the Doric temples at Ægina, Phigaleia, Pæstum, and Agrigentum, were all entirely coated inside and out with this beautiful material—itself pleasant both in texture and hue, and an admirable surface for the further polychromatic decoration with which all Greek buildings seem to have been ornamented. Another highly artistic use of stucco among the Greeks and Romans for the interiors of buildings consisted in covering the walls and vaults with a smooth coat, on which while still wet the outlines of figures, groups, and other ornaments were sketched with a point; more stucco was then applied in lumps and rapidly modelled into delicate reliefs before it had time to set. Some tombs in Magna Græcia of the 4th century B.C. are decorated in this way with figures of nymphs, cupids, animals, and wreaths, all of which are models of grace and elegance, both in form and action, and extremely remarkable for the dexterous way in which a few rapid touches of the modelling tool or thumb have produced a work of the highest artistic beauty and spirit (fig. 3). Roman specimens of this sort of decoration are very common, fine examples have been found in the baths of Titus and numerous tombs near Rome, as well

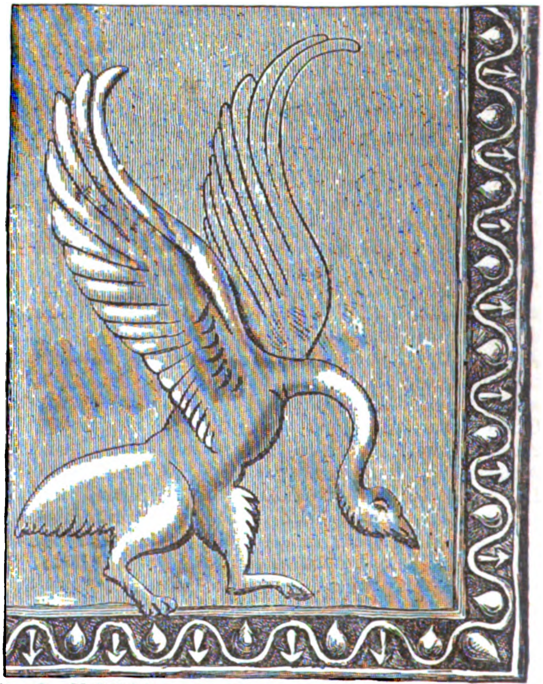

FIG. 3.—Modelled Stucco Wall-Relief, from a Tomb in Magna Græcia. About half full-size.

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[1] See Layard, *Nineveh*; Texier, *L'Arménie*, &c.; Prisse d'Avennes and Bourgoin, *L'Art Arabe* (1869-77); Hèssemer, *Arabische Bau-Verzierungen* (1853); Owen Jones, *Alhambra* (1842); Murphy, *Arabian Antiquities of Spain* (1813); *Monumentos Arquitectonicos de España* (1859-82), article "Alhambra"; Parvillée, *Architect. et décor. Turques, xv^e Siècle* (1874); Coste, *Mon. mod. de la Perse* (1867).

as in many of the houses of Pompeii. These are mostly executed with great skill and frequently with good taste, though in some cases, especially at Pompeii, elaborate architectural compositions with awkward attempts at effects of violent perspective, modelled in slight relief on flat wall-surfaces, produce a very unpleasing effect. Other Pompeian examples, where the surface is divided into flat panels, each containing a figure or group, have great merit for their delicate richness of effect, without offending against the canons of wall-decoration, one of the first conditions of which is that no attempt should be made to disguise the fact of its being a solid wall and a flat surface.

The Moslem architects of the Middle Ages, who excelled in almost all possible methods of mural decoration, made great use of stucco ornament in the most elaborate and magnificent way, both for external and internal walls. The stucco is modelled in high or low relief in great variety of geometrical patterns, of wonderful beauty and richness, alternating with bands of more flowing ornament, or long Arabic inscriptions. Many of their buildings, such as the mosque of Tulún at Cairo (879 A.D.), owe nearly all their beauty to this fine stucco work, the purely architectural shell of the structure being often quite simple and devoid of ornament. These stucco reliefs were, as a rule, further decorated with delicate painting in gold and colours, producing an effect of indescribable beauty and splendour. The Moorish tower at Segovia in Spain is a good example of this class of ornament used externally. With the exception of a few bands of brick and the stone quoins at the angles, the whole exterior of the tower is covered with a network of stucco reliefs in simple geometrical patterns. The Alhambra at Granada and the Alcazar at Seville have the richest examples of this work, both in the delicate intricacy of the designs and in the brilliant colours with which they are painted. The lower part of the walls is lined with marble or tiles to a height of about 4 feet, and above that in many cases the whole surface is encrusted with these reliefs, the varied surface of which, by producing endless gradations of shadow, takes away any possible harshness or over-gaudiness from the brilliance of the gold and colours (fig. 4).[1]

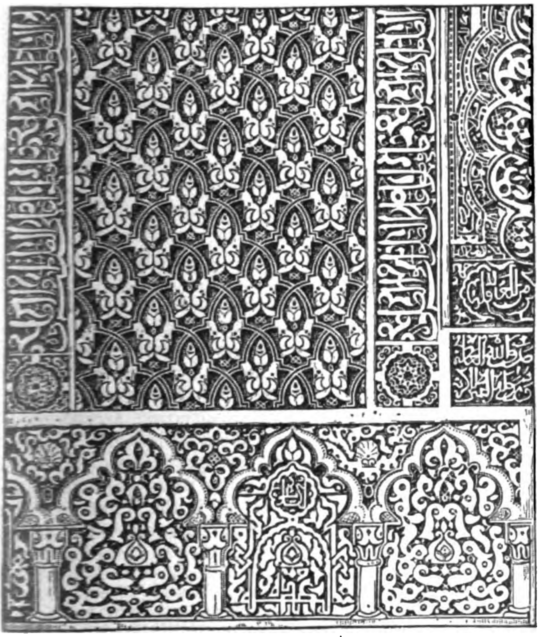

FIG. 4.—Stucco Wall-Relief, from the Alhambra.

During the 16th century, and even earlier, stucco wall-reliefs were used with considerable skill and decorative effect in Italy, England, and other Western countries. Perhaps the most graceful examples are the reliefs with which Vasari in the 16th century encrusted pillars and other parts of the court in the Florentine Palazzo Vecchio, built of plain stone by Michelozzi in 1454. These are very beautiful reliefs, some of flowing vines and other plants winding spirally round the columns. The English examples of this work are very effectively designed, though coarser in execution. The outside of an old half-timbered house in the market-place at Newark-upon-Trent has high reliefs in stucco of canopied figures, dating from the end of the 15th century. The counties of Essex and Suffolk are very rich in examples of this work used externally; and many 16th-century houses in England have fine internal stucco decoration, especially Hardwicke Hall (Derbyshire), one of the rooms of which has the upper part of the wall enriched with life-sized stucco figures in high relief, forming a deep frieze all round. The best English stucco work of this sort is very remarkable for its freedom and spirit of design, as well as for certain grace of line, which is a survival of the old mediæval sense of beauty, then rapidly passing away.

5. *Sgraffito.*—This is a variety of stucco work used chiefly in Italy from the 16th century downwards, and employed only for exteriors of buildings, especially the palaces of Tuscany and northern Italy. The process is this. The wall is covered with a coat of stucco made black by an admixture of charcoal; over this a second very thin coat of white stucco is laid. When it is all hard the design is produced by cutting and scratching away the white skin, so as to show the black under-coat. Thus the drawing appears in black on a white ground. This work is effective at a distance, as it requires a bold style of handling, in which the shadows are indicated by cross-hatched lines more or less near together.[2] Flowing arabesques mixed with grotesque figures occur most frequently in sgraffito. It is still largely practised in northern Italy, and has been used with success in the external decoration of the South Kensington Academy of Music.

6. *Stamped Leather.*—This was a very magnificent and expensive form of wall-hanging, chiefly used during the 16th and 17th centuries. Skins, generally of goats or calves, were well tanned and cut into rectangular shapes. They were then covered with silver leaf, which was varnished with a transparent yellow lacquer, making the silver look like gold. The skins were then stamped or embossed with patterns in relief, formed by heavy pressure from metal dies, one in relief and the other sunk. The reliefs were then painted by hand in many colours, generally brilliant in tone. Italy and Spain (especially Cordova) were important seats of this manufacture; and in the 17th century a large quantity was produced in France. Fig. 5 gives a good example of Italian stamped leather of the 16th century. In England, chiefly at Norwich, this manufacture was carried on in the 17th and 18th centuries, in many cases of very excellent design. In durability and richness of effect stamped leather surpasses most other forms of movable wall-decoration.

7. *Painted Cloth.*—Another form of wall-hanging, used most largely during the 15th and 16th centuries, and in a less extensive way a good deal earlier, is canvas painted to imitate tapestry. English mediæval inventories both

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[1] It is unfortunate that the otherwise valuable work of Owen Jones on the Alhambra gives a very false and unpleasing notion of the colouring of the place.

[2] A good description of the process is given by Vasari, *Tre Arti dei Disegno*, cap. xxvi.

of ecclesiastical and domestic goods frequently contain items such as these: "stayned cloths for hangings," "paynted

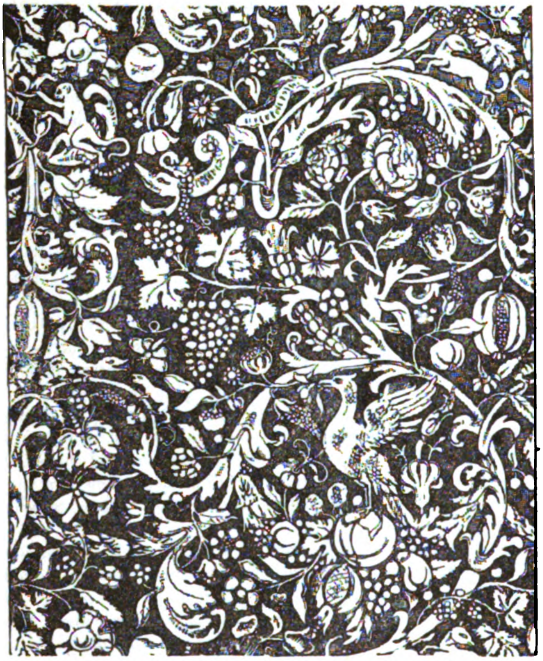

FIG. 5.—Italian Stamped Leather; 16th century

cloths with stories and batailes," or "paynted cloths of beyond sea work," or "of Flaunder's work." Many good artists working at Ghent and Bruges during the first half of the 15th century produced very fine work of this class, as well as designs for real tapestry. Several of the great Italian artists devoted their utmost skill in composition and invention to the painting of these wall-hangings. The most important existing example is the magnificent series of paintings of the triumph of Julius Cæsar executed by Andrea Mantegna (1485-1492) for Ludovico Gonzaga, duke of Mantua, and now at Hampton Court. These are usually, but wrongly, called "cartoons," as if they were designs meant to be executed in tapestry; this is not the case, as the paintings themselves were used as wall-hangings. They are nine in number, and each compartment, 9 feet square, was separated from the next by a pilaster. They form a continuous procession, with life-sized figures of unrivalled grace and beauty, remarkable alike for their composition, drawing, and delicate colouring,—the latter unfortunately much disguised by the most coarse and tasteless "restoration." Like most of these painted wall-hangings, they are executed in tempera, and rather thinly painted, so that the pigment might not crack off through the cloth falling slightly into folds.[1] Another remarkable series of painted cloth hangings are those at Rheims cathedral, admirable for their noble breadth of design and rich colouring.[2] In some cases actual dyes were used for this sort of work. A MS. of the 15th century[3] gives receipts for "painted cloth," showing that sometimes they were dyed in a manner similar to those Indian stuffs which were afterwards printed, and are now called chintzes. These receipts are for real dyes, not for pigments, and among them is the earliest known description of the process called "setting" the woad or indigo vat, as well as a receipt for removing or "discharging" the colour from a cloth already dyed. Another method employed was a sort of "encaustic" process; the cloth was rubbed all over with wax, and then painted in tempera; heat was then applied so that the colours sank into the melting wax, and were thus firmly fixed upon the cloth.

8. *Printed Hangings and Wall-Papers.*—The printing of various textiles with dye-colours and mordants is probably one of the most ancient of the arts. Pliny (*H. N.*, xxxv.) clearly describes a dyeing process employed by the ancient Egyptians, in which the pattern was probably formed by printing from blocks. Various methods have been used for this work—wood blocks in relief, engraved metal plates, stencil plates, and even hand-painting; frequently two or more of these methods have been employed for the same pattern. The use of printed stuffs is of great antiquity among the Hindus and Chinese, and was certainly practised in western Europe in the 13th century, and perhaps earlier. The South Kensington Museum has 13th-century specimens of block-printed silk made in Sicily, of very beautiful design. Towards the end of the 14th century a great deal of block-printed linen was made in Flanders, and largely imported into England.

Wall-papers did not come into common use in Europe till the 18th century, though they appear to have been used much earlier by the Chinese. A few rare examples exist in England which may be as early as the 16th century; these are imitations, generally in flock, of the fine old Florentine and Genoese cut velvets, and hence the style of the design in no way shows the date of the wall-paper, the same traditional patterns being reproduced for many years with little or no change. Machinery enabling paper to be made in long strips was not invented till the end of the last century, and up to that time wall-papers were printed on small square pieces of hand-made paper, difficult to hang, disfigured by numerous joints, and comparatively costly; on these accounts wall-papers were slow in superseding the older and more magnificent modes of mural decoration, such as wood-panelling, painting, tapestry, stamped leather, and painted cloth. A little work by Jackson of Battersea, printed in London in 1744, throws some light on the use of wall-papers at that time. He gives reduced copies of his designs, mostly taken from Italian pictures or antique sculpture during his residence in Venice. Instead of flowing patterns covering the wall, his designs are all pictures—landscapes, architectural scenes, or statues—treated as panels, with plain paper or painting between. They are all printed in oil, with wooden blocks worked with a rolling press, apparently an invention of his own. They are all in the worst possible taste, and yet are offered as great improvements on the Chinese papers which he says were then in fashion.

The method of printing wall-papers of the better sort is probably the same now that it has always been. Wooden blocks with the design cut in relief, one for each colour, are applied by hand, after being dipped in an elastic cloth sieve charged with wet tempera pigment, great care being taken to lay each block exactly on the right place, so that the various colours may "register" or fit together. In order to suit the productions of the paper-mills these blocks are made, in England 21 inches wide, and in France 18 inches wide; the length of the block is limited to what the workman can easily lift with one hand,—2 feet being about the limit, as the blocks are necessarily thick, and in many cases made heavier by being inlaid with copper, especially the thin outlines, which, if made of wood, would not stand the wear and tear of printing. In "flock" and gold or silver printing the design is first printed in strong size; the flock (finely cut wool of the required colour), or metallic powder is then sprinkled by hand all over the paper; it adheres only to the wet size, and is easily shaken off the ground or unsized part. If the pattern is required to stand out in some relief this process is repeated several times, and the whole paper then rolled to compress the flock. Cheaper sorts of paper are printed by machinery, the design being cut on the surface of wooden rollers, under which the paper passes. The chief drawback to this process is that all the colours are applied rapidly one after the other, without allowing each to dry separately, as is done in hand printing. A somewhat blurred appearance is the usual result.

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[1] See Crowe and Cavalcaselle, *Painting in North Italy*, i. p. 404, 1871; and Waagen, *Art Treasures*, 1854.

[2] Leberthais, *Toiles peintes de Reims* (Paris).

[3] Merrifield, *Treatises on Painting*, 1849.

Though at first wall-papers were a mere makeshift and feeble imitation of rich textiles, yet, with a good feeling for the harmonies of colour and a regard for the technical necessities of the process, very rich and beautiful effects may be produced at a comparatively small cost if hand-printing be adopted. Imitations of stamped leather are now produced with great success, though of inferior durability. Very thick tough paper is used for this, and treated in the same way as the real skins mentioned above. Fig. 6 is a good English example of 18th-century wall-paper printed on squares of stout hand-made paper 22 inches wide. The design is apparently copied from an Indian chintz.

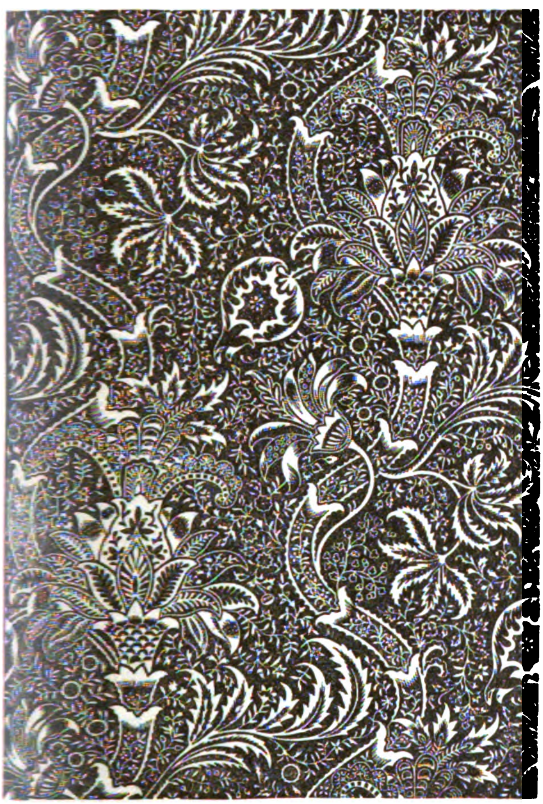

FIG. 6.—Early 18th-century Wall-Paper. 22 inches wide.

PAINTING.

This is naturally the most important and the most widely used of all forms of wall-decoration, as well as perhaps the earliest.

Egyptian Paintings.—Egypt is the chief storehouse of ancient specimens of this, as of almost all the arts. Owing to the intimate connexion between the sculpture and painting of early times, the remarks above both as to subjects and treatment under the head of Egyptian wall-sculpture will to a great extent apply also to the paintings. It is a very important fact, and one which testifies clearly to the enormous antiquity of Egyptian civilization, that the earliest paintings, dating more than 4000 years before our era, are also the cleverest both in drawing and execution. In later times the influence of Egyptian art, especially in painting, was very important among even very distant nations. In the 6th century B.C. Egyptian colonists, introduced by Cambyses into Persepolis, largely influenced the painting and sculpture of the great Persian empire and throughout the valley of the Euphrates. In a lesser degree the art of Babylon and Nineveh had felt considerable Egyptian influence several centuries earlier. The same influence affected the early art of the Greeks and the Etrurians, and it was not till the middle of the 5th century B.C. that the further development and perfecting of art in Greece obliterated the old traces of Egyptian mannerism. After the death of Alexander the Great, when Egypt came into the possession of the Lagidæ (320 B.C.), the tide of influence flowed the other way, and Greek art modified though it did not seriously alter the characteristics of Egyptian painting and sculpture, which still retained much of their early formalism and severity. And yet the increased sense of beauty, especially in the human face, derived from the Greeks was counterbalanced by loss of vigour and force; art under the Ptolemies ceased to have a real life and became a mere dull copyism of earlier traditions.

The general scheme of mural painting in the buildings of ancient Egypt was very complete and magnificent. Columns, mouldings, and other architectural features were enriched with patterns in brilliant colours; the flat wall-spaces were covered with figure-subjects, generally in horizontal bands, and the ceilings were richly ornamented with sacred symbols, such as the vulture, or painted blue and studded with gold stars to symbolize the sky. The wall-paintings are executed in tempera on a thin skin of fine lime, laid over the brick, stone, or marble to form a smooth and slightly absorbent coat to receive the pigments, which were most brilliant in tone and of great variety of tint. Not employing fresco, the Egyptian artists were not restricted to "earth colours," but occasionally used purples, pinks, and greens which would have been destroyed by fresh lime. The blue used is a very beautiful colour, and is generally laid on in considerable body—it is frequently a "smalt" or deep-blue glass, coloured by copper oxide, finely powdered. Red and yellow ochre, carbon-black, and powdered chalk-white are most largely used. Though in the paintings of animals and birds considerable realism is often seen (fig. 7), yet for human figures certain conventional colours are employed, *e.g.*, white for females' flesh, red for the males, or black to indicate people of negro race. Heads are painted in profile, and little or no shading is used. Considerable knowledge of harmony is shown in the arrangement of the colours; and otherwise harsh combinations of tints are skilfully softened and brought into keeping by thin separating lines of white or yellow. Though at first sight the general colouring, if seen in a museum, may appear crude and gaudy, yet it should be remembered that the internal paintings were much softened by the very dim light that was sparingly

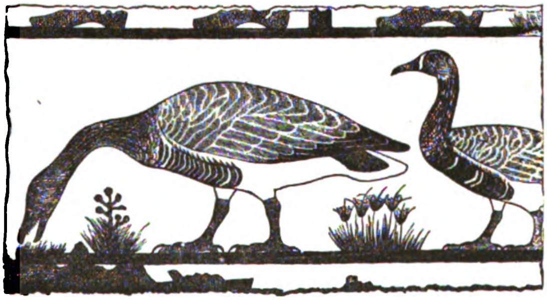

FIG. 7.—Egyptian Wall-Painting of the Ancient Empire, in the Bulak Museum. Taken from Loftie's *Ride in Egypt*.

admitted into Egyptian buildings, and those outside were subdued by contrast with the brilliant blue sky and glowing sunshine under which they were always seen.[1]

Etruscan Painting.—The rock-cut sepulchres of the Etrurians (see ETRURIA, vol. viii. p. 645) supply the only existing specimens of their mural painting; and, unlike the tombs of Egypt, only a small proportion appear to have been decorated in this way. The actual dates of these paintings are very uncertain, but they range possibly from about the 8th century B.C. down to almost the Christian era. The tombs which possess these paintings are mostly square-shaped rooms, with slightly-arched or gabled roofs, excavated in soft sandstone or tufa hillsides. The earlier ones show distinct Egyptian influence alike in drawing and in composition: they are very broadly designed with flat unshaded tints, the faces in profile, except the eyes, which are drawn as if seen in front. Colours, as in Egypt, are used conventionally—male flesh red, white or pale yellow for the females, black for demons. In one respect these paintings differ from those of the Egyptians; very few colours are used—red, brown, and yellow ochres, carbon-black, lime or chalk-white, and occasionally blue are the only pigments. The rock-walls are prepared by being covered with a thin skin of lime stucco, and lime or chalk is mixed in small quantities with all the colours; hence the restriction to "earth pigments," made doubly necessary by the constant dampness of these subterranean chambers. The process employed was in fact a kind of *fresco*, though the stucco ground was not applied in small patches only sufficient for the day's work; the dampness of the rock was enough to keep the stucco skin moist, and so allow the necessary infiltration of colour from the surface. Many of these paintings when first discovered were quite fresh in tint and uninjured by time, but they are soon dulled by exposure to light. In the course of centuries great changes of style naturally took place; the early Egyptian influence, probably brought to Etruria through the Phœnician traders, was succeeded by an even more strongly-marked Greek influence—at first archaic and stiff, then developing into great beauty of drawing, and finally yielding to the Roman spirit, as the degradation of Greek art advanced under their powerful but inartistic Roman conquerors.

Throughout this succession of styles—Egyptian, Greek, and Græco-Roman—there runs a distinct undercurrent of individuality due to the Etruscans themselves. This appears not only in the drawing but also in the choice of subjects. In addition to pictures of banquets with musicians and dancers, hunting and racing scenes, the workshops of different craftsmen and other domestic subjects, all thoroughly Hellenic in sentiment, other paintings occur which are very un-Greek in feeling. These represent the judgment and punishment of souls in a future life. Mantus, Charun, and other infernal deities of the Rasena, hideous in aspect and armed with hammers, or furies, depicted as black bearded demons winged and brandishing live snakes, terrify or torture shrinking human souls. Others, and not the earliest in date, represent human sacrifices, such as those at the tomb of Patroclus—a class of subjects which, though Homeric, appears but rarely to have been selected by Greek painters. The constant import into Etruria of large quantities of fine Greek painted vases appears to have largely contributed to keep up the supremacy of Hellenic influence during many centuries, and by their artistic superiority to have prevented the development of a more original and native school of art. Though we now know Etruscan painting only from the tombs, yet Pliny mentions (*H. N.*, XXXV. 3) that fine wall-paintings existed in his time, with colours yet fresh, on the walls of ruined temples at Ardea and Lanuvium, executed, he says, before the founding of Rome. As before mentioned, the actual dates of the existing paintings are very uncertain. It cannot therefore be positively asserted that any existing specimens are much older than 600 B.C., though some, especially at Veii, certainly appear to have the characteristics of more remote antiquity. The most important of these paintings have been discovered in the cemeteries of Veii, Cære, Tarquinii, Vulci, Cervetri, and other Etruscan cities.[2]

Greek Painting.—This is a very obscure subject, for, although Strabo, Pliny, Pausanias, and others have left us minute descriptions of Greek paintings and ample accounts of painters and styles, yet of the pictures themselves almost nothing now remains. Even in Egypt the use of colour does not appear to have been more universal than it was among the Greeks, who applied it freely to their marble statues and reliefs, the whole of their buildings inside and out, as well as for the decoration of flat wall-surfaces. They appear to have cared but little for pure form, and not to have valued the delicate ivory-like tint and beautiful texture of their fine Pentelic and Parian marbles, except as a ground for coloured ornament. A whole class of artists, called ἀγαλμάτων ἐγκαυσταί, were occupied in colouring marble sculpture, and their services were very highly valued.[3] In some cases, probably for the sake of hiding the joints and getting a more absorbent surface, the marble, however pure and fine in texture, was covered with a thin skin of stucco made of mixed lime and powdered marble. Among the extremely rare specimens of Greek painting still existing, the most important is an alabaster sarcophagus, found in a tomb near Corneto, and now in the Etruscan museum at Florence.[4] This is decorated outside with very beautiful and purely Greek paintings, executed on a stucco skin as hard and smooth as the alabaster itself. The pictures represent combats of the Greeks and Amazons, drawn with marvellous beauty of outline and grace of movement and composition. The colouring, though rather brilliant, is very simply treated, and the figures are kept strictly to one plane without any attempt at complicated perspective. Other most valuable specimens of Greek art, found at Herculaneum and now in the Naples museum, are some small paintings, one of girls playing with dice, another of Theseus and the Minotaur. These are painted with miniature-like delicacy on the bare surface of marble slabs; they are almost monochromatic, and are of the highest beauty both in drawing and in their skilfully-modelled gradations of shadow—quite unlike any of the Greek vase-paintings. The first-mentioned painting is signed ΑΛΕΞΑΝΔΡΟΣ ΑΘΗΝΑΙΟΣ. It is probable that the strictly archaic paintings of the Greeks, such as those of Polygnotus in the 5th century B.C., executed with few and simple colours, had much resemblance to those on vases, but Pliny is certainly wrong when he asserts that, till the time of Apelles (*c.* 350-310 B.C.), the Greek painters only used black, white, red, and yellow.[1] Judging from the peculiar way in which the Greeks and their imitators the Romans used the names of colours, it appears that they paid more attention to *tones* and *relations* of colour than to actual hues. Thus most Greek and Latin colour-names are now quite untranslatable. Homer's "wine-like sea" (οἶνοψ), Sophocles's "wine-coloured ivy" (*Œd. Col.*), and Horace's "purpureus olor" probably refer less to what we should call colour than to the chromatic strength of the various objects and their more or less strong powers of reflecting light, either in motion or when at rest. Nor have we any word like Virgil's "flavus," which could be applied both to a lady's hair and to the leaf of an olive-tree.[2]

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[1] See Champollion, *Panthéon Égyptien* (1825); De Joannis, *Peintures murales . . . des Égyptiens*; Blechy, *La Peinture chez les Égyptiens* (1868); Lenormant, *Antiquités Égyptiennes*; Lepsius, *Denkmäler aus Aegypten*; Wilkinson, *Anc. Egypt.*; *Descr. de l'Égypte* (Paris, 1821, &c.); Perrot et Chipiez, *L'Art d'Égypte* (1880), and other works on Egypt.

[2] See Dennis, *Cities and Cemeteries of Etruria* (1878); Golini, *Pitture murali Etrusche*; Micali, *Mon. inediti*; *Mon.* and *Ann. d. Inst. Arch.* (Rome, various years); Canina, *L'antica Etruria* (1846, *et sq.*); Bartoli, *Sepolchri Rom. ed Etrus.* (1727); Müller, *Etrusker*, and other works; Helbig, *Pitture Cornetane* (1863); Inghirami, *Mon. Etruschi* (1821-26); Byres, *Sepulchral Caverns of Tarquinia* (1842); and Raoul Rochette, *Mon. d'Antiquité Grecque, Etrusque, et Romaine* (1833).

[3] This process, *circumlitio*, is mentioned by Pliny (*H. N.*, xxxv. 40).

[4] See *Mon. Inst. Arch.*, Rome, ix. plate 60.

During the best periods of Greek art the favourite classes of subjects were scenes from poetry, especially Homer, and contemporary history. The names πινακοθήκη and στοὰ ποικίλη were given to many public buildings from their walls being covered with paintings. Additional interest was given to the historical subjects by the introduction of portraits; *e.g.*, in the great picture of the battle of Marathon (490 B.C.), on the walls of the στοὰ ποικίλη in Athens, portraits were given of the Greek generals Miltiades, Callimachus, and others. This picture was painted about forty years after the battle by Polygnotus and Micon. One of the earliest pictures recorded by Pliny (xxxv. 8) represented a battle of the Magnesians (c. 716 B.C.); it was painted by Bularchus, a Lydian artist, and bought at a high price by King Candaules. Many other important Greek historical paintings are mentioned by Pausanias and earlier writers. The Pompeian mosaic of the defeat of the Persians by Alexander is probably a Romanized copy from some celebrated Greek painting; it obviously was not designed for mosaic work.

Landscape painting appears to have been unknown among the Greeks, even as a background to figure subjects. The poems especially of Homer and Sophocles show that this was not through want of appreciation of the beauties of nature, but partly, probably, because the main object of Greek painting was to tell some definite story, and also from their just sense of artistic fitness, which prevented them from attempting in their mural decorations to disguise the flat solidity of the walls by necessarily delusive effects of aerial perspective and distance.

It is interesting to note that even in the time of Alexander the Great the somewhat archaic works of the earlier painters were still highly appreciated. In particular Aristotle gives high praise to Polyghotus, both for his power of combining truth with idealisation in his portraits and for his skill in depicting men's mental characteristics; on this account he calls him ὁ ἠθογράφος. Lucian too is no less enthusiastic, and praises Polygnotus alike for his grace, drawing, and colouring. Later painters, such as Zeuxis and Apelles, appear to have produced easel pictures more than mural paintings, and these, being easy to move, were mostly carried off to Rome by the early emperors. Hence Pausanias, who visited Greece in the time of Hadrian, mentions but few works of the later artists. Owing to the lack of existing specimens of Greek painting it would be idle to attempt an account of their technical methods, but no doubt those employed by the Romans described below were derived with the rest of their art from the Greeks. Speaking of their stucco, Pliny refers its superiority over that made by the Romans to the fact that it was always made of lime at least three years old, and that it was well mixed and pounded in a mortar before being laid on the wall; he is here speaking of the thick stucco in many coats, not of the thin skin mentioned above as being laid on marble.

Greek mural painting, like their sculpture, was chiefly used to decorate temples and public buildings, and comparatively rarely either for tombs[3] or private buildings,—at least in the days of their early republican simplicity. They were in the true sense of the word works of monumental art, and were no doubt designed and executed with that strict self-restraint and due subordination to their architectural surroundings which we see so strongly marked in all Greek sculpture of the best periods.[4]

Roman Painting.—A very large number of Roman mural paintings now exist, of which by far the greatest quantity was discovered in the private houses and baths of Pompeii, nearly all dating between 63 A.D., when the city was ruined by an earthquake, and 79 A.D., when it was buried by Vesuvius. A catalogue of these and similar paintings from Herculaneum and Stabiæ, compiled by Professor Helbig, comprises 1966 specimens. The excavations in the baths of Titus and other ancient buildings in Rome, made in the early part of the 16th century, excited the keenest interest and admiration among the painters of that time, and very largely influenced the later art of the Renaissance. These paintings, especially the "grotesques" or fanciful patterns of scroll-work and pilasters mixed with semi-realistic foliage and figures of boys, animals, and birds, designed with great freedom of touch and inventive power, seem to have thoroughly fascinated Raphael during his later period, and many of his pupils and contemporaries. The "loggie" of the Vatican and of the Farnesina palace are full of carefully-studied 16th-century reproductions of these highly-decorative paintings. Of late years the excavations on the Palatine and in the garden of the Farnesina in Rome have brought to light some mural paintings of the 1st century of our era, perhaps superior in execution even to the best of the Pompeian series.

The range of subjects found in Roman mural paintings is very large—mythology, religious ceremonies, genre, still life, and even landscape (the latter generally on a small scale, and treated in an artificial and purely decorative way), and lastly history. Pliny mentions several large and important historical paintings, such as those with which Valerius Maximus Messala decorated the walls of the Curia Hostilia, to commemorate his own victory over Hiero II. and the Carthaginians in Sicily in the 3d century B.C. The earliest Roman painting recorded by Pliny was by Fabius, surnamed Pictor, on the walls of the temple of Salus, executed about 300 B.C. (*H. N.*, xxxv. 4).

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[1] Pliny's remarks on subjects such as this should be received with caution. He was neither a scientific archæologist nor a practical artist.

[2] So also a meaning unlike ours is attached to Greek technical words—by τόνος they meant, not "tone," but the gradations of light and shade, and by ἁρμογή the relations of colour. See Pliny, *H. N.*, xxxv. 5; and Ruskin, *Mod. Painters*, pt. iv. cap. 13.

[3] One instance only of a tomb-painting is mentioned by Pausanias (vii. 22). Some fine specimens have recently been discovered in the Crimea, but not of a very early date; see Stephani, *Compte rendu*, &c., St Petersburg, 1878, &c.

[4] Some of the following works contain accounts of the painting of the Romans as well as of the Greeks:—Letronne, *La Peint. histor. murale* (1835); Hittorf, *L'Arch. polychrome chez les Grecs* (1851); Wornum, *Hist. of Painting* (1847); Newton, *Lect. on the Painting of the Ancients, deliv. at Univ. Coll. Lon.* (1882); Hermann, *Die Polygnotischen Gemälde*; Lenormant, *Les Peintures de Polygnote* (1864); Winckelmann, *Storia dell' Arti* (1784); Müller, *Handbuch d. Archäol. der Kunst*, &c. (1830); Pliny, *H. N.*, Books xxxv., xxxvi.; Pausanias, x. 25-31,—description of paintings in the Lesche at Delphi,—and various other passages throughout his work; Artaud de Montor, *Peintres primitifs* (1841-43); Humphrey Davy, "Colours used by the Ancients," *Trans. Roy. Soc.* (1815, pp. 97-124); Bluemner, *Gewerbe u. Kunst bei Griechen u. Römern* (1879); Brunn, *Gesch. der Griech. Künstler* (1853-56); Durand, *Hist. de la Peinture Ancienne* (1725); Meyer, *Gesch. der bildenden Künste* (1824); Raoul Rochette, *La Peinture des Grecs* (1840), and *Mon. d'Antiq.* (1833); Poynter, *Decorative Art*, series of lectures published by the Society for the Protection of Ancient Buildings (1882).

Unfortunately no existing Roman paintings seem to be earlier in date than the Christian era, and all belong to a period of decline in art. Pliny (xxxv. 1) laments the fact that the wealthy Romans of his time preferred the costly splendours of marble and porphyry wall-linings to the more artistic decoration of paintings by good artists. Historical painting seems then to have gone out of fashion; among the numerous specimens now existing very few from Pompeii represent historical subjects; one has the scene of Masinissa and Sophonisba before Scipio, and another of a riot between the people of Pompeii and Nocera, which happened 59 A.D.

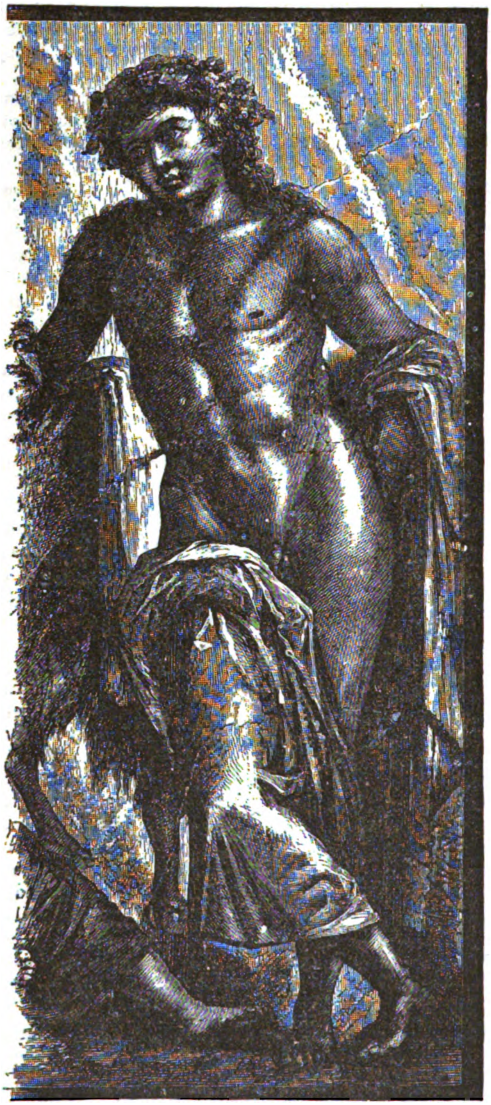

FIG. 8.—One Figure from a Pompeian Wall-Painting—Ariadne and Dionysus. Now in the Naples Museum.

Mythological scenes, chiefly from Greek sources, occur most frequently: the myths of Eros and Dionysus are especial favourites. Only five or six relate to purely Roman mythology. We have reason to think that some at least of the Pompeian pictures are copies, probably at third or fourth hand, from celebrated Greek originals. The frequently repeated subjects of Medea meditating the murder of her children and Iphigenia at the shrine of the Tauric Artemis suggest that the motive and composition were taken from the celebrated originals of these subjects by Timanthes. Those of Io and Argus, the finest example of which is in the Palatine "villa of Livia," and of Andromeda and Perseus, often repeated on Pompeian walls, may be from the originals by Nicias.[1]

In many cases these mural paintings are of high artistic merit, though they are probably not the work of the most distinguished painters of the time, but rather of a humbler class of decorators, who reproduced, without much original invention, stock designs out of some pattern-book. They are, however, all remarkable for the rapid skill and extreme "verve" and freedom of hand with which the designs are, as it were, flung on to the walls with few but very effective touches. Though in some cases the motive and composition are superior to the execution, yet many of the paintings are remarkable both for their realistic truth and technical skill. The great painting of Ceres from Pompeii, now in the Naples museum, is a work of the highest merit—the simple grandeur of the drawing and the delicate modelling of the flesh, executed in the easiest and most direct manner possible, are alike admirable. The round juiciness of the fruit in her basket, rapidly painted with a few telling strokes of the brush, recalls to mind in effect, though not in execution, the startling realism of the Dutch painters of still life, who laboured painfully to gain the effect produced with such rapidity and ease by the Roman artist. Fig. 8, from a Pompeian picture, is a fine example of good modelling of flesh.

In the usual scheme of decoration the broad wall-surfaces are broken up into a series of panels by pilasters, columns, or other architectural forms. Some of the panels contain pictures with figure-subjects; others have conventional ornament, or hanging festoons of fruit and flowers. The lower part of the wall is painted one plain colour, forming a dado; the upper part sometimes has a well-designed frieze of flowing ornaments. In the better class of painted walls the whole is kept flat in treatment, and is free from too great subdivision, but in many cases great want of taste is shown by the introduction of violent effects of architectural perspective, and the space is broken up in a disagreeable way by complicated schemes of design, studded with pictures in varying scales which have but little relation to their surroundings. The colouring is on the whole very pleasant and harmonious—quite unlike the usual chromolithographic copies. Black, yellow, or a rich deep red are the favourite colours for the main ground of the walls, the pictures in the panels being treated separately, each with its own background.

Technical Methods of the Romans.—Much has been written on this subject, and the most varying opinions have been expressed. The real fact appears to be that several methods were employed in each painting. First, the ground of the required colour was laid on while the stucco was still moist. This ground therefore was true fresco or "fresco buono." On this, when dry, the various pictures and ornaments were painted in tempera. That the pictures themselves were not in true fresco is shown: (1) because the coloured ground always exists *under* the pictures; (2) by the wide distances apart of the "fresco edges" or joinings in the stucco, showing that a much larger area of stucco was applied at once than could have been covered with the frequently elaborate paintings before the stucco was dry; (3) by the fact that many of the brilliant pigments were not such as could have been used upon moist stucco. The next point is how these tempera paintings on the fresco ground were *fixed* so as to last for nearly eighteen hundred years uninjured by the damp which necessarily soaked through into the soil and ashes in which they were buried. This was probably effected by the "encaustic" process (ἔγκαυσις). When the painting was finished and dry, hot melted wax was brushed all over it; and then a red-hot iron or brazier of burning charcoal was held near the face of the wall till, bit by bit, all the wax disappeared from the surface and soaked thoroughly into the absorbent stucco,—thus fixing the pigments with a vehicle that could stand the effects of damp. This application of hot wax appears to have been repeated more than once. The extreme smoothness of the fresco ground *under* the tempera pictures seems to show that the ground itself was both waxed and polished *before* the pictures were painted over it. By another method of encaustic the pigments themselves were mixed with hot wax, probably rendered more fluid and easy to work by the addition of some mineral spirit or essential oil. The final application of heat to the painted surface blended the colours together and fixed them on and into the absorbent stucco ground. Vitruvius (vii. 9) describes the former process, in which the wax was applied after the colours were laid on the wall. According to him this was necessary in order to prevent the painted surface becoming patchy, especially in the case of the red ground made of vermilion, an oxide of mercury. This, as well as the evidence of the paintings themselves, shows that Pliny is mistaken in asserting that encaustic work could not be used for walls.[1] Vitruvius (vii.) also gives an interesting account of the great care that was needed in preparing stucco for painting. Three coats of old slaked lime and sand were first to be laid, and then three more coats mixed with pounded white marble, each coat of more finely powdered marble than the one beneath; the last coat was to be polished till it gave a reflexion like a mirror. Damp or external walls were to be built hollow, and the cavity ventilated; this was sometimes done, *e.g.*, in the Palatine villa, by facing the wall inside with hollow bricks or tiles, on which the stucco was laid. Vitruvius, who probably died shortly before the Christian era, laments the decay of taste in his time, much as Pliny does; he specially deprecates the use of gaudy red lead, and the sham architectural paintings in which candelabra, reeds, and other incongruities are made to support heavy cornices and roofs of buildings. He complains also of the novel taste for expensive but inartistic colours, such as purple and azure.[2]

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[1] See Newton, *Lect. on Painting of the Ancients*, 1882.

Early Christian Mural Paintings in Italy.—A very interesting series of these exists in various catacombs, especially those of Rome and Naples. They are of great value, both as an important link in the history of art and also as throwing considerable light on the mental state of the early Christians, which was distinctly influenced by the older faith. Thus in the earlier paintings of about the 4th century we find Christ represented as a beardless youth, beautiful as the artist could make him, with a lingering tradition of Greek idealization, in no degree like the "Man of Sorrows" of mediæval painters, but rather a kind of genius of Christianity in whose fair outward form the peace and purity of the new faith were visibly symbolized, just as certain distinct attributes were typified in the persons of the gods of ancient Greece. The favourite early subject, Christ the Good Shepherd (fig. 9), is represented as Orpheus playing on his lyre to a circle of beasts, the pagan origin of the picture being shown unmistakably by the Phrygian cap and by the presence of lions, panthers, and other incongruous animals among the listening sheep. In other cases Christ is depicted standing with a sheep borne on his shoulders like Hermes Criophoros or Hermes Psychopompos—favourite Greek subjects, especially the former, a statue of which Pausanias (ix. 22) mentions as existing at Tanagra in Bœotia. Here again the pagan origin of the type is shown by the presence in the catacomb paintings of the pan-pipes and pedum, special attributes of Hermes, but quite foreign to the notion of Christ. Though in a degraded form, a good deal survives in some of these paintings, especially in the earlier ones, of the old classical grace of composition and beauty of drawing, notably in the above-mentioned representations where old models were copied without any adaptation to their new meaning. Those of the 5th and 6th centuries still follow the classical lines, though in a rapidly deteriorating style, until the introduction of a foreign—the Byzantine—element, which created a fresh starting-point on quite different lines. The old naturalism and survival of classical freedom of drawing is replaced by stiff, conventionally hieratic types, very superior in dignity and strength to the feeble and spiritless compositions produced by the extreme degradation into which the native art of Rome had fallen. The designs of this second period of Christian art are very similar to those of the mosaics, such as many at Ravenna, and also to the magnificently illuminated MSS. on which the utmost skill and labour of the time were lavished. For some centuries there was but little change or development in this Byzantine style of art, so that it is impossible in most cases to be sure from mere internal evidence of the date of any painting. This to some extent applies also to the works of the earlier or pagan school, though, roughly speaking, it may be said that the least meritorious pictures are the latest in date.

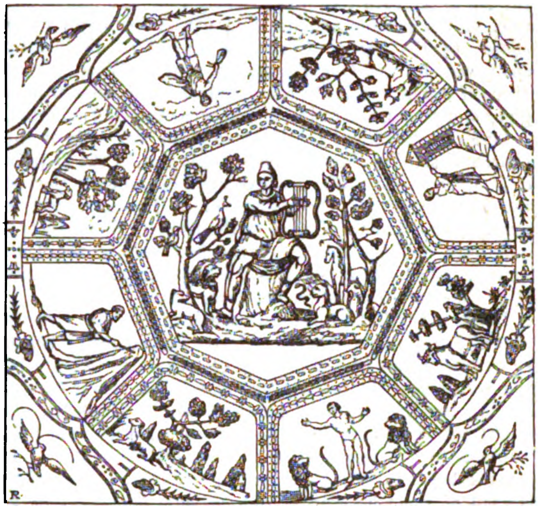

FIG. 9.—Painted Vault from the Catacombs of St Callixtus, Rome. In the centre Orpheus, to represent Christ the Good Shepherd, and round are smaller paintings of various types of Christ.

These catacomb paintings range over a long space of time; some may possibly be of the 1st or 2d century, *e.g.*, those in the cemetery of Domitilla, Rome; others are as late as the 9th century, *e.g.*, some full-length figures of St Cornelius and St Cyprian in the catacomb of St Callixtus, under which earlier paintings may be traced. In execution they somewhat resemble the Etruscan tomb-paintings; the walls of the catacomb passages and chambers, excavated in soft tufa, are covered with a thin skin of white stucco, and on that the mural and ceiling paintings are simply executed in earth colours. The favourite subjects of the earliest paintings are scenes from the Old Testament which were supposed to typify events in the life of Christ, such as the sacrifice of Isaac (Christ's death), Jonah and the whale (the resurrection), Moses striking the rock, or pointing to the manna (Christ the water of life, and the Eucharist), and many others. The later paintings deal more with later subjects, either events in Christ's life or figures of saints and the miracles they performed. A very fine series of these exists in the lower church of S. Clemente in Rome, apparently dating from the 6th to the 10th centuries; among these are representations of the passion and death of Christ—subjects never chosen by the earlier Christians, except as dimly foreshadowed by the Old Testament types. When Christ Himself is depicted in the early catacomb paintings it is in glory and power, not in His human weakness and suffering.

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[1] His remarks on the subject (xxxv. 11) are quite unintelligible.

[2] Gell and Gandy, *Pompeiana* (1817-19 and 1835); *Herculaneum et Pompei, Recueil des Peintures*, &c., Paris (1870-72); Jorio, *Descr. des Peintures antiques* (1825); Renier et Perrot, *Les Peintures du Palatin* (1870); Hittorf, *Arabesques of the Ancients*; *Real Museo Borbonico* (1824 *et seq.*); Mau, *Gesch. der Decorationen in Pompei* (1882); Donner and Helbig, *Wandgemälde der vom Vesuv verschütteten Städte* (1868); *Ann.* and *Bull. dell' Inst. di Cor. arch. di Roma* (various years); Ternite and Müller, *Wandgemälde aus Pompei*; Zahn, *Gemälde aus Pompei* (1828); Rochette, *Peintures de Pompei* (1844-59); Mazois, *Ruines de Pompei* (1824); Overbeck, *Pompei*, &c. (1856); *Revue Archéol.*, vol. ii. (1845); *Le Pitture antiche d' Ercolano* (1757-79); Fiorelli, *Pomp. ant. Hist.* (1860-4); Sogliano, *Le Pitture murali Campane* (1880); Paderni, *Dipinti, &c., di Pompei, Ercolano*, &c. (1865); Caylus, *La Peinture à l' Encaustique* (1755); and Minervini, *Bull. arch. Napol.* (1852-59). See also the list of works on Greek painting.

Other early Italian paintings exist on the walls of the church of the Tre Fontane near Rome, and in the Capella di S. Urbano alla Caffarella, executed in the early part of the 11th century. The atrium of S. Lorenzo fuori le mura, Rome, and the church of the Quattro Santi Incoronati have mural paintings of the first half of the 13th century, which show no artistic improvement over those at S. Clemente four or five centuries older.

It was not in fact till the second half of the 13th century that stiff traditional Byzantine forms and colouring began to be superseded by the revival of native art in Italy by the painters of Florence, Pisa, and Siena (see FRESCO). During the first thirteen centuries of the Christian era mural painting appears to have been for the most part confined to the representation of sacred subjects. It is remarkable that during the earlier centuries council after council of the Christian church forbade the painting of figure-subjects, and especially those of any Person of the Trinity; but it was quite in vain. The double desire, both for the artistic effect of painted walls and for the religious teaching afforded by the pictorial representation of sacred scenes and the celebration of the sacraments, was too strong. In spite of the zeal of bishops and others, who sometimes with their own hands defaced the pictures of Christ on the walls of the churches, in spite of threats of excommunication, the forbidden paintings by degrees became more numerous, till the walls of almost every church throughout Christendom were decorated with whole series of pictured stories. The useless prohibition was becoming obsolete when, towards the end of the 4th century, the learned Paulinus, bishop of Nola, ordered the two basilicas which he had built at Fondi and Nola to be adorned with wall-paintings of sacred subjects, with the special object, as he says, of instructing and refining the ignorant and drunken people. These painted histories were in fact the books of the unlearned, and we can now hardly realize their value and importance as the chief mode of religious teaching in ages when none but the clergy could read or write.[1]

English Mural Painting.—During the Middle Ages, just as long before among the ancient Greeks, coloured decoration was used in the widest possible manner, not only for the adornment of flat walls, but also for the enrichment of sculpture and all the fittings and architectural features of buildings, whether the material to be painted was plaster, stone, marble, or wood. It was only the damp and frosts of northern climates that to some extent limited the external use of colour to the less exposed parts of the outsides of buildings. The varying tints and texture of smoothly-worked stone appear to have given no pleasure to the mediæval eye; and in the rare cases in which the poverty of some country church prevented its walls from being adorned with painted ornaments or pictures the whole surface of the stone-work inside, mouldings and carving as well as flat wall-spaces, was covered with a thin coat of whitewash. Internal rough stonework was invariably concealed by stucco, forming a smooth ground for possible future paintings. Unhappily the ignorant barbarity of the 19th century has in the case of most English cathedrals and parish churches stripped off the internal plaster, often laying bare rubble walls of the roughest description, never meant to be exposed, and has scraped and rubbed the surface of the masonry and mouldings down to the bare stone. In this way a great proportion of mural paintings have been destroyed, though many in a more or less mutilated state still exist in England. It is difficult (and doubly so since the so-called "restoration" of most old buildings) to realize the splendour of effect once possessed by every important mediæval church. From the tiled floor to the roof all was one mass of gold and colour. The brilliance of the mural paintings and richly-coloured sculpture and mouldings was in harmony with the splendour of the oak-work—screens, stalls, and roofs—all richly decorated with gilding and painting, while the light, passing through stained glass, softened and helped to combine the whole into one even mass of extreme decorative effect. Colour, and not in dull tints, was boldly applied everywhere, and thus the patchy effect was avoided which is so often the result of the modern timid and partial use of painted ornament. Even the figure-sculpture was painted in a strong and realistic manner, sometimes by a wax encaustic process, probably the same as the *circumlitio* of classical times. In the accounts for expenses in decorating Orvieto cathedral wax is a frequent item among the materials used for painting. In one place it is specially mentioned that wax was supplied to Andrea Pisano (in 1345) for the decoration of the beautiful reliefs in white marble on the lower part of the west front.

General Schemes of Mural Painting.—From the 11th to the 16th century the lower part of the walls, generally 6 to 8 feet from the floor, was painted with a dado—the favourite patterns till the 13th century being either a sort of sham masonry with a flower in each rectangular space (fig. 10), or a conventional representation of a curtain with regular folds stiffly treated (Plate I.). Above this dado ranges of pictures with figure-subjects were painted in tiers one above the other, each picture frequently surrounded by a painted frame with arch and gable of architectural design. Painted bands of chevron or other geometrical ornament till the 13th century, and flowing ornament afterwards, usually divide the tiers of pictures horizontally and form the top and bottom boundaries of the dado. In the case of a church, the end walls usually have figures to a larger scale. On the east wall of the nave over the chancel arch there was generally a large painting of the "Doom" or Last Judgment. One of the commonest subjects is a colossal figure of St Christopher (fig. 11), usually on the nave wall opposite the principal entrance,—selected because the sight of a picture of this saint was supposed to bring good luck for the rest of the

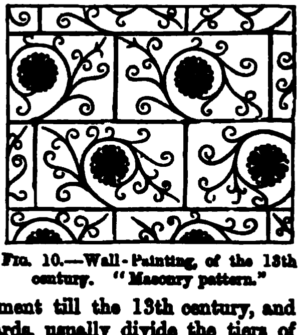

FIG. 10.—Wall-Painting, of the 13th century. "Masonry pattern."

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[1] See Rossi, *Roma sotterranea* (1864-77); Northcote and Brownlow, *Subterranean Rome* (1877); Bottari, *Roma sotterr.* (1737-54); Perret, *Catacombes de Rome* (1851-55); Bellermann, *Katacomben zu Neapel*; Garrucci, *Arte Cristiana* (1880); Mullooly, *Paintings in S. Clemente, Rome* (1868); Lord Lindsay, *Christian Art* (1847); Agincourt, *Hist. de l'Art, ivᵉ-xviᵉ siècle* (1823-47); Theophilus, *Div. Art. Schedula*, Hendrie's ed. (1847); Eraclius, *De Art. Romanorum*, MS. in Bibl. Roy., Paris, partly printed by Raspe; "Mappa Claviculæ"—a 12th-century MS.—*Archæologia*, xxxii. pp. 183-244; Cennino Cennini, *Trattato della Pittura*; Vasari, *Tre Arti del Disegno*, Milanesi's ed. (1882); Mrs Merrifield, *Fresco Painting* (1856); L. Batista Alberti, *De Re ædificatoria*; Richmond, *Monumental Painting*, Lectures on Art published by the Society for the Protection of Ancient Buildings (1882); Martigny, *Dict. des Antiquités Chrétiennes* (1877); Dionysius of Zagora, *Ἑρμηνεία τῆς ζωγραφικῆς* (1853); Eastlake, *Materials for Hist. of Painting*, new ed. (1869); Wessely, *Iconographie Gottes u. der Heiligen* (1874); Didron et Durand, *Iconographie Chrétienne* (1845); Cave Thomas, *Mural Decoration*; *Bull. di Arch. Cristiana* (1864-65).

day. Figures were also often painted on the jambs of the windows and on the piers and soffit of the arches, especially that opening into the chancel.

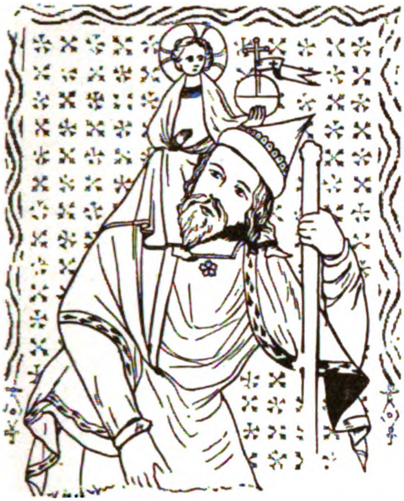

Fig. 11.—Wall-Painting of St Christopher. Large life-size.

The little Norman church at Kempley in Gloucestershire (date about 1100) has perhaps the best-preserved specimen of the complete early decoration of a chancel.[1] The north and south walls are occupied by figures of the twelve apostles in architectural niches, six on each side. The east wall had single figures of saints at the sides of the central window, and the stone barrel vault is covered with a representation of St John's apocalyptic vision—Christ in majesty surrounded by the evangelistic beasts, the seven candlesticks, and other figures. The chancel arch itself and the jambs and mouldings of the windows have stiff geometrical designs, and over the arch, towards the nave, is a large picture of the "Doom." The whole scheme is very complete, no part of the internal plaster or stone-work being undecorated with colour. Though the drawing is rude, the figures and their drapery are treated broadly and with dignity. Simple earth colours are used, painted in tempera on a plain white ground, which covers alike both the plaster of the rough walls and the smooth stone of the arches and jambs.

In the 13th century the painters of England reached a very high point of artistic power and technical skill, so much so that at that time paintings were produced by native artists quite equal, if not superior, to those of the same period anywhere on the Continent, not excepting even Italy. The central paintings on the walls of the chapter-house and on the retable of the high altar of Westminster Abbey are not surpassed by any of the smaller works even of such men as Cimabue and Duccio di Buoninsegna, who were living when these Westminster paintings were executed. Unhappily, partly through the poverty and anarchy brought about by the French wars and the Wars of the Roses, the development of art in England made but little progress after the beginning of the 14th century, and it was not till a time when the renaissance of art in Italy had fallen into a state of degradation and decay that its influence reached the British shores. In the 15th century some very beautiful and noble work, somewhat affected by Flemish influence, was produced in England (fig. 12), chiefly in the form of figures painted on the oak panels of chancel and chapel screens, especially in Norfolk and Suffolk; but, fine as many of these are, they cannot be said to rival in any sense the works of the Van Eycks and other painters of that time in Flanders. To return to the 13th century, the culminating period of English art in painting and sculpture, much was owed to Henry III.'s love for and patronage of the fine arts; he employed a large number of painters to decorate his various castles and palaces, especially the palace of Westminster, one large hall of which was known as the "painted chamber" from the rows of fine pictures with which its walls were covered. After the 13th century the "masonry pattern" was disused for the lower parts of walls, and the chevrony and other stiff patterns for the borders were replaced by more flowing designs (Plate I.). The character of the painted figures became less monumental in style; greater freedom of drawing and treatment was adopted, and they cease in any way to recall the archaic majesty and grandeur of the Byzantine mosaics. A detailed description of the development of the successive styles of mural painting would be almost a complete history of English art, which space does not allow here, but it may be noted that during the

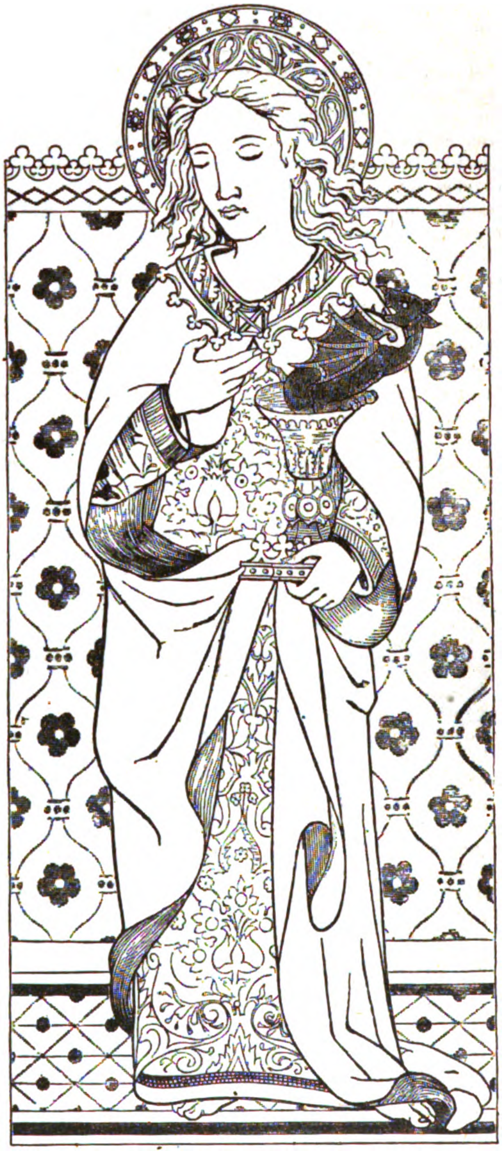

Fig. 12.—15th-century English Painting—St John the Evangelist.

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[1] See *Archæologia*, vol. xlvi., 1880.

14th century wall-spaces unoccupied by figure-subjects were often covered by graceful flowing patterns, drawn with great freedom of hand and rather avoiding geometrical repetition. Fig. 13, from the church of Stanley St Leonard's, Gloucestershire, is a good characteristic specimen of 14th-century decoration; it is on the walls of the chancel, filling up the spaces between the painted figures; the flowers are blue, and the lines red on a white ground. In some cases the motive of the design is taken from encaustic tiles, as at Bengeo Church, Herts, where the wall is divided into squares, each containing an heraldic lion. This imitative notion occurs during all periods—masonry, hanging curtains, tiles, and architectural features such as niches and canopies being very frequently represented, though always in a simple decorative fashion with no attempt at actual deception,—not probably from any fixed principle that shams were wrong, but because the good taste of the mediæval painters taught them that a flat unrealistic treatment gave the best and most decorative effect. Thus in the 15th and 16th centuries the commonest forms of unpictorial wall-decoration were various patterns taken from the beautiful damasks and cut velvets of Sicily, Florence, Genoa, and other places in Italy, some form of the "pine-apple" or rather "artichoke" pattern being the favourite (fig. 14), a design which, developed partly from Oriental sources, and coming to perfection at the end of the 15th century, was copied and reproduced in textiles, printed stuffs, and wall-papers with but little change down to the present century,—a remarkable instance of survival in design. Fig. 15 is a specimen of 15th-century English decorative painting, copied from a 14th-century Sicilian silk damask. Diapers, powderings with flowers, sacred monograms, and sprays of blossom were frequently used to ornament large surfaces in a simple way. Many of these are extremely beautiful (fig. 16).

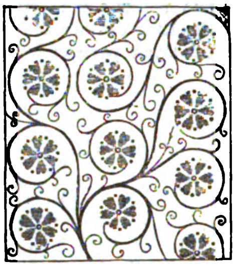

Fig. 13.—Flowing Pattern; English 14th-century Wall-Painting.

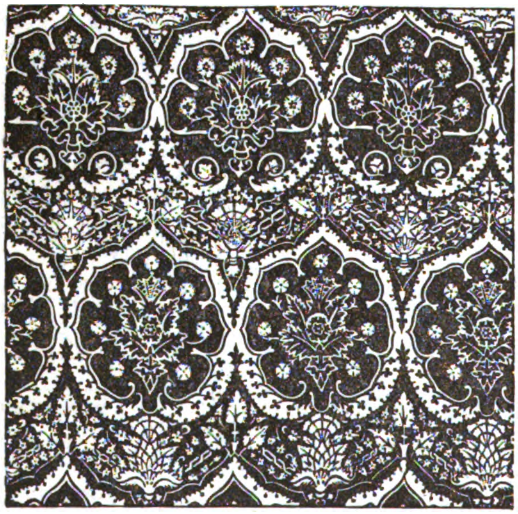

Fig. 14.—15th-century Wall-Painting, taken from a Genoese or Florentine velvet design.

Subjects of Mediæval Wall-Paintings.—In churches and domestic buildings alike the usual subjects represented on the walls were specially selected for their moral and religious teaching, either stories from the Bible and Apocrypha, or from the lives of saints, or, lastly, symbolical representations setting forth some important theological truth, such as figures of Virtues and Vices, or the *Scala Humanæ Salvationis*, showing the perils and temptations of the human soul in its struggle to escape hell and gain paradise—a rude foreshadowing of the great scheme worked out with such perfection by Dante in his *Commedia*. A fine example of this subject exists on the walls of Chaldon Church, Surrey.[1] In the selection of saints for paintings in England, those of English origin are naturally most frequently represented, and different districts had certain local favourites. St Thomas of Canterbury was one of the most widely popular; but few examples now remain, owing to Henry VIII.'s special dislike to this saint and the strict orders that were issued for all pictures of him to be destroyed. For a similar reason most paintings of saintly popes were obliterated.

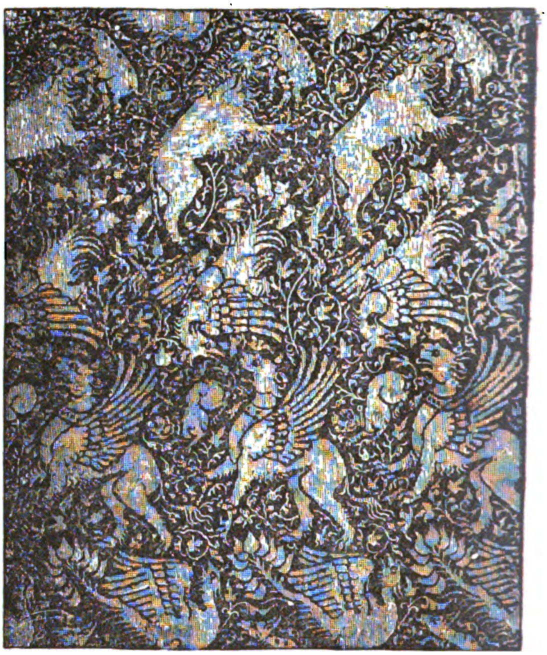

Fig. 15.—15th-century Wall-Painting, the design copied from a 13th-century Sicilian silk damask.

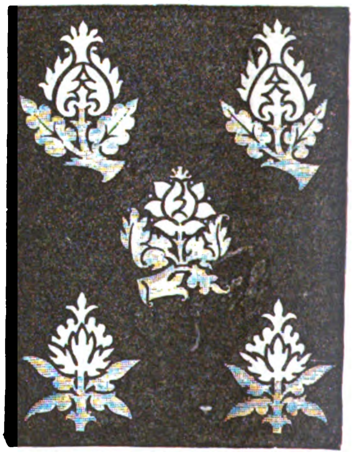

Fig. 16.—Powderings used in 15th-century Wall-Painting.

Methods of Execution.—Though Eraclius, who probably wrote before the 10th century, mentions the use of an oil-medium, yet till about the 13th century mural paintings appear to have been executed in the most simple way, in tempera mainly with earth colours applied on dry stucco; even when a smooth stone surface was to be painted a thin coat of whitening or fine *gesso* was laid as a ground. No instance of true fresco has been discovered in England. In the 13th century, and perhaps earlier, oil was commonly used both as a medium for the pigments and also to make a varnish to cover and fix tempera paintings. Vasari's statement as to the discovery of the use of oil-medium by the Van Eycks is certainly untrue, but it probably has a germ of truth. The Van Eycks introduced the use of *dryers* of a better kind than had yet been used, and so largely extended the application of oil-painting. Before their time it seems to have been the custom to dry wall-paintings laboriously by the use of charcoal braziers, if they were in a position where the sun could not shine upon them. This is specially recorded in the valuable series of accounts for the expenses of wall-paintings in the royal palace of Westminster during the reign of Henry III., printed in *Vetusta Monumenta*, vol. vi., 1842. All the materials used, including charcoal to dry the paintings and the wages paid to the artists, are given. The materials mentioned are *plumbum album et rubeum*, *viridus*, *vermilio*, *synople*, *ocre*, *azura*, *aurum*, *argentum*, *collis*, *oleum*, *vernix*.

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[1] See *Collections of Surrey Archæol. Soc.*, vol. v. part ii., 1871. A useful though necessarily incomplete list of English mediæval mural paintings has been published by the Science and Art Depart., S. Kens. Mus. Fresh wall-paintings are constantly being discovered under later coats of whitewash, so that any list needs frequent additions.

Two foreign painters were employed—Peter of Spain and William of Florence—at sixpence a day, but the English painters seem to have done most of the work and received higher pay. William, an English monk in the adjoining Benedictine abbey of Westminster, received two shillings a day. Walter of Durham and various members of the Otho family, royal goldsmiths and moneyers, worked for many years on the adornment of Henry III.'s palace and were well paid for their skill. Some fragments of paintings from the royal chapel of St Stephen are now in the British Museum. They are very delicate and carefully-painted subjects from the Old Testament, in rich colours, each with explanatory inscription underneath. The scale is small; the figures being scarcely a foot high. Their method of execution is curious. First the smooth stone wall was covered with a coat of red, painted in oil, probably to keep back the damp; on that a thin skin of fine gesso (stucco) has been applied, and the outlines of the figures marked with a point; the whole of the background, crowns, borders of dresses, and other ornamental parts have then been modelled and stamped with very minute patterns in slight relief, impressed on the surface of the gesso while it was yet soft. The figures have then been painted, apparently in tempera, gold leaf has been applied to the stamped reliefs, and the whole has been covered with an oil varnish. It is difficult to realize the amount of patience and labour required to cover large halls such as the above chapel and the "painted chamber," the latter about 83 feet by 27, with this minute and gorgeous style of decoration.

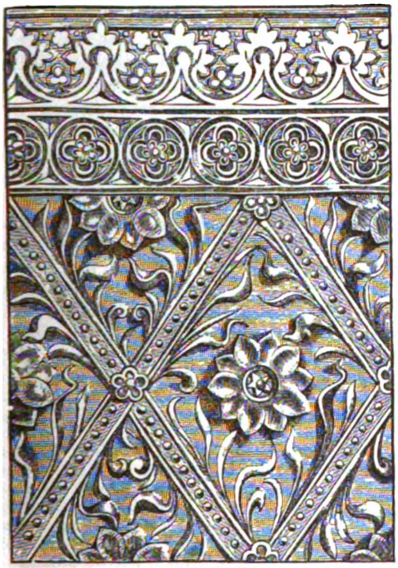

FIG. 17.—Pattern in Stamped and Moulded Plaster, decorated with gilding and transparent colours; 15th-century work. Full size.

In many cases the grounds were entirely covered with shining metal leaf, over which the paintings were executed; those parts, such as the draperies, where the metallic lustre was wanted, were painted in oil with transparent colours, while the flesh was painted in opaque tempera. The effect of the bright metal shining through the rich colouring is very magnificent. This extreme minuteness of much of the mediæval wall-decoration is very remarkable. Large wall-surfaces and intricate mouldings were often completely covered by elaborate gesso patterns in relief of almost microscopic delicacy (fig. 17). The cost of stamps for this is among the items in the Westminster accounts. These patterns when set and dry were further adorned with gold and colours in the most laborious way. So also with the architectural painting; the artist was not content simply to pick out the various members of the mouldings in different colours, but he also frequently covered each bead or fillet with painted flowers and other patterns, as delicate as those in an illuminated MS.,—so minute and highly-finished that they are almost invisible at a little distance, but yet add greatly to the general richness of effect. All this is completely neglected in modern reproductions of mediæval painting, in which both touch and colour are alike coarse and harsh—mere caricatures of the old work, such as unhappily disfigure the Sainte Chapelle in Paris, and many cathedrals in France, Germany, and England. Gold was never used in large quantities without the ground on which it was laid being broken up by some such delicate reliefs as that shown in fig. 17, so its effect was never gaudy or dazzling.

Mural painting in England fell into disuse in the 16th century. For domestic purposes wood panelling, stamped leather, and tapestry were chiefly used as wall-coverings. In the reign of Henry VIII., probably in part through Holbein's influence, a rather coarse sort of tempera wall-painting, German in style, appears to have been common.[1]

A good example of arabesque painting of this period in black and white, rudely though boldly drawn and very Holbeinesque in character, was discovered in 1881 behind the panelling in one of the canons' houses at Westminster. Other examples exist at Haddon Hall (Derbyshire) and elsewhere.

Several attempts have been made in the present century to revive the art of monumental wall-decoration, but mostly, like those in the new Houses of Parliament, unsuccessful both in method and design. A large wall-painting by Sir Frederick Leighton of the Arts of War, on a wall in the South Kensington Museum, is much disfigured by the disagreeable gravelly surface of the stucco. The process employed is that invented by Mr Gambier Parry, and called by him "spirit fresco." A very fine series of mural paintings has been executed by Mr Madox Brown on the walls of the Manchester town-hall. These also are painted in Mr Parry's "spirit fresco," but on a smooth stucco surface, free from the unpleasant granular appearance of the South Kensington picture.

The Mediæval Wall-Paintings of the Continent.—In the main the above remarks on English mural decoration apply equally to that of France, Germany, and Scandinavia. Though each of these countries had certain peculiarities of style, mostly slight and unimportant, yet in method of execution, choice and arrangement of subjects, and division of the wall-spaces there is a very close similarity between them all. Italy, on the other hand, developed a style of her own, more purely pictorial, with less regard to the exigencies of architecture. In northern lands the mural paintings were strictly subordinate to the main features of the structure for which they were designed, while in Italy as a rule the architect did but little to decorate the interior of his buildings, and left the painter free to treat the walls as he pleased.

The very close similarity of the mural decoration in the churches of Sweden to those of England is very remarkable, and some of the Swedish churches have very magnificent and well-preserved schemes of decoration, covering walls and ceilings alike, of dates varying from the 13th to the 15th centuries, all of which have little or nothing to distinguish them from contemporary work in England. Mandelgren's *Monuments Scandinaves* (1862) has well-executed reproductions of some of the best of these, especially the fine and complete specimens in the churches of Bjeresjoe,

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[1] Shakespeare, *Henry IV.*, part ii., act 2, sc. 1: "*Falstaff.* And for thy walls, a pretty slight drollery, or the story of the prodigal, or the German hunting in *waterwork*, is worth a thousand of these bed-hangings and these fly-bitten tapestries."

Amenebarads Råda, Risingë, and Floda. One of these, the north chancel wall of the church of Råda, 13th century, has been selected (Plate I.) as a good and characteristic example of the treatment of a large wall-space in the 14th century; the dado of painted curtain-folds, the tiers of single life-size figures in architectural niches treated with great breadth and decorative skill, and the band below of subjects on a rather smaller scale give a good idea of a common scheme of ecclesiastic decoration. An inscription on one of these paintings gives the date of their execution as 1323. The lower subject represents the death of the Virgin, above are figures of the apostles, and highest of all, painted on the curved boarding of the waggon-vault, are a row of seated prophets under round arches. The other examples on the same plate, given as specimens of 15th-century flowing patterns, are from the church of Kumbla, also in Sweden, and fully illustrated in Mandelgren's valuable work.

Oriental Painting.—In the churches and monasteries of the Greeks mural painting is still practised very much as it was in the 12th or 13th centuries.[1] Neither colouring, nor drawing, nor method has in the least altered during the last six hundred years. Everything is fixed by certain unchangeable hieratic rules, and the Greek painter-monk would think it impious to improve upon or deviate from the artistic canons for sacred subjects handed down from century to century. For this reason it is generally impossible, from internal evidence, to guess the date of the interesting wall-paintings with which many churches in eastern Europe, Egypt, and Asia Minor are decorated.

In India and Ceylon mural painting has been largely used from very early times, especially to decorate the walls of temples. Some of these appear to be executed in true fresco. Birth-stories of Buddha and other sacred subjects most frequently occur. As among the mediæval and modern Greeks, the strong conservatism of the Hindu races makes it difficult to judge as to the dates of these paintings.[2] (W. MO.—J. H. M.)

MURANO, the ancient Ammariuno, an island in the Venetian lagoon about 1 mile north of Venice, is 5 miles in circumference, a large part of which is occupied by gardens. It contains about 4000 inhabitants, but was once much more populous than it is at present, its inhabitants numbering 30,000. It was a favourite resort of the Venetian nobility before they began to build their villas on the mainland; and in the 15th and 16th centuries its gardens and casinos, of which some traces still remain, were famous. It was here that the literary clubs of the Vigilanti, the Studiosi, the Occulti, used to meet.

The town is built upon one broad main canal, where the tidal current runs with great force, and upon several smaller ones. The cathedral, S. Donato, is a fine basilica, probably of the 11th century. The pavement is as richly inlaid as that of St Mark's, and the mosaics of the tribune are remarkable. The exterior of the tribune is very beautiful, and has been successfully restored. The 15th-century church of St Peter the Martyr contains a fine picture by Gentile Bellini. Murano has from ancient times been celebrated for its glass manufactories. When and how the art was introduced is wrapped in great obscurity, but there are notices of it as early as the 11th century; and in 1250 Cristoforo Briani, encouraged by the accounts of the gems of Guinea which the traveller Marco Polo brought to Venice, attempted the imitation of agate and chalcedony. From the labours of his pupil Miotto sprang the whole of that branch of the glass trade which is concerned with the imitation of gems. In the 15th century the first crystals were made, and in the 17th the various gradations of coloured and iridescent glass were invented, together with the composition called "aventurine"; the manufacture of beads is now a main branch of the trade. The art of the glass-workers was taken under the protection of the Government in 1275, and regulated by a special code of laws and privileges; two fairs were held annually, and the export of all materials, such as alum and sand, which enter into the composition of glass was absolutely forbidden. With the decay of Venice the importance of the Murano glass-works declined; but at the present time there are signs of renewed activity. As many as eight firms, employing 2500 hands, are engaged in the trade,—the most renowned being "The Venezia Murano Company" and Salviati. The municipal museum contains a collection of glass illustrating the history and progress of the art.

The island of Murano was first peopled by the inhabitants of Altino, when they fled before their barbarian invaders. It originally enjoyed independence under the rule of its tribunes and judges, and was one of the twelve confederate islands of the lagoons. In the 12th century the doge Vital Micheli II. incorporated Murano in Venice and attached it to the Sestiere of S. Croce. From that date it was governed by a Venetian nobleman with the title of podestà, whose office lasted sixteen months. Murano, however, still retained its original constitution of a greater and a lesser council for the transaction of municipal business, and also the right to coin gold and silver, as well as its judicial powers civil and criminal. The interests of the town were watched at the ducal palace by a nuncio and a solicitor; and this constitution remained in force till the fall of the republic.

Books.—*Venezia e le Sue Lagune*; Paoletti, *Il Fiore di Venezia*; Bussolin, *Guida alle Fabbriche vetrarie di Murano*; Romanin, *Storia Documentata di Venezia*, vol. i. p. 41.

MURAT, JOACHIM (1768-1815), king of Naples and a celebrated French cavalry leader, was, according to most accounts, the younger son of an innkeeper at Bastide Fortunière in the department of Lot, France, and was born in 1768, but by his own account his father was a well-to-do farmer in that village. This is most probably the truth, as after being educated at a seminary at Cahors he was entered at the university of Toulouse, where he studied canon law. He was intended for the priesthood, but led a reckless life; and after spending all his money he enlisted in a cavalry regiment. He had attained the rank of "maréchal des logis" in 1789, and was the recognized leader of the young soldiers from his great prowess in all athletics and feats of daring. His influence was so great and so prejudicial to authority that he received unlimited leave of absence in 1790. In November 1791 he was elected by the department of Lot a member of the garde

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[1] See Byzantine MS. from Mt. Athos, quoted by Didron, *Iconogr. Chrét.*

[2] Many books given under the head of "Early Christian paintings in Italy" apply also to this last division. Plates and descriptions of mediæval paintings are mostly scattered through the proceedings of various societies, such as those of the Society of Antiquaries (*Archæologia*, *Vet. Mon.*, and *Proceedings*), the Archæological Institute, the Archæological Association, and many other central and local societies in England and abroad. The "List of English buildings with mural decoration" (Science and Art Depart., S. Kens. Mus., 1872) gives references to illustrations of most of the paintings catalogued. See also Merrifield, *Original Treatises on Painting, 12th to 18th century* (1849); Latilla, *Treatise on Fresco, Encaustic, and Tempera* (1842); Woltmann and Woermann, *Hist. of Painting*, vol. i. (1880); Blackburn, *Decorative Painting* (1847); Collins, *Gothic Ornaments* (1850); Mérimée, *Peintures de l'Église de S. Savin* (1845); Straub, *Peint. mur. en Alsace*; Voisin, *Peint. mur. de la Cathédral de Tournay*; Fleury, *Peint. mur. du Laonnois* (1860); Galembert, *Peint. mur. de St Mesme de Chinon* (1855); Gaucherel, *Decoration appliqué a l'Architecture*; David, *Hist. de la Peinture au Moyen Âge* (1863); Hotho, *Gesch. d. christlichen Malerei* (1872); Zahn, *Ornamente aller klassischen Kunstepochen* (1843-48); Salazaro, *Mon. dell' Italia Meridionale, 4to al 13mo sec.* (1872-80); Racinet, *Polychromatic Ornament* (1873); Owen Jones, *Grammar of Ornament* (1842-45); Gailhabaud, *L'Architecture du v. au xvii. siècle* (1869-72); Förster, *Gesch. der Ital. Kunst*; Dohme, *Kunst u. Künstler d. Mittelalters* (1877); Ridolfi, *Maraviglie dell' Arte.*

constitutionelle of the king. In May 1792 the garde was disbanded, but Murat had shown such military qualities and such advanced principles that he was at once appointed a sub-lieutenant in the chasseurs-à-cheval, and on the outbreak of war aide-de-camp to General Hué. He was rapidly promoted to be captain and major in the 21st chasseurs, but after Thermidor found himself looked upon with suspicion on account of his former advanced republican sentiments. He was recalled from the front, and happened to be wandering about Paris in the spring and summer of 1795, like another unemployed officer, Napoleon Bonaparte, whose acquaintance he made, and whose friendship he won. When Bonaparte was requested by Barras to undertake the defence of the convention in Vendémiaire 1795 he at once called Murat to his side and commissioned him to bring up from Sèvres the artillery with which the sections were shot down. His services on this occasion were recognized by his receiving the lieutenant-colonelcy of the 21st chasseurs and the appointment of first aide-de-camp to General Bonaparte in Italy. In the first battles of the famous campaign of 1796, Montenotte, Ceva, Dego, and Mondovì, Murat so greatly distinguished himself that he was chosen to carry the flags taken from the enemy to Paris. He was promoted to be general of brigade, and returned to Italy in time to be of essential service to Bonaparte at Bassano and Corona and Fort St Georges, where he was wounded. He then was sent on a diplomatic mission to Genoa, but returned in time to be present at Rivoli. In the advance into Tyrol in the summer of 1797 he commanded the vanguard, and by his passage of the Tagliamento hurried on the preliminaries of Leoben. In 1798 he was for a short time commandant at Rome, and then accompanied Bonaparte to Egypt. At the battle of the Pyramids he led his first famous cavalry charge, and so distinguished himself in Syria that he was made general of division. He returned to France with Bonaparte, and on the 18th Brumaire led into the orangery of Saint Cloud the sixty grenadiers whose appearance broke up the Council of Five Hundred. He was, after the success of the coup d'état, made commandant of the consular guard, and in January 1800 married Marie Annonciade Caroline Bonaparte, the youngest sister of the first consul. He commanded the French cavalry at the battle of Marengo, and was afterwards made governor in the Cisalpine Republic. He was made a marshal of France in 1804; he was titular governor of Paris, was invested with the grand eagle of the Legion of Honour, and appointed grand admiral of France with the title of prince in 1805. He commanded the cavalry of the grand army in the German campaign of 1805, and was so conspicuous at Austerlitz that Napoleon made him grand-duke of Berg and Cleves. He commanded the cavalry at Jena, Eylau, and Friedland, and in 1808 was made general-in-chief of the French armies in Spain. He entered Madrid on 25th March, and did much to hurry on the Spanish policy of Napoleon. The inhabitants of Madrid showed their hatred for the French by murdering on 2d May all the isolated or wounded Frenchmen they could find. Murat vigorously put down the riot, but not cruelly, for only 158 Spaniards fell to 500 Frenchmen; and he hoped for the throne of Spain as his reward. But the throne of Spain was given to Joseph Bonaparte, and Murat received Joseph's former kingdom of Naples.

King Joachim Napoleon, as he called himself, entered Naples in September 1808, and soon won great popularity by his handsome presence and his gaiety of manner. He took Capri from the English, and organized a Neapolitan army of 80,000 infantry and 10,000 cavalry. But his attention was not confined to military matters; he effected other great reforms in finally abolishing all relics of feudalism and putting down brigandism. Unfortunately much injustice was done by General Manhès in this last reform, which seriously affected Murat's popularity in Calabria. He was not present at Aspern or Wagram, but once more commanded the cavalry of the grand army in the Russian campaign of 1812. He manifested his usual headlong valour in the disastrous retreat, but, being offended by Napoleon, he suddenly threw up his command and left for Naples. He then began an intrigue with Austria. Whether it was that he hoped to escape from a doubtful cause or that he was really offended by Napoleon's preference for Eugène Beauharnais is not known, but in March 1813 he sent Prince Cariati to Vienna to declare that he would surrender his claims to Sicily if Austria would guarantee Naples to him. In January 1814 the alliance with Austria was declared by Murat's seizing the principality of Benevento, while Austria promised him Ancona for a force of 30,000 men. At the congress of Vienna his independence was attacked by Talleyrand, who was his personal enemy, and it was as much from distrust of Austria as anything else that he declared in March 1815 that he intended to restore the unity and independence of Italy. He had hoped that Lord William Bentinck, the English general, would have supported him, but in vain. The Austrians steadily advanced, and on 2d May he suffered a disastrous defeat at the battle of Tolentino. With difficulty he escaped, and reached France on 27th May. He offered his sword to Napoleon, who indignantly refused his offer, and he then hid in seclusion near Toulon with a price upon his head. After Waterloo he was refused an asylum in England, and went to Corsica, where he was joined by a few rash spirits, who urged him to strike another blow for his kingdom of Naples. He refused an offer of asylum from Metternich, and started with six ships. By a great mistake he landed in Calabria, where he was hated for the cruelty of Manhès, on 6th October; his ships deserted him, and he was taken prisoner by a captain named Trenta-Capilli, whose brother had been executed by Manhès. He was imprisoned in the fort of Pizzo, and on 13th October 1815 was tried by court-martial, under a law of his own, for disturbing the public peace and was sentenced to be shot in half an hour. After writing a touching letter of farewell to his wife and children, he bravely met his fate, and was buried at Pizzo.

As a king much good can be said of him; by his valour he had risen from nothing to royalty, and instead of being careless of the good of his adopted country he showed himself a truly wise king. As a general he was the most dashing cavalry leader of the age, and, as he himself said, his presence at Waterloo would have given more concentrated power to the French cavalry charges, and possibly success. As a man he was rash, hot-tempered, and impetuously brave; he was adored by his troopers, who followed their idol, the "golden eagle," into the most terrible fire and against the most terrible odds.

For the life of Murat and his rule in Naples consult *Vie de Joachim Murat*, by M* * *, 1815; *Memorie sulla condotta politica e militare tenuta da Gioacchino Murat*, 1815; *Gioacchino Murat, o Storia del Reame di Napoli dal* 1800 *al* 1815, Milan, 1839; *Campagnes des Autrichiens contre Murat en* 1815, by V* * C* * de Br., Brussels, 1821; and particularly Freiherr von Helfert, *Joachim Murat, seine letzten Kämpfe und seine Ende*, Vienna, 1878. For his daring attempt in 1815 and his death see A. de Beauchamp, *Catastrophe de Murat*, 1815; Francis Macirone, *Interesting facts relating to the fall and death of Joachim Murat, King of Naples*, London, 1817; P. Colletta, *Pochi fatti su Gioacchino Murat*, Naples, 1820, correcting Macirone, and translated by L. Gallois, Paris, 1823; Galvani, *Mémoires sur les Événements qui ont précédé la mort de Joachim, roi des Deux Siciles*, Paris, 1843; and Jean de la Rocca, *Le Roi Murat et ses derniers jours*, from the papers of Multedo, who accompanied the king, Paris, 1868. (H. M. S.)

MURATORI, LUDOVICO ANTONIO (1672-1750), a learned Italian scholar, historian, and antiquary, was born at Vignola in the duchy of Modena 21st October 1672. Whilst still young he attracted the attention of Father Bacchini, the librarian of the duke of Modena, by whom he was inspired with a taste for historical and antiquarian research, and introduced to the study of MSS. Having taken minor orders in 1688, Muratori proceeded to his degree of doctor *in utroque jure* before 1694, in which year he was appointed by Count Carlo Borromeo one of the doctors of the Ambrosian library at Milan. From manuscripts now placed under his charge, and which had been hitherto neglected, he made a selection of materials for several volumes (*Anecdota*), which he published with critical and explanatory notes. The reputation he in consequence acquired was such that the duke of Modena offered him the situation of keeper of the public archives of the duchy. Muratori hesitated, until the offer of the additional post of librarian, on the resignation of Father Bacchini, determined him in 1700 to return to Modena. The remainder of his life was an almost uninterrupted course of ardent and indefatigable intellectual labour. The preparation of numerous valuable tracts on the history of Italy during the Middle Ages, and of dissertations and discussions on obscure points of historical and antiquarian interest, as well as the publication of his various philosophical, theological, legal, poetical, and other works absorbed the greater part of his time and attention. These as they successively appeared added to his growing reputation, and brought him into communication with the most distinguished scholars of Italy, France, and Germany. But they also exposed him in his later years to the machinations of the envious. His enemies spread abroad the rumour that the pope, Benedict XIV., had discovered in his writings passages strongly savouring of heresy, even of atheism. Muratori appealed to the pope, repudiating the accusation. His Holiness assured him of his protection, and, without expressing his approbation of the opinions in question of the learned antiquary, freed him from the imputations of his enemies. Muratori died, after a lengthened illness, on 23d January 1750, and was buried with much pomp in the church of Santa Maria di Pomposa, in connexion with which he had laboured as a diligent parish priest for many years. His remains were afterwards, in the year 1774, removed to the church of St Augustin.

The most important of the works of Muratori, which amounted altogether to upwards of sixty-four, are: *Anecdota ex Ambrosianæ Bibliothecæ Codd.*, Milan, 1697, 1698; Padua, 1713, 2 vols. 4to; *Anecdota Græca*, Padua, 1709, 3 vols. 4to; *Antichità Estensi*, Modena, 1717, 2 vols. folio; *Rerum Italicarum Scriptores præcipui ab anno* 500 *ad* 1500, Milan, 1723-1751, 25 vols. folio; *Antiquitates Italicæ medii ævi*, Milan, 1738-1742, 6 vols. folio; *Novus Thesaurus Veterum Inscriptionum*, Milan, 1739-1742, 6 vols. folio; *Annali d'Italia*, Venice, 1744-1749, 12 vols. 4to. His *Lettere*, with a *Life* prefixed, were published by Lazzari, in 1783, Venice, 2 vols. His nephew, G. F. Muratori, also wrote a *Vita del celebre Ludov. Ant. Muratori*, Venice, 1756. Muratori's Latin and Italian works were published at Arezzo, 1767-1780, 36 vols. 4to. See further Tiraboschi, *Biblioteca Modenese*, vols. iii., iv.; Fabroni, *Vitæ Italorum*, vol. x.; Tipaldo, *Biogr. degli Italiani illustri*, vol. vii.

MURCHISON, SIR RODERICK IMPEY (1792-1871), geologist, was descended from a small clan or sept which for many generations lived in the west of Ross-shire, furnishing factors for some of the greater lairds, occupants of farms among the western sea-lochs, and even occasionally a parish minister. His father, educated as a medical man, acquired a competent fortune in India, and while still in the prime of life returned to Scotland, where, marrying one of the Mackenzies of Fairburn, he purchased the estate of Tarradale in eastern Ross and settled for a few years as a resident Highland landlord. At Tarradale his eldest son, the subject of this notice, was born on 19th February 1792. Young Murchison left the Highlands when only three years old, and at the age of seven was sent to the grammar school of Durham, where during six years he received the only connected general education he ever obtained. He was then placed at the military college, Great Marlow, to be trained for the army. With some difficulty he succeeded in passing the not very stringent examinations of the time, and at the age of fifteen was gazetted ensign in the 36th regiment. A year later (1808) he landed with Wellesley in Galicia, and was present at the actions of Roriça and Vimiera. Subsequently under Sir John Moore he took part in the retreat to Corunna and the final battle there. These six months of active service formed the only part of his military career in which he was exposed to the hardships and dangers of actual warfare. The defeat of Napoleon at Waterloo seeming to close the prospect of advancement in the military profession, Murchison, after eight years of service, quitted the army, and married the daughter of General Hugonin, of Nursted House, Hampshire. With her he then spent rather more than two years on the Continent, particularly in Italy, where her cultivated tastes were of signal influence in guiding his pursuits. He threw himself with all the enthusiasm of his character into the study of art and antiquities, and for the first time in his life tasted the pleasures of truly intellectual pursuits.

Returning to England in 1818, he sold his paternal property in Ross-shire and settled in England, where, finding art studies no longer practicable, he took heart and soul to field-sports. He soon became one of the greatest fox-hunters in the northern counties; but at last, getting weary of such pursuits and meeting Sir Humphrey Davy, who urged him to turn his energy to science, he was induced to attend lectures at the Royal Institution. This change in the current of his occupations was much helped by the sympathy of his wife, who, besides her artistic acquirements, took much interest in some branches of natural history. Eager and enthusiastic in whatever he undertook, he was soon fascinated by the young science of geology, and threw himself heartily into its prosecution. He joined the Geological Society of London and soon showed himself one of its most active members, having as his colleagues there such men as Sedgwick, Lyell, Buckland, Herschel, Whewell, and Babbage. Exploring with his wife the geology of the south of England, he devoted special attention to the rocks of the north-west of Sussex and the adjoining parts of Hants and Surrey, on which he wrote his first scientific paper, read to the Society towards the close of 1825. From that early period on to the end of his long life his industry and enthusiasm remained pre-eminent. Though he had reached the age of thirty-two before he took any interest in science, he developed his taste and increased his knowledge so rapidly by unwearied diligence that in the first three years of his scientific career he had explored large parts of England and Scotland, had obtained materials for three important memoirs, as well as for two more written in conjunction with Sedgwick, and from the position of a mere beginner had risen to be a prominent member of the Geological Society and one of its two secretaries.

Turning his attention for a little to Continental geology, he explored with Lyell the volcanic region of Auvergne, parts of southern France, northern Italy, Tyrol, and Switzerland. A little later, with Sedgwick as his companion, he attacked the difficult problem of the geological structure of the Alps, and their joint paper giving the results of their study will always be regarded as one of the classics in the literature of Alpine geology.

It was in the year 1831 that Murchison found the field in which the chief work of his life was to be accomplished. Acting on a suggestion made to him by Buckland he betook himself to the borders of Wales, with the view of endeavouring to discover whether the greywacke rocks underlying the Old Red Sandstone could be grouped into a definite order of succession, as the Secondary rocks of England had been made to tell their story by William Smith. For several years he continued to work vigorously in that region. The result was the establishment of the Silurian system,—a definite section of the geological record, bringing into notice for the first time a remarkable series of formations, each replete with distinctive organic remains older than and very different from those of the other rocks of England. The full import of his discoveries[1] was not at first perceived; but as years passed on the types of existence brought to light by him from the rocks of the border counties of England and Wales were ascertained to belong to a geological period of which there are recognizable traces in almost all parts of the globe. Thus the term "Silurian," derived from the name of the old British tribe Silures, soon passed into the familiar vocabulary of geologists in every country.

The establishment of the Silurian system was followed by that of the Devonian system, an investigation in which Sedgwick and Murchison were fellow-labourers, both in the south-west of England and in the Rhinelands. Soon afterwards Murchison projected an important geological campaign in Russia with the view of extending to that part of the Continent the classification he had succeeded in elaborating for the older rocks of western Europe. He was accompanied by De Verneuil and Keyserling, in conjunction with whom he produced a magnificent work on *Russia and the Ural Mountains*. The publication of this monograph in 1845 completes the first and most active half of Murchison's scientific career.

In 1846 he was knighted, and later in the same year he presided over the meeting of the British Association at Southampton. During the later years of his life a large part of his time was devoted to the affairs of the Royal Geographical Society, of which he became president. So constant and active were his exertions on behalf of geographical exploration that to a large section of the contemporary public he was known rather as a geographer than as a geologist. He particularly identified himself with the fortunes of David Livingstone in Africa, and did much to raise and keep alive the sympathy of his fellow-countrymen in the fate of that great explorer. The chief geological investigation of the last decade of his life was devoted to the Highlands of Scotland, where he succeeded in showing that the vast masses of crystalline schists, previously supposed to be part of what used to be termed the Primitive formations, were really not older than the Silurian period, for that underneath them lay beds of limestone and quartzite containing Lower Silurian fossils. By this important discovery he not only changed at once the accepted views of the structure of half a kingdom but furnished a gigantic example of regional metamorphism, the true significance of which in regard to theories of metamorphism is not yet adequately appreciated.

In the year 1855 Murchison was appointed director-general of the geological survey and director of the Royal School of Mines and Geological Museum, Jermyn Street, London, in succession to Sir Henry de la Beche, who had been the first to hold these offices. Official routine now occupied much of his time, but he found opportunity for the Highland researches just alluded to, and also for preparing successive editions of his work *Siluria*, which was meant to present the main features of the original *Silurian System* together with a digest of subsequent discoveries, particularly of those which showed the extension of the Silurian classification into other countries. His official position gave him still further opportunity for the exercise of those social functions for which he had always been distinguished, and which a considerable fortune inherited from near relatives on his mother's side enabled him to display on a greater scale. His house was one of the great centres where science, art, literature, politics, and social eminence were brought together in friendly intercourse. In 1863 he was made a K.C.B., and three years later was raised to the dignity of a baronet. The learned societies of his own country bestowed their highest rewards upon him: the Royal Society gave him the Copley medal, the Geological Society its Wollaston medal, and the Royal Society of Edinburgh its Brisbane medal. There was hardly a foreign scientific society of note which had not his name enrolled among its honorary members. The French Academy of Sciences awarded to him the Prix Cuvier, and elected him one of its eight foreign members in succession to Faraday.

One of the closing public acts of Murchison's life was the founding of a chair of geology and mineralogy in the university of Edinburgh, for which he gave the sum of £6000, an annual sum of £200 being likewise provided by a vote in parliament for the endowment of the professorship. While the negotiations with the Government in regard to this subject were still in progress, Murchison was seized with a paralytic affection on 21st November 1870. At first his life was in danger, but he eventually rallied, and was able to see his friends, read, and take interest in current affairs until the early autumn of the following year, when his malady began to make rapid progress. At last after a brief attack of bronchitis he died on 22d October 1871.

The chief work for which Murchison will always hold a high place in the annals of geology is the investigation of the older Palæozoic rocks, which culminated in the establishment and subsequent development of the Silurian system of formations. He added a new chapter to geological history, and one of peculiar interest, because it contains the story of almost the earliest appearance of living things upon this planet. From the year 1825, when his first paper was read, down to the year of his death he continued to augment the literature of his favourite science with papers and memoirs. These, upwards of 150 in number, were published in the transactions of scientific societies at home and abroad. His *Silurian System*, *Russia and the Ural Mountains*, and *Siluria* were the most voluminous and important of his independent works. As a careful original observer, a sympathetic and liberal friend of scientific progress, and a man of wealth and good social position Murchison enjoyed a peculiar eminence among the scientific men of his day, and occupied a place which none of his surviving compeers could wholly fill. See Murchison's *Life* by A. Geikie, 1875. (A. GE.)

MURCIA, a maritime province of south-eastern Spain, is bounded on the E. and S. by Alicante and the Mediterranean, on the W. by Almeria and Granada, and on the N. by Albacete, and has an area of 4478 square miles. The total extent of coast is about 75 miles; from Cape Palos westwards to Villaricos Point (where Almeria begins) it is fringed by hills reaching their greatest elevation immediately to the east of Cartagena; northwards from Cape Palos to the Alicante boundary a low and sandy tongue of land encloses the shallow lagoon called Mar Menor. Eastward from the Mar Menor and northward from Cartagena stretches the plain known as El Campo de Cartagena, but the surface of the rest of the province is diversified by ranges of hills of which the general direction, connecting the mountains of Almeria and Granada with those of Alicante, is from south-west to north-east, and which reach their highest point (5150 feet) on the Sierra de España, between the Mula and Sangonera valleys. They belong to the Nevada system, and their geology will be best treated in connexion with that of Spain generally; they are rich in iron, copper, and argentiferous lead, and also yield large quantities of alum, sulphur, and saltpetre; and important mineral springs occur at Mula, Archena (hot sulphur), and Alhama (hot chalybeate).

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[1] The results of these researches were embodied in a massive quarto volume entitled *The Silurian System* (London, 1839).

The greater part of the province drains into the Mediterranean, chiefly by the Segura, which enters it in the northwest below Hellin in Albacete, and leaves it a little above Orihuela in Alicante; within the province it receives on the left the Arroyo del Jua, and on the right the Caravaca, Quipar, Mula, and Sangonera. The insignificant "arroyos" of Nogalte and Albujon fall directly into the Mediterranean and the Mar Menor respectively. The climate is hot and dry, and agriculture is largely dependent on irrigation, which, where practicable, has been carried on since the time of the Moors with great success. Besides the usual cereals (wheat, barley, maize), hemp, oil, and wine (the latter somewhat rough in quality) are produced; fruit, especially the orange, is abundant along the course of the Segura; mulberries for sericulture are extensively grown around the capital; and the number of bees kept throughout the province is exceptionally large. Esparto grass is gathered on the sandy tracts suited to its growth. The live stock consists chiefly of asses, mules, goats, and pigs, horses and sheep being relatively few. Apart from agriculture, the principal industry is that of mining, which has its centre near Cartagena; next comes the culture of the silkworm, the greater part of the crop being exported for manufacture in France. Large quantities of lead and esparto, as well as of zinc, iron, and copper ores and sulphur, are exported from Cartagena; from Águilas the chief exports are esparto and agricultural produce; the port of Mazarron has some trade in alum as well. The province is traversed by a railway line which connects Albacete with Cieza, Archena, Murcia, Orihuela, and Cartagena; the capital is also connected with Lorca and Alicante by good high roads. The communications otherwise are somewhat defective. The canal to connect Huescar in Granada with Cartagena remains only a project. The population of the province in 1877 was 451,611. Besides the cities of Murcia, Cartagena, and Lorca, the following towns in that year had a population exceeding 5000:—Abanilla, Águilas, Alhama, Bullas, Caravaca, Cehegin, Cieza, Fortuna, Fuente-Álamo, Jumilla, Mazarron, Molina, Moratalla, Mula, Torre-Pacheco, Totana, La Union, Yecla.

The province of Murcia was the first Spanish possession of the Carthaginians, by whom Nova Carthago was founded. The Romans included it in Hispania Tarraconensis. Under the Arabs the province was known as Todmír, which included, according to Edrisi, the cities Murcia, Orihuela, Cartagena, Lorca, Mula, and Chinchilla. The kingdom of Murcia, which came into independent existence after the fall of the Omayyads, included the present Albacete as well as Murcia. It became subject to the crown of Castile in the 13th century. Until 1883 the modern province also included Albacete.

Murcia, a city of Spain, capital of the above province, stands on the Segura, nearly in the centre of the beautiful and fertile valley known as the "huerta" or garden of Murcia, which is sheltered on the south by the eastward continuation of the Sierras Alcaraz and Segura, and on the north by the low hills of the Sierras de Molina. The main part of the town stands on the left bank of the river, and is connected with the suburb of San Benito on the right by a very fine stone bridge of two arches. The streets are mostly broad, straight, and well paved; the chief shops are in the narrow Calles de Plateria and Traperia, which are also a favourite resort with loungers, being shaded with awnings of canvas in hot weather. The chief square is the Plaza de la Constitucion, which is planted with orange and other trees; other promenades are the Paseos del Carmen and de Florida Blanca. Of public buildings the most prominent is the cathedral, a late Gothic (1388-1467) structure with a Corinthian façade in the taste of the 17th century; the tower is also composite, having been begun in 1521 and completed in 1766. Murcia has been the seat of the bishop of Cartagena since 1261; the present palace was erected in 1748-52. Near it are the colleges of San Fulgencio and San Isidoro. Other conspicuous public buildings are the hospital of San Juan de Dios, the silk and saltpetre factories, and the "alhondiga" or grain warehouse. The bull-ring is in San Benito. The manufactures of the town are not important; the chief articles of commerce are the silk grown on the huerta, fruit, and agricultural produce. The population in 1877 was 91,805.

Murcia has been identified by some with the Roman *Vergilia*. In the time of Edrisi it was the populous and strongly-fortified capital of the country of Todmír. It was taken in 1240 by Don Alfonso (afterwards King Alfonso el Sabio), who by his own request lies buried here. The town was plundered by General Sebastiani, and in 1810 and again in 1812 suffered from the attack of a detachment of Soult's army. In 1829 an earthquake caused considerable injury, especially to the cathedral.

MURDER, MANSLAUGHTER. In the law of England the unlawful killing of a human being is either murder or manslaughter according as it is or is not accompanied by circumstances constituting the element of malice aforethought. That, according to the old definition of Coke, is the criterion by which murder is distinguished from manslaughter.[1] In like manner Blackstone lays it down as a "general rule" that all homicide is in the eye of the law malicious, and therefore murder, unless it is either *justified* by the command or permission of the law, *excused* on account of accident or self-preservation, or *alleviated* into manslaughter by being the involuntary consequence of some act not strictly lawful, or occasioned by some sudden and sufficiently violent provocation. An exact account of these related offences can only be obtained by an examination of a vast number of judicial decisions, most of which are to be found in the ordinary text-books. (See, more particularly, Russell *On Crimes and Misdemeanours*.) The task of evolving exact definitions from this mass of material has been successfully undertaken by Mr Justice Stephen, and we cannot do better than present here the conclusions at which he has arrived. Art. 223 of his *Digest of the Criminal Law* is as follows:—"Manslaughter is unlawful homicide without malice aforethought. Murder is unlawful homicide with malice aforethought. Malice aforethought means any one or more of the following states of mind preceding or coexisting with the act or omission by which death is caused, and it may exist when that act is unpremeditated:—(*a*) an intention to cause the death of, or grievous bodily harm to, any person, whether such person is the person actually killed or not; (*b*) knowledge that the act which causes death will probably cause the death of, or grievous bodily harm to, some person, whether such person is the person actually killed or not, although such knowledge is accompanied by indifference whether death or grievous bodily harm is caused or not, or by a wish that it may not be caused; (*c*) an intent to commit any felony whatever; (*d*) an intent to oppose by force any officer of justice on his way to, on, or returning from the execution of the duty of arresting, keeping in custody, or imprisoning any person whom he is lawfully entitled to arrest, keep in custody, or imprison, or the duty of keeping the peace or dispersing an unlawful assembly, provided that the offender has notice that the person killed is such an officer so employed." The expression "officer of justice" in this clause includes every person who has a legal right to do any of the acts mentioned, whether he is an officer or a private person. Notice may be given either by word, by the production of a warrant or other legal authority, by the known official character of the person killed, or by the circumstances of the case. Art. 224 states that "homicide which would otherwise be murder is not murder but manslaughter if the act by which death is caused is done in the heat of passion, caused by provocation,” the acts amounting to which are enumerated. But provocation does not extenuate the offence “unless the person provoked is at the time when he does the act deprived of the power of self-control by the provocation which he has received, and in deciding the question whether this was or was not the case regard must be had to the nature of the act by which the offender caused death, to the time which elapsed between the provocation and the act which caused death, to the offender's conduct during that interval, and to all other circumstances tending to show the state of his mind.”

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[1] "When a person of sound memory and discretion unlawfully killeth any reasonable creature in being and under the king's peace with malice aforethought either express or implied" (Coke, 3 *Inst.*).

The law of the future is almost certainly to be found in the draft code presented by the Criminal Code Bill Commissioners of 1879, and founded on Mr Justice Stephen's *Digest* above cited. The enactment of this measure being a mere question of time some of its provisions may usefully be stated here.

After defining homicide and culpable homicide, the code (sect. 74) declares culpable homicide to be murder in the following cases:—(*a*) if the offender means to cause the death of the person killed; (*b*) if the offender means to cause to the person killed any bodily injury which is known to the offender to be likely to cause death, and if the offender, whether he does or does not mean to cause death, is reckless whether death ensues or not; (*c*) if the offender means to cause death or such bodily injury as aforesaid to one person, so that if that person be killed the offender would be guilty of murder, and by accident or mistake the offender kills another person though he does not mean to hurt the person killed; (*d*) if the offender for any unlawful object does an act which he knows or ought to have known to be likely to cause death, and thereby kills any person, though he may have desired that his object should be effected without hurting any one.

Further (sect. 75), it is murder (whether the offender means or not death to ensue, or knows or not that death is likely to ensue) in the following cases:—“(*a*) if he means to inflict grievous bodily injury for the purpose of facilitating the commission of any of the offences hereinafter mentioned, or the flight of the offender upon the commission or attempted commission thereof, and death ensues from his violence; (*b*) if he administers any stupefying thing for either of the purposes aforesaid and death ensues from the effects thereof; (*c*) if he by any means wilfully stops the breath of any person for either of the purposes aforesaid and death ensues from such stopping of the breath.” The following are the offences referred to:—“high treason and other offences against the queen's authority, piracy and offences deemed to be piracy, escape or rescue from prison or lawful custody, resisting lawful apprehension, murder, rape, forcible abduction, robbery, burglary, arson.” The code (sect. 76) reduces culpable homicide to manslaughter if the person who causes death does so “in the heat of passion caused by sudden provocation;” and “any *wrongful act or insult* of such a nature as to be sufficient to deprive any ordinary person of the power of self-control may be provocation if the offender acts upon it on the sudden, and before there has been time for his passion to cool.” Whether any particular wrongful act or insult amounts to provocation and whether the offender was deprived of self-control shall be questions of fact; but no one shall be deemed to give provocation by doing that which he had a legal right to do, or which the offender incited him to do in order to provide an excuse for killing him or doing grievous bodily harm. Further, “an arrest shall not necessarily reduce the offence from murder to manslaughter because an arrest was illegal, but if the illegality was known to the offender it may be evidence of provocation.” The “provocation” clause is not very happily expressed and will doubtless have to be recast.

America.—The most notable difference between England and the United States in regard to the law on this subject is the recognition by recent State legislation of degrees in murder. English law treats all unlawful killing not reducible to manslaughter as of the same degree of guilt. American statutes seek to discriminate between the graver and the less serious forms of the crime. Thus an Act of the legislature of Pennsylvania (22d April 1794) declares all murder which shall be perpetrated by means of poison or by lying in wait or by any other kind of wilful, deliberate, and premeditated killing, or which shall be committed in the perpetration of or attempt to perpetrate any arson, rape, robbery, or burglary shall be deemed murder of the first degree; and all other kinds of murder shall be deemed murder of the second degree. This statute, says Bishop (*Commentaries on the Criminal Law*, vol. ii. § 745), “is the parent of all the others.” In Michigan it has been enacted in exact words; and in most of the other States which have adopted this line of legislation the departure from the language of the Pennsylvania provision is not such as calls for the application of different principles of interpretation. It is pointed out by Bishop that the language used in these statutes to discriminate the degrees of murder is similar to that by which the common law distinction between murder and manslaughter is usually expressed. Thus in Massachusetts murder committed with “deliberately premeditated malice aforethought” is in the first degree. In Indiana the expression used is “purposely and of deliberate and premeditated malice.” The technical interpretation of “malice aforethought” in English law is of course inapplicable to these phrases. There are also statutory degrees of manslaughter in the legislation of some of the States, but Bishop observes that “the books do not contain sufficient adjudications to direct us into a profitable discussion of this subject.”

For some historical account of the law reference should be made to Mr Justice Stephen's *History of the Criminal Law of England* (London, 1883), vol. iii. c. 26. Stephen finds in the laws of Alfred the earliest and most important recognition of the properly criminal consequences of homicide as distinguished from the damages to be paid to the family of the deceased and the compensation to be made to the person whose peace had been broken, which are the prominent points of the early law of homicide. (E. R.)

MURDOCK, William (1754-1839), inventor, was born near the village of Auchinleck in Ayrshire on 25th August 1754. His father, John Murdoch (as the name is spelt in Scotland), was a millwright and miller, and William was brought up in the same occupation until 1777, when, at the age of twenty-three, he entered the employment of Boulton and Watts in the Soho Works at Birmingham. Shortly afterwards he was sent to Cornwall to superintend the fitting of Watts's engines, which had come to be in demand there. While staying at Redruth he had carried a series of experiments in the distillation of coal-gas so far that in 1792 he was able to apply the new invention to the purpose of lighting his cottage and offices; renewing his researches after his return to Birmingham (where he had become a partner in the firm), he made such progress in the discovery of practical methods for making, storing, and purifying the new illuminant that in 1802 the whole exterior of the factory was lighted with it in celebration of the peace of Amiens. Murdock was also the inventor of important improvements in the steam-engine; besides introducing the double D slide-valve, he was the first to devise an oscillating engine, and as early as 1784 he had constructed a model high-pressure engine to run on wheels. His inventive ingenuity was also directed to various applications of compressed air and of the exhausted air-tube; and in 1803 he also constructed a steam-gun. He retired from business in 1830, and died in 1839. His “Account of the Application of the Gas from Coal to Economical Purposes” appeared in the *Phil. Trans.* for 1808.

MURE, William (1799-1860), historian of Greek literature, was born at the family seat near Caldwell, Ayrshire, Scotland, 9th July 1799. He was educated at Westminster school and Edinburgh, and he spent several years at the university of Bonn, where he laid the foundations of his classical knowledge. From 1846 to 1855 he represented the county of Renfrew in parliament in the Conservative interest, and he was lord rector of Glasgow university in 1847-48. For many years he devoted his leisure to Greek studies, and in 1850-57 he published five volumes of a *Critical History of the Language and Literature of Ancient Greece*, which, however, he did not live to complete. While C. O. Müller's work, as translated and continued by Donaldson, is the best general history of Greek literature in English, Mure's treatment of the Homeric poems, of the lyric poets, and of the historians of the Attic period is the fullest in our language, and is everywhere marked by thorough knowledge, at first hand, of the Greek authors. Of the unity of the authorship of the *Iliad* and *Odyssey* he is a strenuous defender, attributing both to the one person, Homer. Colonel Mure was for many years commandant of the Renfrewshire militia. He died at London on 1st April 1860.

His other works are—*Remarks on the Chronology of the Egyptian Dynasties*, 1829; *Dissertation on the Calendar of the Zodiac of Ancient Egypt*, Edinburgh, 1832; *Journal of a Tour in Greece and the Ionian Islands in* 1838, Edinburgh, 1842. He also edited the *Caldwell Papers*, 3 vols., for the Maitland Club.

MURET, or **Muretus, Marc Antoine** (1526-1585), French humanist, was born of respectable parentage at Muret near Limoges on 12th April 1526. Nothing is recorded of his early education, but at the age of eighteen he was already sufficiently accomplished to attract the notice of the elder Scaliger, and to be invited to prelect upon Cicero and Terence in the archiepiscopal college at Auch. He afterwards taught Latin at Villeneuve, and then at Bordeaux, where the youthful Montaigne was one of his pupils and played some of the principal parts in his Latin tragedies. Some time before 1552 he received a regency in the college of Cardinal Lemoine at Paris, and his brilliant lectures were largely attended, Henry II. and his queen being occasionally, it is recorded, among his hearers. His success seems to have excited more than the usual amount of envy; and in consequence of a disgraceful charge—which, however, was never established—he was thrown into prison. Here he had begun to carry out a resolution to starve himself to death, when the exertions of powerful friends procured his release. Hardly had he resumed lecturing at Toulouse when his career was again cut short by a new charge similar to that which had proved so disastrous at Paris; he saved his life by timely flight, but the records of the town bear that he was burned in effigy as a Huguenot and as shamefully immoral (1554). After a wandering and insecure life of some years in Italy, he received and accepted the invitation of the Cardinal d'Este to settle in Rome in 1559. Henceforward his life was one of unclouded prosperity. He was even able to revisit France in 1561 as a member of the cardinal's suite at the colloquy of Poissy. The interest shown in his lectures on the *Ethics* of Aristotle, and on the *Pandects*, almost recalled his early successes in Paris, and in 1578 his services as a teacher of jurisprudence were sought by the "natio Germanorum" studying law at Padua, and also by the king of Poland for his new college at Cracow. Muretus, however, who about 1576 had taken holy orders, was induced by the liberality of the pope to remain in Rome, where he died on 4th June 1585.

The first collected edition of the works of Muretus appeared at Verona in 1727-1730 (5 vols. 8vo); a more complete edition was published by Ruhnken at Leyden in 1789 (4 vols. 8vo); there is also an edition by Frotscher and Koch (3 vols., Leipsic, 1834-41), and two volumes of *Scripta selecta* have been edited by Frey (Leipsic, 1871-73). He annotated wholly or partially, in a learned and scholarly way that has proved more or less serviceable to subsequent editors, Terence, Horace, Catullus, Tibullus, Propertius, Tacitus, Sallust, Cicero, Aristotle, Xenophon. His other works include *Juvenilia et poemata varia*, *Orationes*, and *Epistolæ*. His merits as a stylist at one time secured for his *Orationes* a place among Latin school-books, but, although, according to his pupil Montaigne, he was recognized alike by France and Italy to be "the best orator of his time," the modern judgment must rather be in substance that of a later critic, that, if he "appears to have had a more delicate ear than almost any of the moderns and his Latinity surpasses in elegance that of any of the Romans themselves, excepting Cicero and Cæsar," he at the same time was "conceited, fantastical, and weakly-minded" (Landor, *Im. Conv.*, "Chesterfield and Chatham").

MURGER, Henry (1822-1861), French man-of-letters, was born in February 1822 at Paris. His father was a *concierge*, with which employment he combined the trade of tailoring. At the age of fifteen Murger was sent into a lawyer's office, but the occupation was very uncongenial to him, and his father's trade still more so. He thus incurred the paternal displeasure, and in his devotion to literature and liberty began to meet with not a few of the hardships which he afterwards described. He was, however, for a time saved from actual want by the employment of secretary to the Russian Count Tolstoy, which was procured for him by M. de Jouy (an old academician of the classical faction, but a very kind friend to youthful literary aspirants) in the year 1838. For the next ten years little positive is known of Murger's life except that it probably provided the experiences, and certainly supplied him with the ideas, of his most famous book. He made his first independent appearance as an author in 1843 with a book entitled *Via Dolorosa*, but it made no mark. He also tried journalism, and the paper *Le Castor*, which figures in the *Vie de Bohême*, and which combined devotion to the interests of the hat trade with recondite philosophy and elegant literature, is said to have been a fact, though a shortlived one. At length he was introduced to better work, either in the *Corsaire*, then a favourite organ of the second romantic generation, or in the *Artiste*; for both stories are told. In 1848 appeared the collected sketches called the *Vie de Bohême*. This book, which is of its kind famous, describes the fortunes and misfortunes, the loves, studies, amusements, and sufferings, of a group of impecunious students, artists, and men of letters, of whom Rodolphe represents Murger himself, while the others have been more or less positively identified. Murger, in fact, belonged to a set or clique of so-called Bohemians, the most remarkable of whom, besides himself, were Privat d'Anglemont and Champfleury. The *Scènes de la Vie de Bohême* have been very variously judged. Their very easy-going morality, and the supposed danger of their pictures in prompting to imitation have prejudiced some readers against the book. It is fair, however, to Murger to say that he neither holds up the Bohemian as a hero, nor in the least disguises the hardship and the folly of his ways. He was himself an instance of the dangers of Bohemianism. From the date above mentioned it was perfectly easy for him to make a comfortable living by journalism and general literature. He was introduced in 1851 to the *Revue des Deux Mondes*, and contributed to it for two or three years, and he never had any difficulty in securing or keeping literary employment. But he was a slow, a fastidious, and a very capricious worker, and his years of hardship and dissipation had very seriously impaired his health. He continued, however, to produce work pretty regularly, publishing *Claude et Marianne* in 1851, *Le Dernier Rendezvous* and *Le Pays Latin* in 1852, *Adeline Protat* (one of the most graceful and innocent if not the most original of his tales) in 1853, and *Les Buveurs d'Eau* in 1854. This last, the most powerful of his books next to the *Vie de Bohême*, exhibits a reverse side to the picture by tracing the fate of certain artists and students who, exaggerating their own powers and foolishly disdaining merely profitable work, come to an evil end not less rapidly if more respectably than by dissipation. Some years before his death, which took place in a *maison de santé* near Paris on 28th January 1861, Murger went to live at Marlotte, near Fontainebleau, and it was there that he wrote, and in 1859 published, an unequal book entitled *Le Sabot Rouge*, in which the character of the French peasant is very uncomplimentarily treated.' Besides the books already mentioned, Murger's published works fill several volumes of prose and one of verse. The poems contained in the latter (*Les Nuits d'Hiver*) are not very strong, but graceful and frequently pathetic. The prose volumes, with the exception of a novel of some scale, *Les Roueries de l'Ingénue* (which the author left unfinished at his death), consist almost exclusively of short tales in the manner, and more or less on the subject, of the *Vie de Bohême*. All exhibit the same characteristics—an excellent descriptive faculty, lively humour in drawing the follies of youth, frequently pathos, and not seldom a tender and poetical melancholy.

MURILLO, Bartolomé Esteban (1617-1682), the greatest ecclesiastical painter of Spain, was the son of Gaspar Esteban Murillo and Maria Perez, and was born at Seville in 1617, probably at the very end of the year, as he was baptized on 1st January 1618. Esteban-Murillo appears to have been the compound surname of the father, but some inquirers consider that, in accordance with a frequent Andalusian custom, the painter assumed the surname of his maternal grandmother, Elvira Murillo, in addition to that of his father. His parents (of whom nothing distinct is known, save that they were of a humble class), having been struck with the precocious sketches with which the unlettered boy was accustomed to adorn whatever available surface came in his way, wisely resolved to place him under the care of their distant relative, Juan del Castillo, the painter. Juan, a correct draughtsman and dry colourist, taught him all the mechanical parts of his profession with extreme care, and Murillo proved himself an apt and docile pupil. The artistic appliances of his master's studio were by no means abundant, and were often of the simplest kind. A few casts, some stray fragments of sculpture, and a lay figure formed the principal aids available in those days for the Sevillian student of art. A living model was a luxury generally beyond the means of the school, but on great occasions the youths would strip in turn and proffer an arm or a leg to be studied by their fellows. Objects of still life, however, were much studied by Murillo, and he early learned to hit off the ragged urchins of Seville pursuing their adventures in the market-place. Murillo in a few years painted as well as his master, and as stiffly. His two pictures of the Virgin, executed during this period, show how thoroughly he had mastered the style, with all its defects. Castillo was a very kind man, but his removal to Cadiz in 1639-40 threw his favourite pupil entirely upon his own resources. The fine school of Zurbaran was too expensive for the poor lad; his parents were either dead or too poor to help him, and he was compelled to earn his bread by painting rough pictures for the "feria" or public fair of Seville. The religious daubs exposed at that mart were generally of as low an order as the prices paid for them by their rude purchasers. A "pintura de la feria" (a picture for the fair) was a proverbial expression for an execrably bad one; yet the street painters who thronged the market-place with their "clumsy saints and unripe Madonnas" not unfrequently rose to be able and even famous artists. This rough-and-ready practice, partly for the market-place, partly for converts in Mexico and Peru, for whom Madonnas and popular saints were produced and shipped off by the dozen, doubtless increased Murillo's manual dexterity; but, if we may judge from the picture of the Virgin and Child still shown in the Murillo-room at Seville as belonging to this period, he made but little improvement in colouring or in general strength of design. Struck by the favourable change which travel had wrought upon the style of his brother artist Pedro de Moya, Murillo in 1642 resolved to make a journey to Flanders or Italy in quest of further insight into art. But how was he, already struggling for existence and with a poor sister dependent on him, to raise the means necessary for such an expedition? Having bought a large quantity of canvas, he cut it into squares of different sizes, which he converted into pictures of a kind likely to sell. The American traders at once bought up his pieces, and he now found himself sufficiently rich to carry out his much-cherished design. He placed his sister under the care of some friends, and without divulging his plans to any one set out for Madrid. On reaching the capital he waited on Velazquez, his fellow-townsman, the great court-painter, then at the summit of his fortune, and, communicating to him his simple story, asked for some introduction to friends in Rome. The master liked what he saw of the manly youth, and in the noblest manner offered him lodging in his own house, and proposed to procure him admission to the royal galleries of the capital. Murillo accepted the offer, and here enjoyed the masterpieces of Italy and Flanders without travelling beyond the walls of Madrid. The next two years were chiefly spent in copying from Ribera, Vandyck, and Velazquez; and in 1644 he so greatly astonished the latter with some of his efforts that they were submitted to the inspection of the king and the court. His patron now urged him to go to Rome, and offered him letters to smooth his way; but Murillo, from whatever cause, preferred returning to his sister and his native Seville.

The friars of the convent of San Francisco in Seville had about this time piously determined to adorn the walls of their small cloister in a manner worthy of their patron saint. But the brotherhood had no money; and after endless begging they still found themselves incapable of employing an artist of name to execute the task. Murillo was needy, and offered his services; after balancing their own poverty against his obscurity the friars bade him begin. Murillo covered the walls with eleven large pictures of remarkable power and beauty,—displaying by turns the strong colouring of Ribera, the life-like truthfulness of Velazquez, and the sweetness of Vandyck. Among them were to be found representations of San Francisco, of San Diego, of Santa Clara, and of San Gil. These pictures were executed in his earliest style, commonly called his *frio* or cold style. It was based chiefly on Ribera and Caravaggio, and was dark with a decided outline. This rich collection is no longer to be met with in Seville; Marshal Soult carried off ten of the works. The fame of these striking productions soon got abroad, and "El Claustro Chico" swarmed daily with artists and critics. Murillo was no longer friendless and unknown. The rich and the noble of Seville overwhelmed him with their commissions and their praises.

In 1648 Murillo married a wealthy lady of rank, Doña Beatriz de Cabrera y Sotomayor, of the neighbourhood of Seville, and his house soon became the favourite resort of artists and connoisseurs. About this time he was associated with the landscape-painter Yriarte—the two artists interchanging figures and landscapes for their respective works; but they did not finally agree, and the co-operation came to an end. Murillo now painted the well-known Flight into Egypt, and shortly afterwards changed his earliest style of painting for his *calido* or warm style. His drawing was still well defined, but his outlines became softer and his figures rounder, and his colouring gained in warmth and transparency. His first picture of this style, according to Cean Bermudez, was a representation of Our Lady of the Conception, and was painted in 1652 for the brotherhood of the True Cross; he received for it 2500 reals (£26). In 1655 he executed his two famous paintings of San Leandro and San Isidoro at the order of Don Juan Federigo, archdeacon of Carmona, which are now to be seen in the cathedral of Seville. These are two noble portraits, finished with great care and admirable effect, but the critics complain of the figures being rather short. His next picture, the Nativity of the Virgin, painted for the chapter, is regarded as one of the most delightful specimens of his *calido* style. In the following year (1656) the same body gave him an order for a vast picture of San Antonio de Padua, for which he received 10,000 reals (£104). This is one of his most celebrated performances, and still hangs in the baptistery of the cathedral. It was "repaired" in 1833; the grandeur of the design, however, and the singular richness of the colouring may still be traced. The same year saw him engaged on four large pictures of a semicircular form, designed by his fast friend and patron Don Justino Neve y Yevenes, to adorn the walls of the church of Santa Maria la Blanca. The first two were meant to illustrate the history of the festival of Our Lady of the Snow, or the foundation of the Roman basilica of Santa Maria Maggiore. The one represents the wealthy but childless Roman senator and his lady asleep and dreaming; the other exhibits the devout pair relating their dream to Pope Liberius. Of these two noble paintings the Dream is the finer, and in it is to be noticed the commencement of Murillo's third and last style, known as the *vaporoso* or vapoury. It should be noted, however, that the three styles are not strictly separable into date-periods; for the painter alternated the styles according to his subject-matter or the mood of his inspiration, the *calido* being the most frequent. In the *vaporoso* method the well-marked outlines and careful drawing of his former styles disappear, the outlines are lost in the misty blending of the light and shade, and the general finish betrays more haste than was usual with Murillo. After many changes of fortune, these two pictures now hang in the Academy of San Fernando at Madrid. The remaining pieces executed for this small church were a Virgin of the Conception and a figure of Faith. Soult laid his hands on these also, and they have not been recovered.

In 1658 Murillo undertook and consummated a task which had hitherto baffled all the artists of Spain, and even royalty itself. This was the establishing of a public academy of art. By superior tact and good temper he overcame the vanity of Valdes Leal and the presumption of the younger Herrera, and secured their co-operation. The Academy of Seville was accordingly opened for the first time in January 1660, and Murillo and the second Herrera were chosen presidents. The former continued to direct it during the following year; but the calls of his studio induced him to leave it, now flourishing and prosperous, in other hands.

Passing over some half-length pictures of saints and a dark-haired Madonna, painted in 1668 for the chapter-room of the cathedral of his native city, we enter upon the most splendid period of Murillo's career. In 1661 Don Miguel Mañara Vicentelo de Leca, who had recently turned to a life of sanctity from one of the wildest profligacy, resolved to raise money for the restoration of the dilapidated Hospital de la Caridad, of whose pious guild he was himself a member. Mañara commissioned his friend Murillo to paint eleven pictures for this edifice of San Jorge. Three of these pieces represented the Annunciation of the Blessed Virgin, the Infant Saviour, and the Infant St John. The remaining eight are considered Murillo's masterpieces. They consist of Moses striking the Rock, the Return of the Prodigal, Abraham receiving the Three Angels, the Charity of San Juan de Dios, the Miracle of the Loaves and Fishes, Our Lord healing the Paralytic, St Peter released from Prison by the Angel, and St Elizabeth of Hungary. These works occupied the artist four years, and in 1674 he received for his eight great pictures 78,115 reals or about £800. The Moses, the Loaves and Fishes, and the San Juan are still to be found at Seville; but the French carried off the rest. On these pictures Murillo evidently expended all his strength, and he has left in them an enduring monument of his genius. For compass and vigour the Moses stands first; but the Prodigal's Return and the St Elizabeth were considered by Bermudez the most perfect of all as works of art. The front of this famous hospital was also indebted to the genius of Murillo; five large designs in blue glazed tiles were executed from his drawings. He had scarcely completed the undertakings for this edifice when his favourite Franciscans again solicited the aid of his pencil. He accordingly executed some twenty paintings for the humble little church known as the Convent de los Capucinos. Seventeen of these Capuchin pictures are still preserved in the Museum of Seville. Of these the Charity of St Thomas of Villanueva is reckoned the best. Murillo himself was wont to call it "su lienzo" (his own picture). Another little piece of extraordinary merit, which once hung in this church, is the Virgin of the Napkin, believed to have been painted on a "servilleta" and presented to the cook of the Capuchin brotherhood as a memorial of the artist's pencil.

In 1670 Murillo is said to have declined an invitation to court, preferring to labour among the brown coats of Seville. Eight years afterwards his friend the canon Justino again employed him to paint three pieces for the Hospital de los Venerables: the Mystery of the Immaculate Conception, St Peter Weeping, and the Blessed Virgin. As a mark of esteem, Murillo next painted a full-length portrait of the canon, in which all the artist's skill is visible. The sleek spaniel reposing at the feet of the priest has been known before now to call forth a snarl from a living dog as he approached it. His portraits generally, though few, are of great beauty. Towards the close of his life Murillo executed a series of pictures illustrative of the life of "the glorious doctor" for the Augustinian convent at Seville. This brings us to the last work of the artist. Mounting a scaffolding one day at Cadiz (whither he had gone in 1681) to execute the higher parts of a large picture of the Espousal of St Catherine, on which he was engaged for the Capuchins of that town, he stumbled, and fell so violently that he received a hurt from which he never recovered. The great picture was left unfinished, and the artist returned to his beloved Seville only to die. He died as he had lived, a humble, pious, brave man, on the 3d of April 1682 in the arms of the chevalier Pedro Nuñez de Villavicencio, an intimate friend and one of his best pupils. Another of his numerous pupils was Sebastian Gomez, named "Murillo's Mulatto." Murillo left behind him two sons (one of them at first an indifferent painter, afterwards a priest) and a daughter,—his wife having died before him. His body was laid in the church of Santa Cruz, which he had greatly frequented during his last illness; and by his own desire it was covered with a stone slab bearing his name, a skeleton, and the words "*Vive moriturus.*" Soult sacked this church, and nothing is to be seen of it now but a heap of rubbish.

Murillo has always been one of the most popular of painters—not in Spain alone. His works show great technical attainment without much style, and a strong feeling for ordinary nature and for truthful or sentimental expression without lofty beauty or ideal elevation. His ecstasies of Madonnas and Saints, the themes of some of his most celebrated achievements, neither raise the mind nor seize upon the imagination; but they stimulate sluggish perceptions and lukewarm devoteeism, and are accepted as ravishingly pious by mobs of the fashionable and the unfashionable. Take as an example the Immaculate Conception (or Assumption of the Virgin, for the titles may, with reference to Murillo's treatments of this subject, almost be interchanged) in the Louvre, a picture for which, on its sale from the Soult collection, perhaps the largest price on record was given in 1852, some £24,600. His subjects may be broadly divided into two great groups—the scenes from low life (which were a new kind of experiment in Spanish art, so far as the subjects of children are concerned), and the Scriptural, legendary, and religious works. The former, of which some salient specimens are in the Dulwich Gallery, are, although undoubtedly truthful, neither ingenious nor sympathetic; sordid unsightliness and roguish squalor are their foundation. The children have little of the charm of childhood, and none of its auroral promise. The embodiments are accurate and knowing studies of ungainliness. Works of this class belong mostly to the earlier years of Murillo's practice. The subjects in which the painter most eminently excels are crowded compositions in which some act of saintliness, involving the ascetic or self-mortifying element, is being performed,—subjects which, while obtrusively repulsive in some of their details, emphasize at once the broadly human and the expressly Catholic conceptions of life. A famous example is the picture, now in the Madrid academy, of St Elizabeth of Hungary washing patients afflicted with the scab or itch, and hence commonly named El Tiñoso. Technically considered, it unites his three styles of painting, more especially the cold and the warm. His power of giving atmosphere to combined groups of figures is one of the marked characteristics of Murillo's art; and he may be said to have excelled in this respect all his predecessors or contemporaries of whatever school.

Seville must still be visited by persons who wish to study Murillo thoroughly, and to relish the full and native flavour of his art. A large number of the works which used to adorn this city have, however, been transported elsewhither. In the Royal Gallery at Madrid are forty-five specimens of Murillo—the Infant Christ and the Baptist (named Los Niños della Concha), St Ildefonso vested with a Chasuble by the Madonna, &c.; in the Museo della Trinidad, Christ and the Virgin appearing to St Francis in a Cavern, an immense composition, and various others. In the London National Gallery the chief example is the Holy Family; this was one of the master's latest works, painted in Cadiz. Murillo, who was the last pre-eminent painter of Seville, was an indefatigable and most prolific worker, hardly leaving his painting-room save for his assiduous devotions in church; he realized large prices according to the standard of his time, and made a great fortune. His character is recorded as very amiable and soft, yet not the less independent, subject also to sudden impulses, not unmixed with gusts of passion.

For further information see, especially, Stirling, *Annals of the Artists of Spain*, 3 vols., London, 1848; Richard Ford, *Handbook for Spain*, London, 1855; and Curtis, *Catalogue of the Works of Velasquez and Murillo* (1883). (W. M. R.)

MUROM, a district town of Russia in the province of Vladimir, on the craggy left bank of the Oka close by its junction with the Tesha, 107 miles by rail south-east of Vladimir. Murom is the chief entrepôt for grain from the basin of the lower Oka and carries on an active trade with Moscow and Nijni-Novgorod, partly by the Oka, partly by rail, a branch line to Kovroff connecting it with the railway between the towns just mentioned. Murom is still famed, as in ancient times, for kitchen-gardens, raising especially cucumbers and seed for canary-birds. Its once famous tanneries have lost their importance, but the manufacture of linen has greatly increased; it has also steam flour-mills, distilleries, manufactories of soap, &c., and of iron implements. There are also several distilleries in the district. The population is 11,000.

MURPHY, Arthur (1727-1805), dramatist, was the son of a Dublin merchant, and was born near Elphin in Roscommon in 1727. From 1740 to 1747 he was a student at St Omer (France). He then entered the counting-house of his uncle, a merchant at Cork. But four years afterwards he was in London, prosecuting literature as a profession and publishing *The Gray's Inn Journal*, a periodical in the style of *The Spectator*. The drama was also occupying his attention. He produced the farce of *The Apprentice*, and appeared as an actor in the character of Othello. His dramas were more successful than his acting. After treading the stages of Covent Garden and Drury Lane for one season each, he abandoned the profession. His next undertaking was the editing of a political periodical called *The Test*. In this, too, he was unsuccessful. He next turned his attention to the study of law, and was called to the bar by the Society of Lincoln's Inn in 1757. But the smallness of his practice forced him to have recourse to his former vocation of writing for the stage. Among his many popular dramas, *The Upholsterer*, in 1758; *The Way to Keep Him*, in 1760; *All in The Wrong*, in 1761; *The Grecian Daughter*, in 1772; and *Know Your Own Mind*, in 1777, were very successful, and secured for their author both fame and wealth. Murphy is also notable as the first biographer of Fielding, and amidst the miscellaneous literary work of his later years he produced an "essay on the life and genius" of Johnson and translations of Sallust and Tacitus. Towards the close of his life the office of a commissioner of bankrupts, and a pension of £200, were conferred upon him by Government. He died in June 1805.

MURPHY, Robert (1806-1843), mathematician, was the son of a poor shoemaker, and was born at Mallow in Ireland in 1806. At the age of thirteen, while working as an apprentice in his father's shop, he became known to certain gentlemen in the neighbourhood as a self-taught mathematician of wonderful precocity. Through their exertions, after attending a classical school in his native town, he was admitted to Caius College, Cambridge, in 1825. Third wrangler in 1829, he was elected in the same year a fellow of his college. But the temptations of prosperity were too strong for him. A course of extravagant dissipation soon led him into debt; his fellowship was sequestered for the behoof of his creditors, and he was obliged to leave Cambridge in December 1832. After living for some time with his relations in Ireland, he repaired to London in 1836, a penniless literary adventurer. He had already contributed several mathematical papers to the *Cambridge Philosophical Transactions*, and had published *Elementary principles of the theories of Electricity*, &c., Camb., 1833. His pen was now employed in writing for the "Library of Useful Knowledge" a *Treatise on the Theory of Algebraical Equations* (Lond., 1839). He was labouring diligently to throw off the load of debt that still pressed heavily upon him when a disease of the lungs cut short his career in March 1843.

Murphy's mathematical writings are remarkable for elegance and ingenuity, and parts of his work on the theory of equations and on the mathematical theory of electricity still retain their importance.

MURRAIN, a term usually restricted to extensive outbreaks of disease in cattle, but also applied to serious disorders among sheep and pigs, is taken in this article to cover general or infectious disorders of all the domesticated animals, and as synonymous with plague or epizooty.

It is now an established fact that murrains are all infectious, *i.e.*, capable of transmission from diseased to healthy creatures of the same, or perhaps of many different species, the manner and degree of infectiousness varying somewhat in some of the disorders. It is also an established fact that several of them—and presumably all—owe their existence and spread to a micro-organism or germ, vegetable or animal in its nature, which, obtaining access to a healthy body disposed to its reception, grows and multiplies rapidly there, and produces characteristic morbid symptoms and alterations in tissues and organs. On the presence and dissemination of this germ or virulent agent these diseases depend for their continuance and extension; and this knowledge furnishes us with the indications for the sanitary measures required to limit their spread, or to effect their extermination.

In previous ages the great outbreaks of murrains only occurred at comparatively rare intervals, in regions more or less remote from those to which they were native; and then they generally owed their diffusion to the events of war, which sometimes carried them far beyond their ordinary boundaries. In modern times their extension has been greatly facilitated by the vastly improved means of communication. The movement of large numbers of animals through the channels of commerce and their rapid transport from one country to another, their concentration in markets, their incessant renewal, the mixing of native with foreign animals, a general indifference to the existence of contagious diseases and the losses they might inflict, the absence of anything like an organization to control and regulate this movement, carry out sanitary regulations, and investigate and suppress these murrains—all these have operated in rendering some of the most harassing and destructive scourges more or less cosmopolitan, spreading them from a very limited area in the middle of a continent to every quarter of the globe, where they flourish as vigorously and persistently as if indigenous to the soil.

The best-known murrains are discussed below

1. *Anthrax.*—This is one of the most diffused and interesting of murrains, affecting, as it does, wild as well as domesticated animals. It prevails, in one or more of its forms, over the entire surface of the globe. It at times decimates the reindeer herds in Lapland and the Polar regions, and is only too well known in the tropics and in temperate latitudes. It has been observed and described in Russia, Siberia, Central Asia, China, Cochin China, Egypt, West Indies, Peru, Paraguay, Brazil, Mexico, and other parts of North and South America, in Australia, and on different parts of the African continent, while for other European countries the writings which have been published with regard to its nature, its peculiar characteristics, and the injury it inflicts are innumerable. Countries in which are extensive marshes, or the subsoil of which is tenacious or impermeable, are usually those most frequently and seriously visited. Thus there are regions notorious for the prevalence of this murrain, such as the marshes of Sologne, Dombes, and Bresse in France; certain parts of Germany, Hungary, and Poland; in Spain it is severely felt in the half-submerged valleys and the maritime coasts of Catalonia, as well as in the Romagna and other marshy districts of Italy; while it is epizootic, and even panzootic, in the swampy regions of Esthonia, Livonia, Courland, and especially of Siberia, where it is known as the *Sibirskaja jaswa* (Siberian boil-plague), and where it sometimes happens that, in order to suppress its ravages, battalions of soldiers must be sent to bury or burn the carcases of infected animals which float in the canals or lie in the swamps, rendering the air and the water pestilent. The records of the anthrax go back to a very ancient date. It is supposed to be the murrain of Exodus. Classical writers allude to the anthrax as if it were the only cattle disease worthy of mention (see Virgil, *Georg.*, iii.). It figures largely in the histories of the Early and Middle Ages as a devastating pestilence among animals, and through them to mankind; and our oldest Anglo-Saxon manuscripts contain many fantastic recipes, leechdoms, charms, and incantations for the prevention or cure of the "blacan blezene" (black blain) and the relief of the "elf-shot" creatures. From these up to our own times it has attracted more and more attention, as even in the last and this century it has sometimes spread in an epizootic manner over the whole of Europe, from Siberia to France. It was in this malady that the presence of disease-producing germs (*bacilli*) was first discovered by Pollender and veterinary surgeon Brauell of Dorpat, and their real character afterwards verified by Davaine; and it has been in their experiments with this disease that Chauveau, Toussaint, and Pasteur have shown how to make the morbific poison its own antidote.

Symptoms.—These vary according as the disease runs its course as a general or localised affection. While death is usually rapid or sudden when the malady is general, constituting what is designated splenic apoplexy or anthrax fever, in the local form, marked by the formation of carbuncles before general infection occurs, it is more protracted. In the apoplectic form there is apparently no local manifestation, and dissolution may take place so quickly (in a few minutes) that there is no time to afford relief. One or more of the best-conditioned and perhaps robust animals in a herd or flock, which until then exhibited no sign of the disease, are suddenly struck down as if shot while grazing, feeding in the stable, or travelling, and rise no more. Or they commence all at once to tremble and stagger; the breathing becomes hurried and the pulse very rapid, while the heart beats violently; the internal temperature of the body is high; blood flows from the nose, mouth, and anus; the visible mucous membranes are almost black in tint; and death soon supervenes, being immediately preceded by delirium, convulsions, or coma. In some cases the animal rallies from a first attack, but soon a second ensues, to which it speedily succumbs, the creature in the interval remaining drowsy and showing muscular tremors. In the carbuncular form the tumours may appear in any part of the body, being preceded or accompanied by fever. When the tongue is affected, the disease is usually known as blain of the tongue, tongue evil, or glossanthrax.

The tumours or malignant pustules are developed in the subcutaneous connective tissue, where this is loose and plentiful, in the interstices of the muscles, and in the lymphatic glands. In the various animals affected they have their special affinities for certain regions, as between the branches of the lower jaw, upper part of the throat, lower portion of the neck, breast, behind the shoulders, back, flank, substance of the tongue, &c. If the part where an anthrax tumour is about to appear is covered with hair, this will be observed to become erect, and if the hand is passed over the part perhaps a slight crepitation will be felt; there is also increased sensibility. In many cases there soon appears a nodosity, simple or multiple, about the size of a small nut and circular or irregular in outline. Ordinarily this is little sensitive in itself, the pain the animal experiences being due to the increased sensibility of the surrounding parts. In other instances the tumour suddenly commences in the appearance of a soft œdematous swelling, crepitating and undefined. When the eruption takes this form the tumours are quickly developed, and in a few hours invade all the neighbouring parts, extending in every direction with equal rapidity,—the skin covering them becoming tense and hard like parchment, and crackling on pressure. As they extend they become cold and insensible, a variable number of phlyctænæ arise on their surface, and these quickly bursting give issue to a serous irritant fluid. If an incision is made in the swelling at this stage there is no symptom of pain, and a black or reddish serum escapes, extremely fœtid and corrosive, which produces a noise as it flows like the crackling of paper or the bubbling of boiling water. Sometimes passive hæmorrhage ensues after the incision is made, and continues until death.

In whatever form the tumours are developed, their course is always the same, being more rapid the earlier they appear. In from two to eight hours they attain a considerable size, and the tissues mortify as they are invaded. As they are developed the animal seems to become relieved, the fever abates, and the more urgent symptoms vanish. But, when they have attained certain proportions, general symptoms are manifested, and these vary according as the malady is to terminate favourably or otherwise. In some rare instances the matter which constitutes the tumours is suddenly absorbed, abundant sweats, an increased flow of urine, or a serous fœtid diarrhœa ensue, and the animal promptly recovers. In other cases, by surgical intervention, the evolution of the tumours is limited to a certain extent; they reach the suppurative stage, and finally disappear. In ordinary circumstances, however, it happens that after the interval which follows the eruption, the organism being incapable of eliminating the morbid element, the tumours vanish; but this is only a transference, for the disease assumes all the grave characters of anthrax fever without local manifestations, the general symptoms reappear, and, running their course with marvellous rapidity, the animal perishes in a few hours.

A form of anthrax affects the horse more especially, and this by some authors has been designated anthrax typhus. It manifests itself locally and generally, and is very fatal (Fleming, *Veterinary Sanitary Science and Police*, vol. ii. p. 123).

In cattle there is a disease very fatal among young stock, and known to breeders and graziers by various names, the most common of which is "black quarter," which had always been classed among the forms of anthrax until its nature was investigated by Arloing and Cornuvin, who have termed it symptomatic anthrax (*Charbon symptomatique*), while by others it has been named anthracoid erysipelas, &c. This is at first a local disease, affecting usually one hind quarter, and occurring among young animals more especially, particularly those fed on rich food and thriving rapidly. It also occurs very suddenly, runs its course in a very brief space, and nearly always terminates fatally unless surgical and medical treatment is promptly resorted to. It is caused also by a bacillus or bacterium somewhat different from that of ordinary anthrax.

In splenic fever or splenic apoplexy, the most marked alterations observed after death are—the effects of rapid decomposition, evidenced by the foul odour, disengagement of gas beneath the skin and in the tissues and cavities of the body, yellow or yellowish-red gelatinous exudation into and between the muscles, effusion of citron- or rust-coloured fluid in various cavities, extravasations of blood and local congestions throughout the body, the blood in the vessels generally being very dark and tar-like. The most notable feature, however, in the majority of cases is the enormous enlargement of the spleen, which is engorged with blood to such an extent that it often ruptures, while its tissue is changed into a violet or black fluid mass.

Inoculation.—Anthrax in all its forms is an inoculable disease, transmission being surely and promptly effected by this means, and it may be conveyed to nearly all animals either by inoculation or through the digestive organs. The abraded skin is often the channel for the introduction of the bacilli; and persons who handle diseased animals or their products—as flesh, skin, wool, or hair—often die from anthrax, which presents similar symptoms in mankind to those it exhibits in animals. The bacillus of anthrax, under certain conditions, retains its vitality for a long time, and rapidly grows when it finds a suitable fluid in which to develop, its mode of multiplication being by scission and the formation of spores, and depending, to a great extent at least, on the presence of oxygen. The morbid action of the bacillus is indeed said to be due to its affinity for oxygen; by depriving the red corpuscles of the blood of that most essential gas, it renders the vital fluid unfit to sustain life. Others assert that the fatal lesions are produced by the enormous number of bacilli blocking up the minute blood-vessels, especially of the lungs, and thus inducing asphyxia.

It was by the cultivation of this micro-organism, or attenuation of the virus, that Pasteur has been enabled to produce a prophylactic remedy for anthrax, which has already been demonstrated to be very effective; and his discovery is likely to lead to most important results in procuring protective agents for other similar and fatal disorders in man and beast. Though his discovery was first made with regard to the cholera of fowls, a most destructive disorder which annually carries off great numbers of poultry, yet as applied to anthrax it has attracted most attention. This so-called attenuation or cultivation of the virus of the disease by Pasteur is effected by growing the bacillus in an albuminous fluid, the preference being given to chicken-broth which has been previously sterilised by being raised to a temperature of 115° C. This broth is inoculated with a drop of anthrax blood which has been taken with antiseptic precautions from an animal about to die of the disease; it is kept in pure air at a temperature of 42° to 43° C.; at 45° the process of cultivation will not go on. After a certain time another quantity of broth is inoculated with a drop of the first, and kept under the same conditions; and so this cultivation is carried on until a sufficient number of generations of the bacilli have been grown and the required degree of attenuation ensured. This is attained by attention to the temperature, allowing a certain interval to elapse between each inoculation of the broth and the number of generations cultivated. The resulting "vaccine," as it has been improperly designated, when inoculated into the body of an animal liable to anthrax, confers immunity from the disease, if certain rules are attended to.

Toussaint had, previous to Pasteur, attenuated the virus of anthrax by the action of heat; and Chauveau has more recently corroborated by numerous experiments the value of Toussaint's method, demonstrating that, according to the degree of heat to which the virus is subjected, so its innocuousness when transferred to a healthy creature. The attenuation of heat, according to this method, is a safer and readier way to obtain a protective virus than Pasteur's broth cultivations.

2. *Cattle-Plague or Rinderpest.*—The next disease is that which has, since the commencement of the last century, been generally described as "the murrain," but which is now better known as the "cattle-plague" or "rinderpest" (German). While anthrax is, with regard to species of animals attacked, the most universal of all diseases, being transmissible to nearly every living creature, including mankind, cattle-plague is limited to ruminants (oxen, sheep, goats, camels, buffaloes, yaks, deer, &c.). It is an Asiatic malady, and prevails frequently and with great severity in southern Russia (imported), Central Asia, Mongolia, China (south, west, and north), Cochin China, Burmah, Hindustan, Persia, Ceylon, and the islands in the Indian and Malay Archipelagos. It is only known in Europe as an exotic and imported malady, it has not yet appeared on the American continent, in Australia, in New Zealand, or on the African continent, except in Egypt, into which it has been carried on several occasions, and where, owing to the absence of sanitary measures, it now prevails constantly. It is one of the most infectious and fatal diseases of animals—a specific fever which runs its course so rapidly, and attacks such a large percentage of ruminants when it is introduced into a country, that from the earliest times it has excited terror and dismay.

It has been noted that its irruptions into Europe in the earlier centuries of our era always coincided with invasions of barbarous tribes in the east of Europe; and even at a later period the disease accompanied the events of war, when troops with their commissariat moved from the east towards the west, or cattle, when they were carried in the same direction. One of the earliest recorded irruptions of cattle-plague into western Europe occurred in the 5th century after the sanguinary invasion of the Huns under Attila, the expulsion of the Goths from Hungary, and the fierce internecine wars of the whole Germanic population. The disease appears then to have been carried from Hungary through Austria to Dalmatia, while by Brabant it obtained access to the Low Countries, Picardy, and so on to the other provinces of France. In the curious poem *De Mortibus Bovum* written by St Severus, who lived at that period, the course and destructiveness of the disease are specially alluded to. Many invasions of Europe are described, and in several of these Britain was visited by it—as in 809-810, 986-987, 1223-1225, 1513-1514, and notably in 1713, 1745, 1774, 1799. In 1865 and 1872 it was imported direct from Russia.

Symptoms.—Like some other general diseases, this does not offer any exclusive or pathognomonic symptoms, but is rather characterized by a group of functional and anatomical alterations. An exact knowledge of its symptoms and necroscopical appearances is of the utmost importance, as its extension and consequent ravages can only be arrested through its timely recognition and the immediate adoption of the necessary sanitary measures. Intense fever, diarrhœa or dysentery, croupous inflammation of the mucous membranes in general, sometimes a cutaneous papular eruption, and great prostration mark the course of the affection, which is frequently most difficult to diagnose during life, especially if its presence is not suspected. Its introduction and mode of propagation can, in many instances, be ascertained only at a late period, and when great loss may already have been sustained. In the majority of cases the examination of the carcase of an animal which has died or been purposely killed is the best way to arrive at a correct diagnosis. Indeed, this is practically the only certain means of concluding as to the presence of the malady, as in different invasions, and even in different countries and different individuals during the same invasion, there are observed considerable variations in the chief symptoms with regard to their intensity as well as in the secondary symptoms or epiphenomena.

Among cattle indigenous to the regions in which this malady may be said to be enzootic the symptoms are often comparatively slight, and the mortality not great. So much is this the case that veterinary surgeons who can readily distinguish the disease when it affects the cattle of western Europe, can only with difficulty diagnose it in animals from Hungary, Bessarabia, Moldavia, or other countries where it is always more or less prevalent. In these the indications of fever are usually of brief duration, and signs of lassitude and debility are, in some instances, the only marks of the presence of this virulent disorder in animals which may, nevertheless, communicate the disease in its most deadly form to the cattle of other countries. Slight diarrhœa may also be present, and a cutaneous eruption accompanied by gastric disturbance, shedding of tears, and infrequent cough. In the more malignant form the fever runs very high, sometimes to 107·6° Fahr., and all the characteristic symptoms of the disorder are well marked, the lesions during life being observed in the cheese-like deposits on the gums, the presence of petechiæ on the mucous membranes, discharges from the eyes, nose, and mouth, eruption on the skin, cough and laboured breathing, certain nervous phenomena, and dysenteric dejections. Death generally occurs in four or five days, the course of the disorder being more rapid with animals kept in stables than with those living in the open air, and in summer than in winter. After death the chief alterations are found in the digestive canal, and consist in evidence of inflammation of a more or less acute kind, with ulceration, extravasation of blood, gangrene, &c. The membrane lining the air-passages offers similar alterations; indeed, all the mucous membranes of the body appear to be involved, and the malady might almost be considered as a malignant infectious catarrhal fever.

Protective inoculation has often been advocated and practised (particularly in Russia) for this disorder, but the advantages derived have not been sufficient to compensate for the danger attending ... Quite recently, Semmer of the Dorpat veterinary school has made experiments with cultivated or attenuated virus, and so far the results have been encouraging.

3. *Pleuro-Pneumonia or Lung-Plague.*—The next murrain in importance, with regard to destructiveness, is the so-called "lung-plague" or contagious "pleuro-pneumonia" of cattle.

This disease is particularly interesting from the fact that within less than two centuries it has been spread from a very small area over nearly every part of the world. The earliest notices of it testify that it first prevailed in central Europe, and in the last century it was present in certain parts of southern Germany, Switzerland, and France, and had also appeared in upper Italy. Though Valentine described an epizooty occurring among cattle in 1693 in Hesse, yet doubts have been entertained as to whether it was this malady. It was not until 1769 that it was definitely described as prevailing in Franche-Comté by the name of "murie." From that date down to 1789 it appears to have remained more or less limited to the Swiss mountains, the Jura, Dauphiné, the Vosges, Piedmont, and upper Silesia; it showed itself in Champagne and Bourbonnais about the time of the Revolution, when its spread was greatly accelerated by the wars that followed, and the consequent demand for cattle for the commissariat parks of the contending armies. Since that time the continually increasing commercial relations between various countries have carried it to the ends of the earth, the long duration of latency, and the somewhat slow course of the disorder, eminently adapting it for conveyance to great distances. In this century its diffusion has been accurately determined. It invaded Prussia in 1802, and soon spread over North Germany. It was first described as existing in Russia in 1824; it reached Belgium in 1827, Holland in 1833, the United Kingdom in 1841, Sweden in 1847, Denmark in 1848, Finland in 1850, South Africa in 1854, the United States—Brooklyn in 1843, New Jersey in 1847, Brooklyn again in 1850, and Boston in 1850; it was also carried to Melbourne in 1858, and to New South Wales in 1860; New Zealand received it early in 1864. It has also been carried to Asia Minor, and has made its presence felt at Damascus. In Austria it is less prevalent than in some other European countries, being scarcely known except in Bohemia, Moravia, and a portion of Tyrol. In Hungary it appears to be almost unknown, in consequence of the minimum importation of foreign cattle; and in countries to which it has not been introduced by infected animals it is not seen. In consequence of its insidious invasion, the subtlety of its contagion, and the great fatality attending it, there can be no doubt that it is one of the most disastrous plagues that can afflict a cattle-producing country. Fortunately, unlike the two preceding murrains, it is confined entirely to the bovine species; no well-authenticated instances of its transmission, either accidental or experimental, to other species have been recorded.

In its nature it is a specific infectious disease, generally affecting the lungs and the lining membrane of the chest, producing a particular form of lobar or lobular pleuro-pneumonia, and in the majority of cases, if not in all, it is transmitted through the medium of the inspired air,—hence its localization in the lungs. Inoculation with the fluid from the diseased lungs does not produce any effect on other than the bovine species; but in this its action is most energetic. Producing, after a certain interval, characteristic lesions at the seat of inoculation, the morbid change or infective process soon involves parts beyond, and if not checked may cause most serious damage and even the death of the inoculated animal; though it does not develop the lung lesions always observed in accidental infection, yet there is a local anatomical similarity or identity.

Symptoms.—The malady is slow and insidious in its course, lasting from two to three weeks to as many months, the chief symptoms being fever, diminished appetite, a short cough of a peculiar and pathognomonic character, with quickened breathing and pulse, and physical indications of lung and chest disease. The progress of the malady is marked by exacerbation of the symptoms, and towards the end there is great debility and emaciation, death generally ensuing after hectic fever has set in. Recovery is somewhat rare.

The pathological changes are generally limited to the chest and its contents, and consist in a peculiar marbled-like appearance of the lungs on section, and fibrinous deposits on the pleural membrane, with oftentimes great effusion into the cavity of the thorax.

Willems of Hasselt (Belgium) in 1852 introduced and practised inoculation as a protective measure for this scourge, employing for this purpose the serum obtained from a diseased lung; and his success was so marked that he made known his procedure. Since that time inoculation has been extensively resorted to, not only in Europe, but also in Australia and South Africa; and its protective value has been generally recognized. When properly performed, and when certain precautions are adopted, it would appear to confer immunity from the disease. The usual seat of inoculation is the extremity of the tail, the virus being introduced beneath the skin by means of a syringe or a worsted thread impregnated with the serum. One or two drops are sufficient to cause the local and constitutional disturbance which mark successful prophylactic infection. A particular micro-organism has been discovered in the diseased textures and fluids of animals affected with contagious pleuro-pneumonia, which is supposed to cause the malady. It has been cultivated, and inoculation experiments have been made with it. The intravenous injection of the virus has been found to be a safer method of conferring immunity than inoculation beneath the skin, and quite as certain a method.

4. *Foot-and-Mouth Disease* (Epizootic Aphtha, Eczema epizootica), if we were to judge by the somewhat vague descriptions of different disorders by Greek and Roman writers, has been a European malady for more than 2000 years. But no reliance can be placed on this evidence, and it is not until we reach the 17th and 18th centuries that we can find trustworthy proof of its presence, when it was reported as frequently prevailing extensively in Germany, Italy, and France. During this century, owing to the vastly-extended commercial relations between every civilized country, it has, like the lung-plague, become widely diffused. In the Old World its effects are now experienced from the Caspian Sea to the Atlantic Ocean. It gradually extended towards Britain at the commencement of this century, after invading Holland and Belgium, and about 1839 appeared in England, where it was immediately recognized as a new disease; it quickly spread over the three kingdoms. From the observations of the best authorities it would appear to be an altogether exotic malady in the west of Europe, always invading it from the east; at least, this has been the course noted in all the principal invasions. It was introduced into Denmark in 1841, and into the United States of America from Canada, where it had been carried by diseased cattle from England. It rapidly extended through cattle traffic from the State first invaded to adjoining States, but was extinguished, and does not now appear to be known on the American continent. It was twice introduced into Australia in 1872, but was stamped out on each occasion. It appears to be well known in India, Ceylon, Burmah, and the Straits Settlements. In 1870 it was introduced into the Andaman Islands, where it had not previously been seen, by cattle imported from Calcutta, where it was then prevailing. There is evidence that it is common in South Africa, and is frequently epizootic there, causing great inconvenience, owing to the bullocks used for draught purposes, which travel great distances, becoming unfit for work, by which traffic is much interfered with. These cattle also spread the contagion. It is not improbable that it also prevails in Central Africa, as Schweinfurth alludes to the cattle of the Dinkas suffering from a disease of the kind. Though not a fatal malady, and in the majority of cases readily amenable to treatment, yet it is a most serious scourge. It is transmissible to nearly all the

domestic animals, even mankind sometimes becoming infected, but its ravages are most severe among cattle, sheep, and pigs. Since it was introduced into the United Kingdom it has proved more disastrous on the whole, perhaps, than any other murrain, and has most injuriously affected agricultural interests. What makes it more serious is the fact that one attack is not protective against another, an animal sometimes being affected a second time within a few months.

Symptoms.—This is an eruptive fever, characterized by vesicles or blisters in the mouth, sometimes in the nostrils, and on parts of the body where the skin is thin and least covered with hair, as on the udder and towards the feet. The animal cannot eat so well as usual, suffers much pain and inconvenience, loses condition, and, if a milk-yielding creature, gives less milk, or, if pregnant, may abort. Sometimes the feet become very much diseased, and the animal is so crippled that it has to be destroyed. It is often fatal to young creatures. It is transmitted more especially by the saliva and the discharges from the vesicles on the feet and udder, though all the secretions and excretions are doubtless infective, as well as all articles soiled by them. The disease can be produced by injecting the saliva intravenously.

These are the best-known murrains affecting cattle; but there are others which, though they cannot be noticed here, are of some moment. One in particular demands most serious consideration, the disease known as "consumption," "pining," and (from the appearance of the morbid growths in the chest) "grapes," and to the medical and veterinary pathologist as "tuberculosis." It is a highly-infectious disorder in cattle, is becoming very common among the improved breeds, and causes heavy losses in dairy stock. It has been experimentally demonstrated that the tuberculous matter, as well as milk and the juice of the flesh of diseased cows, when given to healthy animals or inoculated in them, will produce the malady, and this leads to the grave question as to the danger incurred by mankind through the consumption of the flesh and milk of tuberculous cows. This is a pressing sanitary problem which demands early solution.

Prevention of Murrains.—The legislative measures necessary for prevention or suppression of murrains are based upon the fact that these diseases depend for their extension solely upon their contagious properties. The object is, therefore, either to prevent the admission of the contagious principle, *i.e.*, through diseased animals or articles which have become infective by contact with them, or to destroy it as quickly as possible. The necessity for this is abundantly evident on every page in the history of these scourges. It is almost impossible to realize the loss and embarrassment caused by cattle-plague, lung-plague, and foot-and-mouth disease only. By the first-named murrain it has been estimated that the loss in Europe from 1711 to 1796 only was 200,000,000 head of cattle. And in this century the disease has not been less severe, though its opportunities for extension, much greater than before, have been much diminished by the progress made in veterinary science. From 1841 to 1844 Egypt lost 400,000 head of cattle; and 1,000,000 perished in Russia in 1844-1845. From 1849 to 1863 the Austrian states lost 258,107. In Hungary from 1861 to 1867 this steppe murrain appeared in 680 communes having a bovine population of 908,209; 25 per cent. were attacked, and of these 145,474 or 63·9 per cent. were lost. In 1860-1861 Austria lost 4800 cattle; and in Russia 183,678 died in 1860. In 1865-1866 Great Britain is supposed to have lost 233,629 head, valued at from five to eight millions of pounds, though this is probably far below the actual figure; and Holland, receiving the infection from England, at this time lost 115,000 cattle. In 1870 Germany reported 3122 as dead from rinderpest; and during the Franco-German war, when the disease was introduced into France by the German troops, the Bas-Rhin department alone lost 6104 cattle and sheep at the period of the invasion, and 582 cattle and 944 sheep when the troops returned, the amount of indemnity paid for cattle destroyed being 1,622,249 francs, while in Lorraine 5000 cattle and more than 3000 sheep, and in the Haut-Rhin 14,000 cattle perished, the compensation to cover this loss being estimated at 1,500,000 francs. In August 1878 thirteen governments in Russia were invaded by rinderpest, and it was computed that 18,000 animals were attacked, 14,000 of which died or were destroyed.

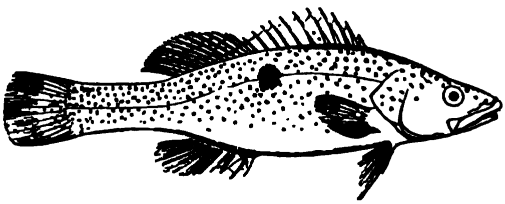
These figures give but a faint idea of the appalling destruction wrought by rinderpest; and lung-plague, though its ravages are not so striking or immediate, has been scarcely less formidable. For instance, in Holland in 230 parishes the average yearly loss has been reckoned at 49,661. In 705 parishes in Würtemberg 1706 stables contained 10,214 cattle; of these 4200 were attacked, and 2583 were killed or died. In France, according to published statistics, the loss caused by this murrain in 217 communes of the department of the Nord during seven consecutive years was 11,200 in a bovine population of 280,000 — or a total in nineteen years of 218,000 head, the estimated value of which was fifty-two millions of francs. In the departments of Aveyron, Cantal, and Lozère the average loss for a long time was not less than 35 per cent. of the entire cattle. In Australia the losses caused by it during thirteen years were supposed to be at least 30 to 40 per cent. of the whole number of cattle, or about 1,404,097 head, which, if valued at only £6 each, would amount to about £8,500,000. Only a very imperfect notion can be formed of the destruction it has caused in Great Britain and Ireland since its introduction; but for the six years ending with 1860 it has been calculated that there perished considerably more than a million of cattle in the United Kingdom, the value of which must have amounted to more than twelve millions of pounds. From 1863 to 1866 the death-rate from the scourge was from 50 to 60 per cent. annually.

The deaths from foot-and-mouth disease vary in number at different outbreaks, and are much less than in the invasions of steppe murrain and lung-plague. The most serious feature of this murrain is its affecting a large percentage (frequently nine-tenths) of the ruminants and pigs on a farm or in a district. In 1839, in a district in Würtemberg comprising about 8 square miles and containing 11,000 head of cattle, only 1300 or 12 per cent. escaped; in the arrondissement of Mulhausen, Alsace, containing 32,000 animals, in 1862-3-4 only about 4000, or one in eight, were not attacked; in the department of the Nord in 1839 of 277,000 cattle 120,000 were affected, more than one-half of the sheep, and one-fifth of the pigs. In Baden in 1864 of 607,825 cattle 139,995 were infected. It is scarcely possible to arrive at anything like a correct estimate of the number of cattle affected during any particular outbreak in Britain. Perhaps it would not be an exaggeration to assert that 150,000 or 200,000 suffered from the disease in 1872, and from 1839 up to 1874 it was estimated that the money loss it caused the country was £13,000,000, but this is probably far below the mark. It has been calculated that the loss experienced from an outbreak in Baden in 1869 was no less than £103,000, and for the southern states of Germany £833,000. France is supposed to have lost from this disease, among cattle only, in twenty years £4,000,000.

When it is considered how rapidly animals lose condition, especially fat stock; what losses occur when it appears among milch cows and those in calf, or amongst oxen used for draught, and among sheep, pigs, and poultry; what embarrassment it may occasion to agriculture and the cattle and milk trade, not to speak of the expense of curative measures,—it will be seen what a serious murrain this is, even under the most favourable circumstances. It is still more so when it assumes a severe character, which it often does, and is likely to be accompanied by complications. The great rapidity with which it spreads greatly increases these losses. In a very few months it has been observed to enter the eastern frontiers and spread over a large portion of the continent of Europe, infecting Germany, Switzerland, France, Holland, and Belgium, and reaching England, always following the course of cattle traffic.

These examples and estimates afford after all only a very faint notion of the devastation, misery, embarrassment, and loss that murrains occasion, and it is this which has compelled enlightened Governments to adopt severe measures for their extinction, or at least limitation. These measures are successful in proportion as they are well devised and energetically carried out, for all the murrains or contagious diseases are perfectly amenable to control, and may even be totally suppressed by international agreement and combined action. There is reason to hope that this most desirable result will be ultimately attained, but at present it is a long way off—some infected countries, in consequence of imperfect measures or the absence of any veterinary sanitary police, proving a standing menace to others which are either free from infection, or are energetically endeavouring to get rid of it. The measures now in force may be briefly said to be interdiction of the importation of cattle from countries in which cattle-plague, foot-and-mouth disease, or contagious pleuro-pneumonia is prevalent, or compulsory slaughter at the ports of debarkation. In some of the infected countries, as in the United Kingdom, where foot-and-mouth disease and contagious pleuro-pneumonia are always more or less prevalent, infected cowsheds, farms, or districts are rigorously isolated, so far as the movement of animals from them is concerned, none being allowed to leave until the disease has been suppressed, and cattle-markets or fairs may be closed for a certain period. In contagious pleuro-pneumonia, diseased animals and those which have been in contact with them are slaughtered, and compensation allowed the owner for the latter by the local authorities, while measures of cleansing and disinfection are enforced. The movement of cattle in, into, and from the infected area is closely watched to extinguish the contagion as speedily as possible by prohibiting communication between sick and healthy animals susceptible to the malady, and so preventing the formation of new infectious centres. Evasion or infraction of the legislative orders in force for the suppression of contagious diseases in animals is punishable by fine or imprisonment. (G. FL.)

MURRAY COD. Of the numerous freshwater Perches inhabiting the rivers and watercourses of Australia the Murray Cod (*Oligorus macquariensis*) is one of the largest, if not the largest, and the most celebrated on account of the excellent flavour of its flesh. In conferring upon the fishes of the new country familiar names, the early colonists were evidently guided by the fancied resemblance in taste or appearance to some fish of their northern home rather than by a consideration of their taxonomic affinities. These, as far as the Murray Cod is concerned, lie in the direction of the Perch and not of the Cod family. The shape of the body is that of a Perch, and the dorsal fin consists of a spinous and rayed portion, the number of spines being eleven. The length of the spines varies with age, old individuals having shorter spines, that is, a lower dorsal fin. The form of the head and the dentition also resemble those of a Perch, but none of the bones of the head have a serrated margin. The scales are small. The colour varies in different localities; it is generally brownish, with a greenish tinge and numerous small dark green spots. As implied by the name, this fish has its headquarters in the Murray river and its tributaries, but it occurs also in the northern parts of New South Wales. It is the most important food fish of these rivers, and is said to attain to a length of more than 3 feet, and to a weight of 120 ℔.



Murray Cod.

MURRAY RIVER, the largest river in Australia, rises in the Australian Alps about 36° 40′ S. lat. and 147° E. long., and, flowing north-westwards, skirts the borders of New South Wales and Victoria until it passes into South Australia, shortly after which it bends southward into Lake Alexandrina, a shallow lagoon, whence it makes its way to the sea at Encounter Bay by a narrow opening at 35° 35′ S. lat. and 138° 55′ E. long. Near its source, the Murray Gates, precipitous rocks, tower sheer above it to the height of 3000 feet; and the earlier part of its course is very tortuous, broken, and uneven. Farther on it in some parts loses so much by evaporation as to become merely a series of pools. Its length till it debouches into Lake Alexandrina is 1120 miles, its average breadth in summer is 240 feet, its average depth about 16; and it drains an area of about 270,000 square miles. For small steamers it is navigable as far as Albury. Periodically it overflows its banks, causing wide inundations. Operations have lately been undertaken to render its mouth accessible for ships; but, owing to the force of the southern ocean, navigation is difficult and dangerous. The principal tributaries of the Murray are those from New South Wales, including the Edward river, the united streams of the Murrumbidgee and Lachlan, and the Darling or Callewatta. It was in 1829 that Captain Sturt traced the Murrumbidgee river till it debouched in a magnificent stream 300 feet wide. This stream, the Murray river, he followed down to Lake Alexandrina, but was compelled, after enduring great hardships, to return without discovering its outlet to the sea. In 1831 Captain Barker, while attempting to discover its outlet, was murdered by the natives. In 1836 the discovery was made by Major Mitchell that the Darling flowed into the Murray. (See Australia, vol. iii. pp. 105, 107.)

MURRAY, or Moray, James Stuart, Second Earl of (1533-1570), regent of Scotland, was the illegitimate son of James V. by Margaret Erskine, daughter of the fourth Lord Erskine. While only in his fifth year he was appointed prior of the abbey of St Andrews in order that James V. might obtain possession of its funds. Under the tutorship of George Buchanan his intellectual training was carefully attended to, and as early as his fifteenth year he gave evidence of rare courage and decision by an impetuous attack on an English force which had made a descent on the Fife coast, and which he routed with great slaughter. In addition to the priory of St Andrews, he subsequently received those also of Pittenweem and of Mascon (France), but on reaching manhood he manifested no vocation for monasticism. The discourses of Knox, which he heard at Calder, won his high approval, and shortly after the return of the Reformer in 1559 Murray left the party of the queen-regent and joined the lords of the congregation, who resolved to adopt the bold measure of forcibly abolishing the Popish service. After the return of Queen Mary in 1561 he became her chief adviser, and his cautious firmness was for a time effectual in inducing her to adopt a policy of moderation and tolerance towards the Reformers. In 1562 he was created earl of Mar, and soon after married Lady Agnes Keith, daughter of the earl marischal. The earldom of Mar being claimed by Lord Erskine, he resigned the title and property and was created earl of Murray. After the defeat of Lord Huntly, leader of the Catholic party, who died soon afterwards, the policy of Murray met for a time with no obstacle or hindrance, but he awakened the displeasure of the queen by his efforts in behalf of Knox when accused of high treason, and, as he was also strongly opposed to her marriage with Darnley, he was after that event declared an outlaw and compelled to take refuge in England. Returning after the death of Rizzio, he found the sentiments of the queen towards him very greatly altered, and received a full pardon. On the abdication of Queen Mary at Lochleven he was appointed regent. The position was full of temptation and difficulty, but his conspicuous integrity and moderation, joined to unflinching courage and the utmost readiness of resource, proved to be adequate to what the circumstances demanded. When Mary made her escape from Lochleven, he occupied her attention with pretended negotiations until he had gathered his adherents in sufficient force, when he completely defeated her at Langside (13th May 1568) and compelled her to flee to England. Immediately afterwards he frustrated an attempt at insurrection by the duke of Chatelherault, whom he confined in the castle of Edinburgh. The disappointed partisans of the queen resolved to have revenge, and one of their number, Hamilton of Bothwellhaugh, shot him through the body at Linlithgow, 21st January 1570. The wound proved fatal, and he died the same evening.

MURRAY, John, M.D. (1778-1820), lecturer on chemistry and materia medica, was born in Edinburgh in 1778 and died in 1820. He was a clear and popular lecturer, and his books well represent the chemistry of the time, but he will be chiefly remembered on account of his opposition to Davy's theory of chlorine. In support of the old view that chlorine is a compound of oxygen and anhydrous muriatic acid, he attempted to prove experimentally that muriatic acid gas contains combined water, and that chlorine contains oxygen. Dr John Davy conclusively proved that Murray's experiments were inaccurate, and that all the phenomena can be perfectly well explained without assuming the existence of the unknown anhydrous muriatic acid or the compound nature of the apparently elementary chlorine. It is interesting to note that it was in the course of the experiments made with the view of disproving Murray's conclusions that Davy discovered phosgen, the compound of carbonic oxide and chlorine.

Murray wrote *Elements of Chemistry*, 2 vols. 8vo, Edinburgh, 1801 (fourth edition, 1816); *Elements of Materia Medica and Pharmacy*, 2 vols. 8vo, 1804 (new edition, 1810); *A System of Chemistry*, 4 vols. 8vo, 1806 (fourth edition, 1818); and numerous papers in the *Transactions of the Royal Society of Edinburgh* and *Nicholson's Journal*.

MURRAY, Sir Robert (*c.* 1600-1673), one of the founders of the Royal Society, was the son of Sir Robert Murray of Craigie, Ayrshire, and was born about the beginning of the 17th century. In early life he served for some years in the French army, and, winning the favour of Richelieu, he rose to the rank of colonel. On the outbreak of the civil war he returned to Scotland and was energetic in collecting recruits for the royal cause. The triumph of Cromwell compelled him for a time to return to France, but he took an active part in the Scottish insurrection in favour of Charles II. in 1650, and was named lord justice clerk and a privy councillor. These appointments, which on account of the overthrow of the royal cause proved to be at the time only nominal, were confirmed at the Restoration in 1660. Soon after this event Sir Robert Murray began to take a prominent part in the deliberations of a club instituted in London for the discussion of natural science, or, as it was then called, the "new philosophy." When it was proposed to obtain a charter for the society he undertook to interest the king in the matter, the result being that on 15th July 1662 the club was incorporated by charter under the designation of the Royal Society. Sir Robert Murray was its first president, and during the remainder of his life exerted himself with great zeal and ability to extend its influence. He died in June 1673.

MURREE, or **Marri**, a sanatorium and hill station in the Ráwal Pindi district, Punjab, is situated in 33° 54′ N. lat. and 73° 26′ E. long. It forms the great northern sanatorium for the Punjab, and is the ordinary summer resort of the local Government. The houses crown the summit and sides of an irregular ridge of the Murree hills, 7507 feet above sea-level, and command a magnificent view. The climate is admirably adapted to the constitution of Europeans; the lowest recorded temperature is 21° Fahr., the highest 96°. The resident population in 1868 was 2346; but in the height of the season it probably amounts to 12,000 or 14,000, numbers of visitors being attracted from Lahore, Ráwal Pindi, Pesháwar, and the plains generally.

MURSHIDÁBÁD, or **Moorshedabad**, a district in the lieutenant-governorship of Bengal, lying between 23° 43′ and 24° 52′ N. lat. and 87° 43′ and 88° 47′ E. long., is bounded along its whole frontier from the extreme N. to the S.E. by the Ganges, separating it from the Nadiyá and Rájaháhí districts; on the S. by Nadiyá and Bardwán —the Jalangi river marking its boundary for a considerable distance; and on the E. by Bírbhúm and the Santál Parganás district. The area is 2141 square miles. The district is divided into two nearly equal portions by the Bhágirathi, the ancient channel of the Ganges, which flows due north and south. The tract to the west, known as the Rárh, consists of hard clay and nodular limestone. The general level is high, but interspersed with *bíls* or broad marshes and seamed by hill torrents. The Bágri or eastern half differs in no respect from the ordinary alluvial plains of eastern Bengal. There are few permanent swamps; but the whole country is low-lying, and liable to annual inundation. In the north-west are a few small detached hillocks, said to be of basaltic formation. The river system is constituted by the Ganges or Padma, and its offshoots and tributaries the Bhágirathi, Bhairab, Siálmári, Jalangi, and Singá,—the first mentioned being by far the most important river within Murshidábád, though only navigable during half the year. It is embanked along the entire length of its left bank. There are no canals in the district.

The census of 1881 returned the population of the district at 1,226,790 (males 586,483, females 640,307),—Hindus numbering 634,796, Mohammedans 589,957, native Christians 250, and aborigines 836. The population comprises Bengalis of the delta, hill tribes from Chutiá Nágpur, and the peculiar Hindu castes of Behar, while the presence of the court has introduced Rájputs from the north-west for railway service or trade, Afgháns and Persians from beyond the frontier, and a bodyguard of Habshis from the east coast of Africa. The six following towns contained in 1872 a population exceeding 5000,—Murshidábád, 46,182; Barhampur, 27,210; Kandi, 12,016; Jangipur, 11,361; Beldanga, 6037; and Margrám, 5766. Other places of some importance are the river marts of Azímganj and Jiáganj, situated opposite each other on the Bhágirathi, Bhagwangola and Dhuljan on the Ganges, and the railway stations of Murarai and Nalháti. Sites of historical interest include the now deserted Kásímbazar, Badrihat, Rángámáti, and the battlefield of Gheria.

Rice constitutes the staple crop, the *áman* or winter rice being prevalent in the western half of the district, and the *aus* or early rice in the eastern. A second or cold weather crop of wheat, barley, and many varieties of oil-seeds and pulses is also grown in this latter tract, jute is but little grown, and the cultivation of indigo and of mulberry for silkworms is on the decline. There is little that is peculiar in the land tenures of the district beyond the *rámnás* or deer parks, held revenue-free by the nawáb, and the cultivating tenure known as *ut-bandi*, according to which the peasant pays rent, not for his entire holding, but only for the land actually cultivated, the amount being determined by the nature of the crops grown, and being paid in kind. Silk is still manufactured, but the industry is rapidly losing its importance. At Murshidábád city and at Barhampur there are special industries of ivory-carving, bell-metal work, and gold and silver embroidery. The district is favourably situated for trade, both by river and rail. In 1876-77 the exports amounted to £1,020,124; the imports to £739,906. The principal exports consisted of rice, gram and pulses, wheat, silk, and indigo; the principal imports of European piece goods, salt, and raw cotton.

In 1881-82 the net revenue amounted to 1,803,828 rupees, of which 1,298,735 were derived from the land-tax. Education in 1876 was afforded by 506 schools, attended by 14,664 pupils. The special educational institutions are the Barhampur College, founded in 1853; the Nizámat College, limited to the education of the relatives of the nawáb; and the Nizámat free school in Murshidábád city. The climate does not differ from that common to Lower Bengal, except that it experiences to some extent the burning winds of Central India during the hot season. The average annual temperature is 78°·6 Fahr. In 1880-81 it was 59·82, and in 1881-82 it was 47·76. The average annual rainfall is 54·30 inches. The district has a low standard of health. The stagnant pools formed by the Bhágirathi during the dry season constitute a perennial source of malaria, and cholera is rarely absent from the city and suburbs. Elephantiasis and hydrocele are also endemic.

The history of the district centres round the city of Murshidábád, the latest Mohammedan capital of Bengal. In 1704 the nawáb Murshid Kulia Khan changed the seat of government to the little town of Maksudábád, but when Alí Vardí Khán won the throne by conquest in 1740 he also adopted Murshidábád as his capital. The great family of Jagat Seth maintained their position as state bankers at Murshidábád from generation to generation. Even after the conquest of Bengal by the British, Murshidábád remained for some time the seat of administration. Warren Hastings removed the supreme civil and criminal courts to Calcutta in 1772, but in 1775 the latter court was brought back to Murshidábád again. In 1790, under Lord Cornwallis, both the entire revenue and judicial staffs were ultimately fixed at Calcutta.

Murshidábád, principal city of the above district, is situated on the left bank of the Bhágirathi river, in 24° 11′ N. lat. and 88° 18′ E. long. Its importance has entirely departed since it ceased to be the capital of Bengal, and its population has steadily diminished. In 1872 the population was 46,182 (Hindus 27,211, Mohammedans 18,824, Christians 38, "others" 109). It is still a great centre of trade and manufacture, and the Jain merchants of Murshidábád still rank as the wealthiest of their class in Bengal. Their dealings in gold and silver bullion are especially large, and some of their number almost monopolize the local traffic on the Brahmaputra as far as the north-east frontier of Assam. The principal industries of the city are those fostered by the luxury of the native court. Carving in ivory, conducted with much skill and finish, is an old speciality of the city. The principal building is the new palace of the nawáb názim, a large and imposing pile of buildings on the banks of the river, and nearly in the centre of the city.

MURZUK. See Fezzan, vol. ix. p. 130.

MUS, the name of a family of the plebeian gens of the Decii. Two members of the family, a father and a son, crowned distinguished careers in the service of Rome by a singular act of self-devotion. The father, Publius Decius Mus, won his first laurels in the Samnite war, when in 343 B.C., while serving as tribune of the soldiers, he rescued the Roman main army from an apparently hopeless position. In 340 B.C. he was consul, and had, with his colleague Manlius Torquatus, the command in the Latin war. A decisive battle took place under Mt. Vesuvius; the Romans wavered, and Decius, repeating after the chief pontiff a solemn formula by which he devoted "the legions and auxiliaries of the enemy along with himself to the Dii Manes and the earth-goddess," dashed into the ranks of the Latins and met a death which was followed by a crushing defeat of the enemy (Livy, viii. 9).

The son, who was also called Publius, was consul for the fourth time in 295 B.C., and devoted himself after the pattern of his father in the battle of Sentinum, when the left wing which he commanded was shaken by the Gauls (Livy, x. 28). The story of the elder Decius is regarded by Mommsen as an unhistorical "doublette" of what is related on better authority of the son.

MUSÆUS is the name of three Greek poets. The first is an almost fabulous personage, who is said to have flourished in Attica, and to have been buried on the Museum Hill in Athens. The mystic and oracular verses and usages of Attica, and especially of Eleusis, attach themselves to his name, and when this representative character is deducted nothing of his individuality remains.

The second Musæus was an Ephesian who was attached to the court of the Pergamenian kings.

The third is of uncertain date, but probably belongs to the 5th century A.D., as the structure of his hexameters is evidently modelled after the canons of Nonnus. The poem in 340 lines which he wrote on the story of Hero and Leander is by far the most beautiful Greek poem of the age. He conveys the pathetic tale of love and death by selecting a few striking situations; he describes each of them in a telling manner, with no attempt to represent ethical character or earnest thought, but with a good eye to the situation, the dramatic and rhetorical effect. The work shows the influence of the schools of rhetoric, and is evidently the forerunner of the love romances of the Byzantine period.

MUSÄUS, J. K. A. (1735-1787), a German author. He studied theology at Jena, his birthplace, and would have become the pastor of a parish but for the resistance of some peasants, who objected that he had been known to dance. In 1760 to 1762 he published in three volumes his first work, *Grandison der Zweite*, afterwards (in 1781-82) rewritten and issued with a new title, *Der deutsche Grandison*. The object of this book was to show the comic aspects of Richardson's hero, who had many sentimental admirers in Germany. In 1763 Musäus was made tutor of the court pages at Weimar, and in 1770 he became a professor at the Weimar gymnasium. His second book—*Physiognomische Reisen*—did not appear until 1778-79. It was directed against Lavater, and attracted much favourable attention. In 1782 to 1786 he published his most famous work, *Volksmärchen der Deutschen*. Even in this series of tales, the substance of which Musäus collected among the people, he could not refrain from expressing the satirical tone which had marked his previous writings. The stories, therefore, lack the unconscious simplicity which characterizes genuine folk-lore. Still, they are very brightly written, and retain at the present day some of their original popularity. In 1785 was issued *Freund Hein's Erscheinungen in Holbein's Manier* by J. R. Schellenberg, with explanations in prose and verse by Musäus. A collection of stories entitled *Straussfedern*, of which a volume appeared in 1787, Musäus was prevented from completing by his death, which occurred on the 28th of October 1787. After his death appeared his *Moralische Kinderklapper* and *Nachgelassene Schriften*, the latter edited by his friend and relative Kotzebue. Musäus was a man of cheerful and genial temperament, and this dominant characteristic is reproduced in his writings, in which, although satirical, he is never morose. His style is animated, light, and graceful.

See Müller, *Johann Karl August Musäus* (1867).

MUSCAT, or more correctly Masḳaṭ, the chief town of 'Omán in Arabia, lies upon the sea-coast in 23° 40′ N. lat. and 58° 25′ E. long., at the extremity of a small cove in the gorges of a great pass leading inland through dark mountain walls, scorched with the sun and utterly without vegetation, which rise almost right out of the sea to a height of from 300 to 500 feet on both sides of the cove. The town itself is built on a sloping shore, which affords space for some scanty patches of cultivated ground beyond the gates. The interior aspect of Muscat does not correspond to the extremely striking appearance it presents when approached from the sea. The ruins of the Portuguese cathedral; the palace, the minarets, and a few other great buildings tower over narrow crowded streets and filthy bazaars, long rows of good houses now falling into decay, and a mass of mean dwellings of sun-dried brick or wretched huts of palm branches. The whole aspect was described by Palgrave in 1863 as that of decay, but the town was still populous, and Palgrave estimated the inhabitants at 40,000, exclusive of the suburbs. Indeed the excellent harbour so admirably situated for the Indian and Persian Gulf trade, the strength of the whole position, which is defended by forts on the encircling rocks and might easily be rendered impregnable, together with the command of the passes to the fertile lands beyond, make it naturally the most important point on all the coast. The inhabitants and government are favourably spoken of; the population is a mixture of the most varied nationalities, including very many Indians; but good order is maintained and equal justice administered to all creeds. The Mohammedan citizens have a considerable strain of African blood, the slave trade having been very active before the convention of England with Zanzibar. The climate is not good; the summer heat in so confined a situation is very great, and epidemic fevers are common. The exports (salt, dates, fish, cotton, pearls, mother-of-pearl, &c.) and imports (rice, coffee, sugar, piece goods, &c.) are very considerable, amounting perhaps together to a million sterling per annum.

Round the cape which forms the north-west limit of the cove lies the prosperous and well-built town of Matrah, with 20,000 to 25,000 inhabitants, and a considerable production of 'Omán stuffs. It may be regarded as a suburb of Muscat, though the land road over the cape is so rough that communication between the towns is conducted chiefly by boats.

Muscat is an ancient place, perhaps identical with the Moscha of the *Periplus*. In the 9th century of the Christian era ships trading from Síráf to China took in water at Muscat from the well which still supplies the town; but the place was then quite small, Ṣohár, farther up the gulf, being the chief place on the 'Omán coast. The importance of Muscat appears to date from the Portuguese occupation (1508-1658). In the first half of last century the contests of the rival imáms of 'Omán, Saif and Ibn Murshid, placed the town in the hands of the Persians, who were expelled about 1749 by Ahmed b. Sa'íd. The residence of this prince was at Rustáḳ, but his grandson Sa'íd made Muscat the capital, and cultivated the friendship and commerce of the English in Bombay and of the United States, to the great advantage of the city. Under Sa'íd's successor Thuainí family feuds and the intervention of the Wahhábites impaired the prosperity of the state. Thuainí was murdered in 1867, but after some further troubles his son Turkí was established on the throne by the aid of British influence.

MUSCATINE, a city of the United States, the county seat of Muscatine county, Iowa, is built on a rocky bluff on the west bank of the Mississippi, at the apex of what is known as the Great Bend. It carries on a large business in lumber, milling, canning fruits and vegetables, &c. Settled in 1836, and incorporated as a city in 1853, it increased its population from 5324 in 1860 to 8295 in 1880.

MUSCINEÆ. The Muscineæ are a highly interesting class of plants on account of the important part they play in the economy of nature, and also from the remarkable conditions of their development and formation. In many parts of the world it is principally the mossy covering of forests which, by collecting the rainfall like a sponge, prevents the pouring down from mountains of violent and excessive torrents of water, while the Bog-moss (*Sphagnum*) plays an important part in the formation of peat; and many other Mosses which grow on rocks produce by the decay of their dead parts a thin layer of mould (humus) in which the seeds of higher plants are able to take root. The importance, however, of Mosses in a morphological point of view proceeds from their position in the botanical system. The Muscineæ immediately follow the first division of the vegetable kingdom, the Thallophytes, under which are included the Algæ and Fungi, because their vegetative body is a "thallus,"—that is to say, is not divided into stem and leaf like that of higher plants, nor are they possessed of roots like those observed in higher plants (Ferns, Conifers, Monocotyledons, Dicotyledons, &c.). Their anatomical structure is also very simple, the individual essential tissue-elements being but little differentiated from each other.

The Muscineæ agree in many of their conditions with the Thallophytes, in others again with the next higher division, the vascular Cryptogams (Pteridophytes), to which the Ferns, Equisetums, and Lycopodiums belong. In many Muscineæ of the division of Liverworts (*Hepaticæ*) the vegetative body has still the form of a thallus (fig. 1), which is ribbon-shaped and grows in close contact with the substratum. There are, however, several gradual stages of transition from this ribbon-shaped thallus to a leaved stem, such as many Liverworts (*Hepaticæ*) and all Leaf-mosses (*Musci frondosi*) possess. Yet the structure of the leaves and of the stem, even in the latter, is very simple. The leaves present for the most part a cell-surface of one layer, and that (if we leave out of sight those in the middle part of the leaf, which in Leaf-mosses form the "mid-rib") is ordinarily composed of cells of uniform character. There is thus no epidermis as in higher plants, and the leaf itself attains but very trifling dimensions. The stem is also of simple structure; it possesses no "vascular bundles," but consists only of simple cells, among which there is no differentiation, except that those which lie outside often have thicker walls, and thus form a firmer rind-layer, while the interior ones are more elongated and serve for the storage and transmission of the plastic substances (albumen, hydrocarbons, &c.). The roots also by which the stems are attached to the ground are of very simple organization. They are either hair-like tubules as in many Liverworts, or rows of cells as in the Leaf-mosses. To distinguish them from the roots of higher plants they have been termed "rhizoids." In many cases the vegetative body scarcely attains one twenty-fifth of an inch in length, in others, however, it rises into a much-branched form of from about 4 to about 12 inches or more. The duration of its life reaches in some small forms (*Ephemerum*, *Phascum*, &c.) only a few weeks or months; in most cases, however, it is virtually unlimited, since the vegetative body continues to grow at its point while the older parts below are dying away. From this cause too the branches are isolated from each other, and become independent plants. In a peat-moor, for instance, the Bog-moss plants on the upper surface are the points and branches of the very same plants whose under-parts have long ago died away, and have principally contributed to the formation of the peat. This isolation of the branches through the dying away of the older parts which keep them together is at the same time a means of multiplication. Mosses also possess many other arrangements for asexual multiplication, as through gemmæ, "innovations," &c. In the Liverworts, for instance, almost every cell is capable of giving origin to a new plant.

The most extensive propagation, however, of the Mosses is that by means of spores, small roundish cells which are formed in a peculiar capsule, the *sporogonium*. The formation of these sporogonia is especially characteristic of the Muscineæ. They originate, as a consequence of fertilization, from a cell—the ovum-cell—which is generated in the female sexual organ, the *archegonium*. These archegonia (fig. 6) have, when ready for fertilization, the form of a flask. They consist of an inferior and somewhat swollen portion, which contains the ovum-cell, and of a superior portion drawn out to some length, the neck. The neck forms a canal through which the male fertilizing bodies, the spermatozoids (fig. 5, *D*), enter to blend with the ovum-cell. In the immature condition the archegonium is closed, its neck portion is filled up with a string of cells and covered at the top by a layer of cells which closes it like a lid (fig. 6). At a later period, however, the membranes of the string of cells which fills up the neck (the canal-cells of the neck) are converted into a jelly, which on contact with water swells up greatly, forces open the apex of the neck portion, and thus presents an open access to the ovum-cell. The mucilage which arises from the swelling up of the canal-cells of the neck is also so far of importance with regard to fertilization that by it the freely-moving male fertilizing bodies are stopped when they reach the neck of the archegonium. The male fertilizing bodies are here, as in many Algæ, in the vascular Cryptogams, and in most animals, termed *spermatozoids*. They are spirally-coiled filaments, thickened at the posterior extremity, finely pointed at the anterior, and bearing at this thin end two long fine cilia by means of which they can move in water. The spermatozoids are formed in the male sexual organs, the *antheridia* (fig. 5, *C*), which are bodies with long or short stalks, and of spherical, oval, or club-shaped form, surrounded by a wall-stratum consisting of a simple layer of cells, and which possess in their interior a tissue formed of numerous small cells, in each of which one spermatozoid takes its origin. When the wall-layer of the antheridium is torn asunder the spermatozoids are set free at its apex, and move in water by means of their cilia, like Infusoria. Thus water is always necessary to fertilization; it is only in water that the neck of the archegonium opens, and that the spermatozoids can move. Since either the Mosses grow in moist localities, or those which spring up in dry situations always form little turfs so as to suck up every drop of rain like a sponge, their fertilization is always secured, provided the organs of both sexes are present.

Even before the opening of the archegonium-case the oosphere has formed itself in the inferior portion of the archegonium. Originally in this inferior ventricose portion of the archegonium is a large cell, the *central cell* (fig. 6). From this a small cell is severed in an upward direction, which perishes at a later period, and is called the *ventral canal-cell* (fig. 6, *b*), while the inferior cell becomes round and forms itself into the oosphere. When ready for fertilization the ovum-cell is a spherical portion of protoplasm with a cell-nucleus (fig. 6, *e*). Fertilization follows on the blending of one or perhaps several spermatozoids with the oosphere. The first result of fertilization is that the oosphere becomes surrounded by a membrane of cellulose, and then grows very notably, while correspondingly with this growth it becomes divided by cell-walls, and thus becomes a cellular body. From the fertilized oosphere proceeds the moss-fruit, the sporogonium. The embryo which has proceeded from the fertilized oosphere lives at the expense of the vegetative body on which the archegonium is situated, like a parasite on the plant that nourishes it. The ventral portion of the archegonium grows along with the embryo. In *Riccia*, the lowest form of one subdivision of the Liverworts, the sporogonium remains even during the whole lifetime of the plant shut up within the ventral portion of the archegonium, and the spores formed in the sporogonium are not set free until that part of the plant on which the archegonium is situated withers away. In most other Liverworts also the sporogonium attains almost its entire development within the ventral portion of the archegonium, which grows contemporaneously with it, and it is not until the spores are mature that the stalk of the sporogonium extends itself considerably (fig. 3, (1), *A*); then the ventral portion of the archegonium springs in pieces and the spore-capsule issues forth and scatters its spores,—an occurrence which is completed within a few days. The ventral portion of the archegonium, which increases considerably after fertilization and which surrounds the embryo like a sheath, is termed *calyptra*. In the case of the Liverworts this calyptra is burst open by the sporogonium; in the Mosses, however, the elongated fusiform-embryo tears away the calyptra at its base and raises it up like a cap on its apex, and it is then found situated on the extremity of the sporogonium. In many Leaf-mosses (*Polytrichum*, *Hypnum crista castrensis*) the sporogonium requires more than a year for its development.

The function of the sporogonium is the production of spores. The simplest mode in which this takes place is seen in the species *Riccia*. Here the sporogonium is a spherical cell-body, consisting of a wall-layer and an interior tissue. The cells of this latter are called the mother-cells of the spores, because each of them by division forms four spores. In the species, however, which stand higher we can distinguish in the sporogonium a foot, which frequently penetrates into the tissue of the vegetative body, and in many Liverworts and almost all Mosses prolongs itself into a stalk supporting the capsule in which the spores are formed (figs. 3, 7, 8). In the case of most Liverworts we find in this capsule, besides the spores, also a number of cells which do not become spores. These either act as "nutrient cells" to the spore-forming cells, which gradually consume the matters stored up in them (*Riella*), or they form themselves into fusiform-cells with spiral thickenings of parts of the wall—the so-called *elaters*, which play a part in the dispersion of the spores. The sporogonia of Mosses do not possess elaters. They are rather complex structures, and attain a higher anatomical differentiation than the moss-stem itself. For example, at certain points in their epidermis they possess openings (*stomata*), which are entirely absent on the stem. In order to ensure the dispersion of the spores, special arrangements are found in the sporogonia of Mosses.

The course of development of the Muscineæ divides itself into two sharply-defined stages. The vegetative body, whether it be only a thallus as in many Liverworts, or a leafy stem, produces the sexual organs, the antheridia and the archegonia. From the fertilized oosphere of the archegonium arises a special structure, the sporogonium, which does not nourish itself independently, but lives like a parasite upon the moss-plant, and produces the spores only in a sexual way. The two stages—on the one hand the moss-plants that bear sexual organs, and on the other the sporogonium developed as the result of fertilization—are termed *generations*; accordingly in the Muscineæ the course of development consists in a regular alternation of these two stages—in an *alternation of generations*. The one generation possesses sexual organs, and is thus the sexual one. The other generation, the result of fertilization, possesses no sexual organs and is asexual, but produces the spores. Such alternation of generations is exhibited still more strikingly in Ferns. In this case, however, it is the proper leafy fern-plant which is the asexual generation, producing spores, but possessing no sexual organs. It arises out of a fertilized oosphere, and thus corresponds to the sporogonium of the Muscineæ. The sexual generation of the Ferns is a small and insignificant expansion, the prothallium, which bears antheridia and archegonia, and thus corresponds to the sexual generation of the Muscineæ, which is here represented by the proper moss-plant. The vegetative body of the Mosses which bears the sexual organs is not, however, the immediate product of the germination of the spore, from which there is produced in the first place a simple structure, a *pro-embryo* (specially developed in the Mosses proper, where it is termed "protonema," and where it assumes the appearance of a much-branched filamentous confervaceous Alga, fig. 15); it is from this pro-embryo that the leafy stems arise as lateral buds.

From a systematic point of view the Muscineæ are divided into two sections—Liverworts (*Hepaticæ*) and Mosses (*Musci frondosi*). The two sections are closely related to each other, but in external characters they are separated by rather sharp boundary lines.

I. LIVERWORTS (*Hepaticæ*).

Liverworts stand below the Mosses proper in regard to the number both of species and of individuals. They are also of much more limited occurrence, for they are found, for the most part, only in damp and shady localities, and seldom occupy any large extent of ground. The most extensive growths are those of many *Marchantiaceæ*—as, for example, *Fegatella conica*, which often forms a continuous covering on moist stones, walls, &c.

(1) *The Organs of Vegetation.*—With a few exceptions, the vegetative body is closely united to the substratum on which it grows, and fastened to it by clasping-roots (rhizoids) composed of a single cell. The side turned towards the substratum is of different structure from the upper or dorsal side. The Liverworts thus belong, with the exception of two species, to the class of *dorsi-ventral* plants, or those possessing two sides of different structure, a dorsal side and a ventral side, as in vertebrate animals.

The vegetative body of the Liverworts is either a thallus or a leafy plant; and we have consequently to distinguish between *thallose* and *foliose* Liverworts. The latter have already been termed *Hepaticæ frondosæ*. There occur, however, transitional

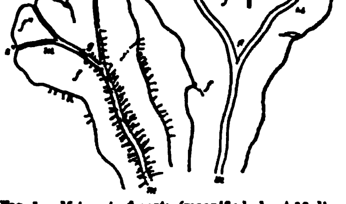


FIG. 1.—*Metzgeria furcata* (magnified about 10 diameters). The anterior portion of a thallus, seen on the right hand from above and on the left hand from below. *m*, mid-rib; *s*, *s'*, *s''*, the growing points; *f*, *f*, the wing-like expanded portion of the thallus, composed of a single layer of cells: *f'*, *f''*, *f'''*, its development by ramification. (After Sachs.)

forms between these two. Fig. 1 represents an example of a thallose Liverwort, showing the anterior portion of a plant of *Metzgeria furcata*. On the right hand is shown the upper, on the left the under side. The vegetative body is a ribbon-shaped thallus, on the under side of which the clasping-roots (rhizoids) spring out of the mid-rib. Here the mid-rib is sharply separated from the side portions, but in other cases (as *Aneura* and *Pellia*) it passes into them by a very gradual transition. In front, in an indentation of the growing point (*s*), are found the only organs which are formed upon it. These are hairs secreting mucilage (papillæ), and which stand on the under side. The mucilage which they secrete is probably intended for the purpose of protecting the vegetative point against the effects of drought.

A peculiar exception appears in the growth of the genus *Riella* (fig. 2). In this case a membranous wing, about one-fifth of an inch in width, of the finest green and of extreme delicacy, turns regularly on a central rib or axis, so as to form with the axis a sort of screw or winding staircase, having the form of an inverted cone with the apex downwards. The length of the whole plant of *Riella helicophylla* is about 2 inches. This plant, which is decidedly one of the most remarkable forms in the vegetable kingdom, grows upright in water, and was discovered in Algiers. At its lower end it is attached to the ground by clasping-roots. This is the only thallose Liverwort that grows upright, and also one of the few that grow in water. There are likewise two species of *Riccia* which swim in water—*Riccia natans* and *Riccia fluitans*; but these also possess forms which live on land, and it is these forms which attain to the formation of sporogonia. It follows hence that these plants also were originally, in every case land plants. A few others too, such as *Pellia epiphylla* and *Marchantia polymorpha*, have the power of vegetating in water, but this happens only exceptionally, and the plants are then sterile.

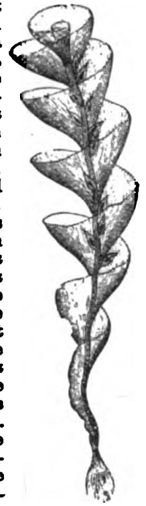


FIG. 2.—Plant of *Riella helicophylla*, from Algiers.

Returning to the thallose Liverworts that live on land, we have to remark that the differentiation of their tissues is a very simple one. The cells of the thallus, so far as they are not employed in the formation of clasping-roots and sexual organs, are all homogeneous. Those only of the mid-rib present a difference in *Metzgeria*, *Blyttia*, and others by their lengthened form. From this simple form has arisen a further complication in the development of the vegetative body in two different series. In the *Marchantiaceæ* the vegetative body retains the form of a thallus, but its anatomical organization is of higher structure. In the *Jungermanniaceæ* it is the external organization of the vegetative body which is the richer, and here the transition takes place in it to the foliose Liverworts, which possess a stem with leaves.

We may consider as representative of the *Marchantiaceæ* the very widely-spread *Marchantia polymorpha*. Its vegetative body is a broad ribbon-shaped thallus, which has on its under side clasping-roots (single-celled tubules, which are either simple, or have on their inner side characteristic conical or tubercular thickenings) and two rows of membranous lamellæ, the uppermost of which cover the growing point and form a protection to it. (See the section through *Fegatella*, an allied form, fig. 3, (1), *L.*) The upper surface presents a division into small rhomboidal spaces (areolæ), and in the middle of each space is an opening, the *stoma* or breathing hole. A section through the thallus shows a strongly-marked epidermis broken through at definite spots by the stomata or breathing holes, which, however, in this case have a very different structure from that presented in the higher plants. In *Marchantia* (fig. 3, (5), *Sp*) they are of barrel-shaped figure, and consist of several rings or tiers of cells placed over one another. Their origin may be traced in fig. 3, (3) and (4). Below the epidermis we find chambers filled with air. These, however, are not empty; from their base sprout forth cellular threads (fig. 3, (5)), the cells of which contain a large quantity of chlorophyll. It is in these that the assimilation of the carbon takes place. Those cells of the thallus which lie beneath serve only for the storing up and transmission of the materials for construction. The individual chambers are separated from each other by flat layers of cells, and on these rest the rhomboidal areolæ of the upper surface which can be seen with the naked eye. In other *Marchantiæ* the stomata are of a different structure. In *Fegatella*, for example, they are not barrel-shaped, but are bounded by several concentric circles of cells, which all lie on the upper surface of the thallus. Early stages of these are represented in fig. 3, (2). The way in which the air-chambers and stomata attain their condition is very remarkable. Small depressions in the cell-layer of the upper surface are formed in large numbers behind the growing point (fig. 3, (1), *U*). These widen considerably, and become, as it were, roofed over by the neighbouring parts, so that an epidermis (fig. 3, (1), *E*) grows in this manner over the hollows from the bottom of which at a later period the green cellular threads sprout forth. The strings of mucilage-cells which are found in the tissue of *Fegatella*, the brown threads which appear in that of *Preissia*, and the cells filled with a brown oily secretion which are found in *Marchantia* and other species must also be mentioned.

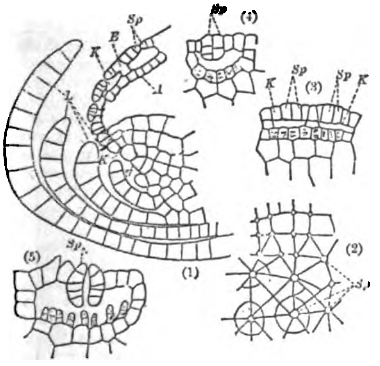


FIG. 3.—(1) Longitudinal section through the growing-point (apex) of *Fegatella conica*. On the upper side of the thallus are formed the air-chambers, as depressions in the upper surface *K*. On the under side of the thallus are formed membranous scales *L*, which always proceed from *one* cell. (2) Surface-view of a young portion of the thallus; the stomata appear as gaps in the epidermis. They are surrounded by a few concentric cells, of which the first are represented. (3), (4), (5) *Marchantia polymorpha*; development of the air-chambers and stomata. In (5) a number of cell-threads containing chlorophyll are seen sprouting from the bottom of the air-chamber.

The second series, which comes next to the simple thallose forms, is that of the foliose or leafy *Jungermanniæ*. Forms intermediate between the thallose and the foliose are represented by the species *Blasia* and *Fossombronia*. The former, which not unfrequently grows in the damp soil of forests, possesses a flat, thallus-like stem, which bears on its longitudinal axis two rows of leaves inserted parallel to each other, and has also on the under side two rows of toothed scales, the *amphigastria*. *Fossombronia* makes a nearer approach to the proper leafy forms; it possesses two rows of leaves inserted obliquely to the longitudinal axis of the flattened stem. In the foliose *Jungermanniæ*, in the narrower sense of the term, the stalk is thin and thread-like, and bears distinctly defined leaves. In this case also—with the exception of the upright growing *Haplomitrium Hookeri*—the stem grows in close connexion with the substratum. The leaves stand in three rows: two lateral, and one ventral towards the substratum. The ventral leaves are in this case also, as in *Blasia*, termed *amphigastria* or under leaves. They are smaller than the side leaves, and are sometimes reduced to the form of mere hairs, or even are entirely wanting, as in *Jungermannia bicuspidata*, where it is only in rare exceptional cases that they appear. The leaves of Liverworts consist of a single layer of cells without any mid-rib. They are commonly bifid at the apex, but in many forms this condition is only recognizable in early development, and disappears before maturity.

In general the leaves stand so thickly that they overlap each other with their margins, and quite cover the upper surface of the stem. The way in which the leaves overlap has been employed as a systematic character. *Overshot* leaves (*folia succuba*) are those in which the anterior margin turned towards the vegetative point of the stem stands higher than the posterior one, and thus the anterior margin of each leaf overlaps the posterior margin of the leaf which stands before it, while its own posterior margin is overlapped by the anterior margin of the leaf which stands behind it. In the opposite case of *undershot* leaves (*folia incuba*), the posterior margin of the leaf is higher than its anterior margin, and the anterior margin, inclining obliquely outwards, is overlapped by the posterior margin of the leaf which comes next before it, as in fig. 4. The mode in which the leaves overlap each other depends on a difference in the relative amount of growth of the upper or dorsal and the under or ventral side respectively. If the growth of the upper side preponderates, then we have the overshot, in the opposite case the undershot mode of covering. Originally the leaves do not stand obliquely to the longitudinal axis; it is only gradually that they are shifted out of their place. The position of the leaves is explained by their origin. The apex of the stem is occupied by a cell which has the form of a three-sided pyramid with a vaulted base. The surface of one side of the pyramid is directed downwards, the two others are directed laterally. This apical cell is divided by walls which are parallel alternately to one of the side walls. Thus segments are cut off from the apical cell and lie in three rows. From each of these segments arises a leaf. The leaves are thus necessarily likewise arranged in three rows, one of which is turned towards the substratum.

The anatomical structure of the stem is also a very simple one. Its exterior cells have their walls somewhat more strongly thickened, and thus form a firmer rind-layer. We must also notice the secretion of dark-brown oily corpuscles, which undergo no further conversion, and are met with in certain leaf-cells. In the thallose forms the ramification is of a forked character (dichotomous) (fig. 1). Frequently too, on the older portions "adventitious" shoots are formed; they may frequently be seen to spring from the margin and the mid-rib of the thallus of *Metzgeria furcata*. The ramification of the foliose Liverworts is a very complex one, but is never of a really forked character. The branchlets commonly stand below the leaves on the sides of the stem.

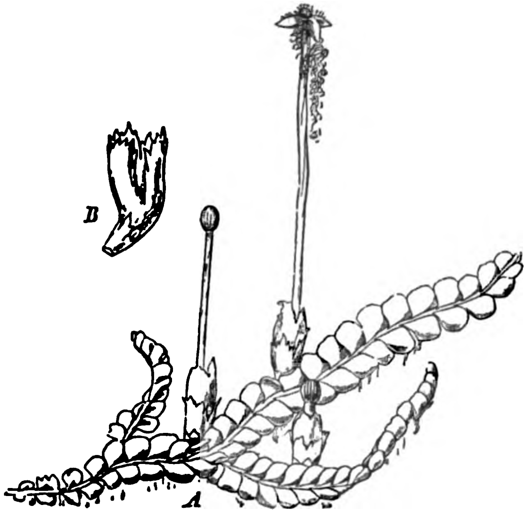


FIG. 4.—*A.* A leafy (foliose) *Jungermannia* (*Chiloscyphus polyanthos corda*) with three sporogonia; on the right above is one with the capsule open, while in the two others it is still closed. *B.* A "perianthium," with the perichætial leaves below.

The above-mentioned "adventitious" shoots serve the purpose of vegetative increase. The same end is attained by the gemmæ, which are of many different forms. In *Aneura* individual cells detach themselves from the thallus and grow up into new plants. In the *Marchantieæ* the gemmæ are formed in peculiar receptacles which stand on the upper side of the ribbon-shaped thallus. In *Marchantia polymorpha* these receptacles have the form of a basket open at the top, while in *Lunularia* the margin of the same receptacle is semicircular. The gemmæ, which are developed on the base of the receptacle, are flat upright cellular bodies, with two indentations at the sides, out of which at a later period, at the time of germination, proceed two growing points. The gemmæ, however, are of similar structure on both sides. Which side is at the time of germination to become dorsal with stomata and air-chambers, and which ventral with root-hairs, is decided by its position with respect to the light. It is always the side turned towards the light which develops itself into that which bears stomata. This occurs even when gemmæ that swim on water receive light only from below. In that case the under side becomes that which possesses stomata and the air-chambers described above, while the upper side develops root-hairs (rhizoids). *Blasia pusilla* has also very peculiar receptacles for gemmæ, provided with a long channel leading outwards, while in many foliose *Jungermannieæ*—for example, *Jungermannia ventricosa*, *Scapania nemorosa*, *Jungermannia bicuspidata*, and others—gemmæ consisting of a few cells are formed on the leaves or the stem respectively.

(2) *The Organs of Sex.*—The antheridium in Liverworts is a spherical or ellipsoidal cellular body with a shorter or longer stalk (fig. 5, *C*), and consists of a wall-layer and an interior tissue, the mother-cells of the spermatozoids. In each of these cells a spermatozoid is formed, and, as it appears, in the following way:—the peripheral layer of the cell-nucleus becomes thickened, and splits up into a ribbon, either annular or rolled up spirally. The cilia by means of which the spermatozoid moves in water appear, on the other hand, to be formed from the protoplasm in which the cell-nucleus lies. The process, however, requires still closer investigation. Each antheridium is originally a simple cell, which grows by repeated subdivision and becomes the antheridial body. By the swelling up of the walls of the spermatozoid mother-cells, the cells of the antheridium-wall are forced asunder at the apex, and the spermatozoids, each imbedded in mucilage, are emitted in jets either free from one another or united into a pulp. This pulp is often ejected by an explosion of the antheridium, as may be easily observed in *Frullania dilatata*. In water the spermatozoids isolate themselves, and in the most favourable cases are carried over to the archegonia. Since very many spermatozoids are formed in one antheridium, and since one or very few of these suffice for the fertilization of an archegonium, it is evident that an enormous number of them must perish.

The archegonia also proceed from one cell, through the division of which their construction is accomplished. They always take their origin from the cells of the upper surface, and the same is the case with those of *Anthoceros*, which, however, are sunk into the tissue of the thallus, so that their neck and ventral portions remain united with the tissue of the thallus and do not project freely over it.

The distribution of the organs of sex is either monœcious or diœcious. In the latter case the antheridia and archegonia are found on different individual plants, as in *Sphærocarpus terrestris*, where the male plant is smaller than the female. In the former case the antheridia and archegonia are found on the same plant. In the thallose forms they are always inserted on the dorsal side of the thallus, and commonly sunk into a cavity in it (fig. 5, *B*). In *Anthoceros* the antheridia even stand in closed cavities, which do not open till the antheridium is mature. The organs of sex stand either on ordinary branches, which at a later period vegetate and grow, or on special sexual shoots. These are of especially remarkable construction in the *Marchantieæ*, of which *Marchantia polymorpha* may serve as an example. In this species the antheridia are found on the upper side of a peltate radially-lobed disk, supported on a stalk (fig. 5, *A*). The archegonia stand on the under side of a similar receptacle. These structures may be termed "inflorescences." They are not simple branches, but systems of branches which have arisen from the repeated bifurcation of a thallus-shoot. Each indentation in the disk of the "inflorescence" corresponds to the vegetative point of a branch, and this explains the fact that the oldest antheridia are found in the centre of the disk; and from this point to the periphery, where the vegetative points are found, are successive groups of antheridia of younger growth, for the youngest organs of sex always stand next to the vegetative point of the shoot. The stalk of the inflorescence is nothing else than the inferior portion of the branch-system greatly prolonged. In the leafy *Jungermannieæ* the distribution of the organs of sex is also either monœcious or diœcious. The archegonia in this case stand either singly (*Lejeunia*, &c.) or in larger groups. The first archegonium always arises from the apical cell of the shoot connected with it, so that with it the latter closes its longitudinal growth. This circumstance has been employed in the classification of the foliose *Jungermannieæ* (with the exception of *Haplomitrium*) as *acrogynous* in contradistinction to the *anacrogynous*, in which latter the archegonia never proceed from the apex of the shoot itself.

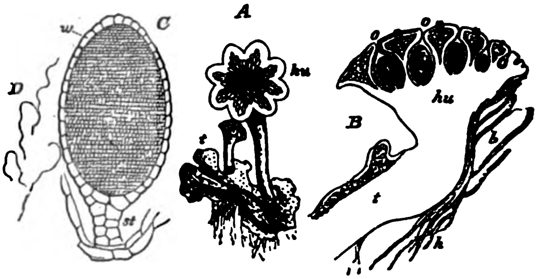


FIG. 5.—*Marchantia polymorpha.* *A.* Anterior portion of a thallus, *t*, with two erect antheridial inflorescences *hu*. *B.* Longitudinal vertical section through a young antheridial inflorescence. The antheridia are situated in depressions of the upper surface. *b*, scales; *h*, roots (rhizoids); *o*, *o*, the openings of the depressions in which the antheridia lie. *C.* A nearly mature antheridium; *st*, its stalk; *w*, the wall. *D.* Two spermatozoids, magnified 800 diameters. Each possesses two fine cilia. (After Sachs.)

Whilst the archegonia of the thallose forms are protected by being lodged in an excavation of the thallus, or surrounded by a luxuriant growth of its tissue, the archegonia of the foliose *Jungermannieæ* are enveloped by the leaves of the stem-bud, which on that account are termed perichætial leaves (*folia perichætialia*), or, collectively, perichætium. Between these perichætial leaves and the archegonia there grows up in most forms a second involucre, of a goblet or pitcher shape, the "perianthium" (fig. 4, *B*). It springs up in the form of a circular fence, gradually growing upwards. In many *Jungermannieæ* (*Calypogeia*) the archegonia are enclosed in a kind of sack-shaped structure, which forces its way into the ground, in which, in fact, it takes root. This "fruit-sac" in the *Jungermannieæ geocalyceæ* is the hollowed-out shoot from which the archegonia arise. Its extremity becomes thickened and forms a circular fence about the archegonia; thus there arises a structure about two twenty-fifths of an inch long, which is constantly becoming deeper, and at the bottom of which the archegonia are placed. There is always an endeavour to protect and envelop the archegonia. This is notably conspicuous in the *Marchantieæ*, where round every archegonium there grows after fertilization a special goblet-shaped involucre, whilst every group of archegonia is also enveloped by two scales, which incline towards each other like the valves of a mussel-shell.

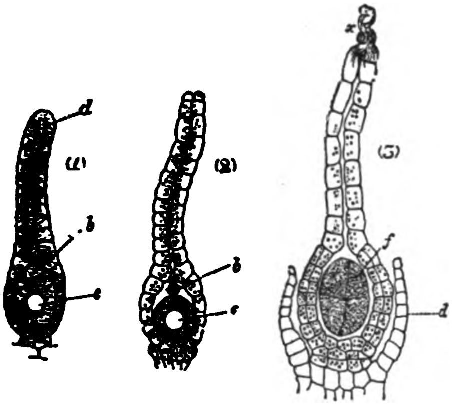


FIG. 6.—*Marchantia polymorpha.* Archegonia at different stages of development, in longitudinal section. (1) An archegonium not yet open; its neck portion is still covered at its point by the lid-cells *d*. In the ventral portion lies a large cell, which has divided into a small upper cell, the "ventral canal-cell," *b*, and a lower one, the oosphere. In (2) the neck portion of the archegonium is open; the oosphere has assumed a spherical form; the ventral canal-cell is shrivelled up. (3) A fertilised archegonium; the oosphere has become developed into an embryo, here consisting of eight cells; *d* is an involucre, which in *Marchantia* grows round the archegonium after fertilisation. (After Sachs.)

(3) *Development of the Asexual Generation of the Sporogonium.*—Just as in the vegetative classification we are led in a continuous series from the simple thallose forms to the foliose forms, so in the perfecting of the fertilised oosphere into an embryo (here the sporogonium) there is a gradual advance from simple to more complex forms. The first result of fertilization always is that the oosphere becomes surrounded by a membrane, grows, and transforms itself by division into a cellular body. In the simplest case, in *Riccia* (fig. 7, *A*), the only differentiation which takes place in this cellular body is that it forms a wall-layer which is soon reabsorbed, while the whole of the interior cells form spores in such a way that by division four spores proceed from every mother-cell. In *Marchantia* (fig. 7, *B*) we find a separation taking place in the embryo, in which the inferior portion (that beneath the line 1, 1) becomes the short stalk of the sporogonium and its superior portion becomes the capsule. In the *Jungermannieæ* (fig. 7, *C*, *E*, *F*) we find in the young embryo a group of cells from which proceed the mother-cells of the spores (shown by hatched lines in the figures); they are covered by a layer of cells which at a later period becomes the wall of the spore-capsule. Lower down (distinguished by a bracket in fig. 7, *C*) comes that part of the embryo out of which the stalk of the sporogonium is formed, while the cell *a* represents an appendage of the embryo. The inferior portion of the stalk often swells into a thickened foot, which frequently penetrates deeply into the tissue of the fertile shoot (fig. 8). The upper part of the sporogonium, in which the spores and elaters are formed, swells into a sphere. In the *Jungermannieæ*, when the sporogonium attains maturity, the stalk becomes very considerably lengthened, the ventral part of the archegonium, which had hitherto kept pace with it in growth, flies asunder, and the capsule emerges. This opens in various ways. In the *Jungermannieæ* the wall breaks up into four valves (fig. 4). The sporogonia of *Anthoceros* behave in a very peculiar manner. The period occupied by their development is much longer than that of the *Jungermannieæ*. While they are discharging mature spores at their apex they are still growing at their base, and forming new spores. The sporogonium dehisces by two valves, and is traversed in the middle line by a longitudinal string of cells not employed in the formation of spores. This persists till the maturation of the sporogonium as a little column, and is termed the "columella" (see fig. 7, *D*). The cells from which the mother-cells of the spores proceed have here the form of a dome and enclose an inner portion which becomes the columella, while the inferior portion of the embryo becomes its foot. In *Dendroceros*, a foreign form of *Anthoceros*, it drives tubules resembling roots into the tissue of the plant on which the sporogonium is seated. There is no want of transitional steps between this method of formation of the sporogonia and that of the *Jungermannieæ*. The species *Notothylas* is especially noteworthy in this respect.

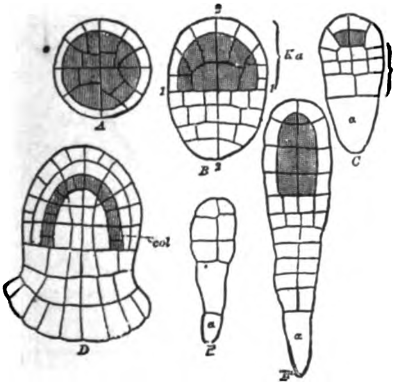


FIG. 7.—Young embryos of Liverworts in longitudinal section (semi-diagrammatic). The cells from the division of which the mother-cells of the spores proceed are shaded. *A.* A spherical embryo of *Riccia*, without stalk. *B. Marchantia polymorpha*; the upper part of the embryo *Ka* turns into the capsule, the lower part into the stalk. *C. Pellia epiphylla*; the cell *a* forms an appendage to the embryo; the stalk proceeds from the cells marked by brackets, and from those above is formed the capsule, whose wall and internal mass are now distinguishable. The whole inner portion of the capsule proceeds from the division of four cells. *D. Anthoceros lævis*; *col*, columella. *E. Jungermannia bicuspidata.* *F. Radula complanata.* *E* shows the arrangement of the cells of the embryo which is characteristic of the *Jungermannieæ*; it is composed of a number of transverse disks, which always consist of four cells.

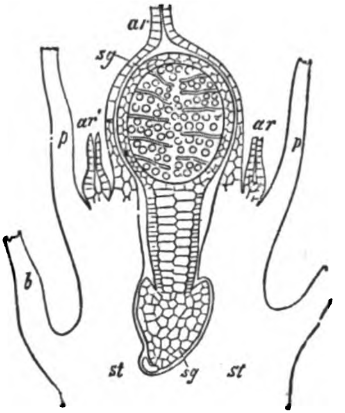


FIG. 8.—*Jungermannia bicuspidata.* Longitudinal section of the immature sporogonium *sg*, surrounded by *ar*, the calyptra (the ventral portion of the archegonium which has kept pace with it in growth). In the sporogonium three parts are to be distinguished: the globular capsule in which lie the mother-cells of the spores and the elaters, the cylindrical stalk which at a later period lengthens very considerably, and the swollen foot which has penetrated deeply into the tissue of the fruit-shoot. *ar'*, archegonia which have remained unfertilised; *p*, base of the perianthium; *st*, stem (fruit-shoot); *b*, leaf. (After Hofmeister.)

The spores, which proceed from one mother-cell by division into four parts, are enveloped by a membrane consisting of two layers—an outer one, which has the character of a cuticle in its great resistance to external agencies, and an inner one, which is composed of cellulose. The plants do not proceed directly from the germination of the spores; there is a pro-embryo of simple structure, which, however, in most cases passes over at its end into the plant itself. In the foliose *Jungermannieæ* the first step in germination is the springing up of a row of cells in the cell at the end of which the growth of the shoot next takes place. The young germ-plant next develops leaves of very simple structure, and at first there generally appear on it only two rows of leaves at the sides. In *Radula*, however, and *Frullania*, both of them leafy forms, a cake-like cell-surface is first developed in germination; and it is from one of the cells of the margin of this that the growth of the leafy plant proceeds.

CLASSIFICATION OF LIVERWORTS

A. *Marchantiaceæ.*

I. *Riccieæ.*—The vegetative body is a dichotomously branched thallus, on the dorsal side of which are air-chambers, either covered by an epidermis like the *Marchantieæ*, or opening outwards in their whole breadth. On the under side of the thallus is a row of scale-shaped lamellæ, which become split up at a later period. The sexual organs are scattered on the dorsal side of the ordinary shoots. In the spore-cavity are neither elaters nor sterile cells

II. *Corsinieæ.*—The organs of sex are united in groups, which stand in cavities on the dorsal side of the thallus. In the spore-space are sterile cells, which in *Boschia* are transformed into elaters. The dorsal side of the thallus possesses stomata.

III. *Marchantieæ.*—The thallus is ribbon-shaped, and has a layer of air-chambers on the dorsal side opening outwards through a stoma. On the ventral side are two rows of scales. In the spore-space are elaters. The formation of the "inflorescences" in the lowest forms agrees with those of *Corsinia*; in the highest forms they appear as branch-systems.

B. *Jungermanniaceæ.*

I. *Jungermannieæ.*—The vegetative body is a thallus without air-chambers, or is a leafy stem. Between these are transitional forms. The sporogonium is differentiated into capsule, stalk, and foot; the capsule dehisces by four valves.

(*a*) *Anacrogynous.*—The apex is not employed in the formation of the archegonium. To this division belong all the thallose forms (including *Blasia* and *Fossombronia*), as well as *Haplomitrium Hookeri*. In *Riella* and *Sphærocarpus* the capsule is without elaters, but possesses sterile cells morphologically corresponding to them. All the others have elaters.

(*b*) *Acrogynous.*—The apex or the apical cell itself is employed in the formation of the archegonium. All the forms are foliose, except *Haplomitrium*, which also, in the development of its leaves, does not correspond with the foliose forms, but with *Fossombronia*.

II. *Anthocerotess.*—Thallose forms. The archegonia, immediately on their first formation, are sunk into the tissue of the thallus. The antheridia stand in closed cavities. The formation of the sporogonium shows no distinction between stalk and capsule, but is pod-shaped and fixed by its swollen foot into the thallus. At maturity the sporogonium opens with two valves, between which the columella becomes visible. At its base it possesses a long and permanent growth.

II. Mosses (*Musci* or *Musci Frondosi*).

The Mosses proper play a much larger part in the economy of nature than the Liverworts; they occur in much greater quantity and are more widely distributed, the conditions of their production not being confined within such narrow limits. While the Liverworts, for the most part, thrive only in localities that are not too dry, though some forms that grow upon bark, such as *Radula* and *Frullania*, can even endure drought, Mosses, on the other hand, have an almost ubiquitous character. Many grow in water (*Conomitrium*, *Fontinalis*, &c.), in swamps (various kinds of *Hypnum* and others), on dry rocks (*Grimmia*, *Andreæa*), on roofs, in fields, and on trees,—in short, under favourable circumstances, a growth of Mosses develops itself almost everywhere. This is connected with the fact that very many have the capacity of enduring drought, and of suspending their growth while it continues and resuming it again in moist weather. Besides, a few, such as *Hypnum cupressiforme*, *Ceratodon*, *Barbula ruralis*, can grow upon any kind of substratum. Others grow by preference on organic substrata: as *Buxbaumia indusiata* on decayed trunks, *Splachnum* on old cowdung or on a damp humus-soil, *Orthotrichum* and the species of *Neckera* on the firm bark of trees, *Phascum* in manured fields, a great number like *Grimmia* and *Andreæa* on rocks. As regards the chemical quality of the substratum, we can distinguish between Mosses that live on chalk (*Seligeria*, the species of *Gymnostomum*, and some *Hypna*) and those that avoid chalk (*Andreæa*, *Dicranum*). The species of *Polytrichum* and *Thuidium abietinum* are fond of sandy soils, *Ephemerum*, *Fissidens taxifolius*, and others of loamy soils, while *Archidium phascoides* grows on muddy ground. This wide extension of the Leaf-mosses is rendered possible by their uncommonly great capacity for reproduction. Not only is the formation of spores in most species very extensively carried on, but we have to add to this the manifold production of asexual means of multiplication, such as gemmæ, &c. The sexual as well as the asexual generation of Mosses attains to a higher grade of perfection than that of Liverworts.

(1) *The Sexual Generation.*—The extent of the sexual generation of the Moss-plants proper varies within wide limits. While the stem of *Ephemerum* and some species of *Phascum* appears in the form of a small bud, often scarcely visible to the naked eye, there are species of more than 4 inches in length, as *Sphagnum*, *Fontinalis*, and the tropical species *Spiridens*. In every case, however, we have here a really leafy stem; no thallose forms exist.

The leaves are simple and always small. They either consist of one layer in their whole extent, or are traversed by a mid-rib of several layers, which is often of rather complex structure, and consists of thick-walled and thin-walled tissue-elements, of which the former give mechanical firmness to the leaf, while it is principally in the latter that the conveyance to the stem of the matter formed in the leaf takes place. In the species of *Polytrichum* the middle nerve occupies the greatest part of the leaf, and is covered with lamellæ, which consist of cells bearing chlorophyll. Instead of these lamellæ, we find in some other Mosses simple rows of cells, as in *Pharomitrium subsessile*. A peculiar structure of the leaf is also found in *Leucobryum glaucum* and *Sphagnum*. The first-named Moss forms thick greenish-white turfs in damp spots. A transverse section through a leaf shows it to be composed of two (or three) layers of cells. Above and below is a layer of large cells devoid of contents, the membrane of which is perforated in various places, so that the cavities of the individual cells communicate with each other; thus arises a system of capillary tubes which suck up water and retain it like a sponge. Between the angles of every two of these colourless cells we find inserted a cell containing chlorophyll. The colourless cells are filled with air instead of water, and thus the whole plant has a whitish appearance (*Leucobryum*), while the green hue comes out at the approach of moisture. The leaves of *Sphagnum* possess a similar structure. In these too are perforated cells devoid of contents, and surrounded by the meshes of cells containing chlorophyll. The inner wall of the empty cells devoid of chlorophyll is for the most part set with peculiar thickenings of annular or spiral form (fig. 9, *f*), which give it the necessary firmness, as in the vessels of higher plants. In this case too the empty perforated cells are intended for the purpose of absorbing water; and the same end is attained by cells of similar structure, which form the rind of the stem.

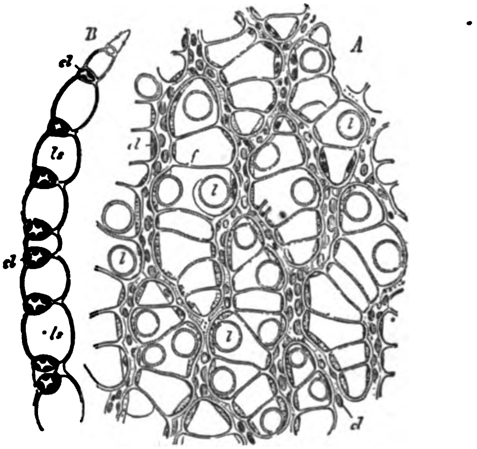


FIG. 9.—*Sphagnum acutifolium.* *A.* A part of the surface of the leaf, seen from above. It consists of tubular cells containing chlorophyll *cl*, and large empty cells, which are thickened on their inner surface by spiral bands *f*, and pierced in some places with openings *l*. *B.* Transverse section of the leaf; *cl*, cells containing chlorophyll; *ls*, the large empty cells. (After Sachs.)

The stem of Mosses is distinguished by its slight but uniform thickness, which for the most part does not exceed that of a thick thread. Compared with this delicacy, the compact, firm, and tough quality of the corresponding forms in higher plants is so much the more striking. It depends on the fact that the exterior layers of cells in the stem have thickened cell-walls, generally of a brown colour, while the central parts have thin walls. The differentiation of the tissues reaches its highest point in *Polytrichum*, *Hookeria*, *Splachnum*, and others. Strings of separated cells pass from the leaves into the stem, and apply themselves to its central tissue, which is of different conformation from the rest of the tissue of the stem,—a circumstance which requires mention because this is the first indication of the fact of such extensive occurrence among "vascular" plants that the vascular bundles which run off from the leaf pass into the stem and there apply themselves to others. The stems are thickly set with leaves. It is but seldom that these stand in two rows on the sides, as in *Fissidens*, *Conomitrium*, and the sterile shoots of *Schistostega*. The last-named plant is of special interest as possessing two kinds of shoots of totally different appearance. The fertile ones have their leaves placed on all sides of the stem in a spiral manner; the sterile ones, on the other hand, have leaves placed on two sides, and have the appearance of a fern-leaf. This position, however, only comes to pass through a shifting and twisting of the stem. Originally, in the bud, the leaves of the sterile stems stand in a spiral line. On examination of the end of the stem it is found that the growing point from which the leaves arise contains, as in the foliose Liverworts, an apical cell of the form of a three-sided pyramid with a vaulted base. By means of partition walls which are successively parallel to one of the side walls of the apical cell "segments" are cut off; and from each of these proceeds a leaf, as well as a part of the rind of the stem and of the inner tissue. On the direction of the partition walls in the apical cell depends likewise the arrangement of the leaves. The branches do not spring as in most phanerogamous plants from the axil of a leaf, but from the upper surface of the stem below a leaf, and only out of one of its cells which becomes the apical cell of the branch.

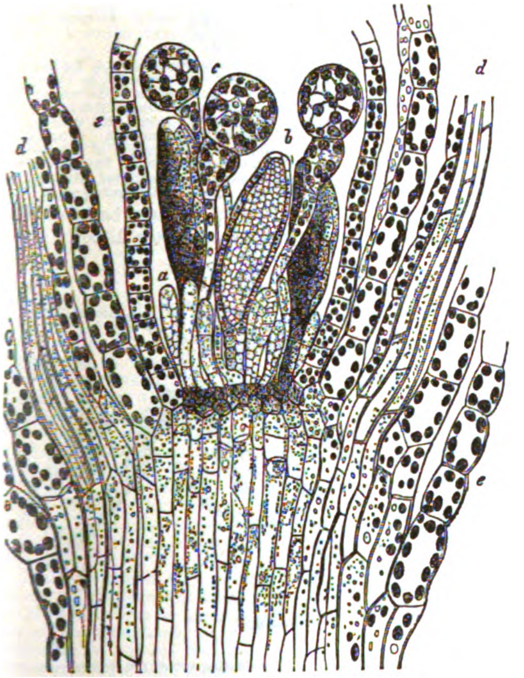


Fig. 10.—Longitudinal section through the summit of a small male plant of *Funaria hygrometrica*, with antheridia in various stages of development. *a* is a young antheridium—at its point is a "two-edged" apical cell; *b*, an antheridium, nearly mature; *c*, paraphyses, hair-like structures which stand between the antheridia and of which the terminal cells are swollen into a globular form; *d*, section of leaves through the mid-rib; *e*, section of leaves through the leaf-surface (lamina). Magnified 300 diameters. (After Sachs.)

In the relation of the ramification to the general structure of the moss-plant two leading classes have to be distinguished—the *acrocarpous* and *pleurocarpous* Mosses. In the former the growth of the stalk concludes with the formation of a sporogonium; for the archegonium, out of which the former springs, proceeds from the apical cell itself. In the pleurocarpous Mosses the sporogonium stands on the tip of a side-branch, and the growth of the principal stem is thus not interfered with by fructification. In many acrocarpous Mosses the stalk dies after fructification, and the Moss is then an annual, as in many *Phascaceæ*. In those acrocarpous Mosses which are perennial the further development is taken up by a side-branch, and a so-called "innovation" is formed. By the dying away of the principal stem, these innovation-shoots become at a later period independent plants. The roots consist of simple rows of cells, springing from the surface of the stem, especially at its base (see p. 72).

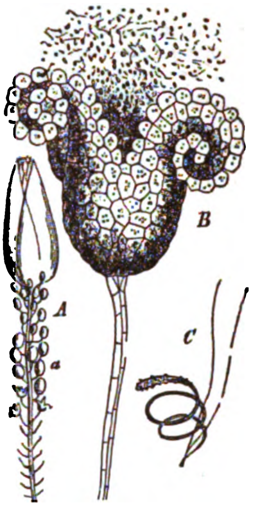


Fig. 11.—*Sphagnum acutifolium*. *A*. A male branch partially deprived of its leaves to show the antheridia *a*. *B*. An open antheridium, very highly magnified. *C*. A mature motile spermatozoid. (After Schimper.)

(2) *The sexual organs* of the Leaf-mosses, the antheridia and the archegonia, in their mature condition correspond in the main with those of the Liverworts, from which, however, they differ somewhat in their development. They occur generally in groups at the extremity of a shoot. Such groups containing, as the case may be, either solely antheridia, or solely archegonia, or a mixture of the two, are termed "flowers." An exception to this condition of the antheridia is found in *Sphagnum* (fig. 11, *A*). Here the antheridia do not stand in groups on the summit of the male branch, but are arranged along it, so as to stand beneath the leaves on the prolonged axis of the shoot. In the rest of the Mosses, with the exception of *Polytrichum*, the first antheridium (or archegonium) of a group proceeds from the apical cell itself; and thus the growth of the shoot connected with it is closed. The general character of the male "flowers" is very various, in the form of buds, heads, or disks. They are enveloped by a number of leaves, the "perigonium" (fig. 11). The male plants of diœcious Mosses are often considerably smaller than the female ones. This is the case with *Funaria hygrometrica*, and to a remarkable extent with *Dicranum undulatum* and *Leucobryum glaucum*. Diœcious Mosses are frequently sterile on account of the absence of one of the sexes. The female "flowers" (fig. 12) are in the shape of buds, enveloped by a number of leaves, which become smaller towards the inside. The archegonia have in general the same structure as those of Liverworts, but are distinguished by a very much developed stalk, diminishing towards the base in the form of a wedge

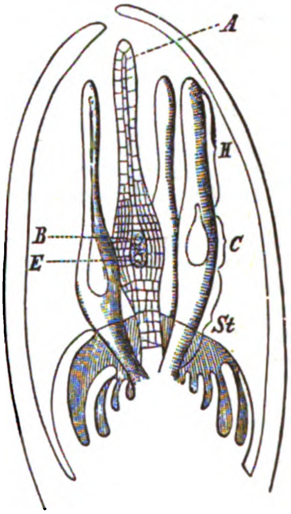


Fig. 12.—Longitudinal section through the female "flower" of *Sphagnum squarrosum*, which shows four archegonia with long stalks. *H*, the neck portion; *C*, the ventral portion; *St*, the stalk; *B*, ventral canal-cell; *E*, oosphere. The archegonium in the middle has proceeded from the apical cell of the shoot.

(fig. 12). They originate, as do the antheridia, from a single cell.

(3) *The development of the fertilised oosphere* into the sporogonium differs considerably from that of the Liverworts, both as regards the external processes of growth and as regards the differentiation in the interior of the embryo. In the first of these points the greatest resemblance to the Liverworts is exhibited by *Sphagnum*. Here the sporogonium continues almost till maturity to be enclosed by the ventral portion of the archegonium—the calyptra,—which keeps pace with it in growth, and which is irregularly ruptured by it at the period of maturity. *Archidium*, one of the *Phascaceæ*, behaves similarly. In all the other Mosses, however, the sporogonium at an early period bursts through the ventral portion of the archegonium, tearing off the calyptra at its base and raising it up as a cap. The sporogonium possesses a stalk which grows up gradually, but which in *Sphagnum*, *Andreæa*, and *Archidium* is very short. In the two first-named genera the shortness of the stalk is made up for by a stalk-like elongation of that portion of the stem on which the archegonium is placed. Thus arises a false stalk, a "pseudopodium," which is to be distinguished from the real stalk, which belongs to the sporogonium. The capsule is often of complex structure. In the *Bryineæ* it possesses a distinct epidermis, often provided with stomata, which is altogether wanting in the vegetative parts of Mosses. A few layers of cells are united to the epidermis, and together with it form the wall. The interior tissue is never entirely employed in the formation of spores, but a part of it remains as a sterile cell-body—the columella (fig. 13, *co*)—with the exception of *Archidium*, which in this respect approaches the Liverworts. The embryo, the young sporogonium, is originally fusiform (fig. 14, *B*, *C*), and is differentiated into capsule and stalk (*seta*). The latter commonly penetrates into the tissue of the fruit-shoot, which forms, outside the base of the sporogonium, an exuberant growth like a fence—the "vaginula"—on which we not unfrequently find archegonia that have miscarried (fig. 13, *v*).

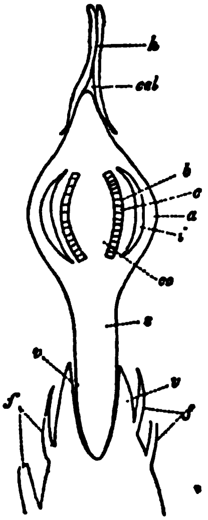


FIG. 13.—Longitudinal section through a half-developed sporogonium of *Phascum bryoides*. (The cells are not shown.) The sporogonium has torn away the ventral portion of the archegonium from its base and lifted the upper part of the archegonium as a cap (calyptra; *cal* in fig.). Beneath the calyptra is the capsular portion of the sporogonium. In its wall-layer there has been formed an annular intercellular space *a*, filled with air. The cells from which the mother-cells of the spores proceed (archesporium) are marked *c*; *co*, columella; *b*, endotherium; *h*, neck of archegonium; *i*, air-space; *s*, stalk of the sporogonium (seta); *v*, vaginula; *f*, leaves of the shoot that bears the archegonia. Magnified 60 diameters.

In Mosses, as in Liverworts, the spores proceed from the division of one mother-cell into four parts. The phenomena of their germination are very peculiar. In the great majority of the Mosses there arise from the germinating spore cellular filaments resembling Confervæ. They have quite the appearance of Algæ, and formerly were even confounded with them. They bear the name of *protonema*, and often form a thick green covering on the ground in forests. Such a protonema consists of two parts: one above and the other below the ground. Both are rows of cells, but those above the ground contain chlorophyll and have transverse walls placed rectangularly, while those below the ground contain no chlorophyll and their transverse walls are placed obliquely. They serve as roots for the protonema, and of similar structure are the roots (rhizoids) which spring from the surface of the leafy stem, especially from its base. On this protonema, and especially from the basal cells of the threads which are above ground, the moss-stem is formed. This originates from an outward pouching of one of these cells, and this becomes the apical cell of a moss-stem. Several moss-plants may be formed on one and the same protonema, which has itself proceeded from one spore. The spores of the Bog-moss (*Sphagnum*) form quite another kind of pro-embryo when they germinate on damp earth. They then transform themselves into an intricately ramified expansion or cell-surface; and any cell of this surface may then become the apical cell of the stem. When they germinate in water the spores of *Sphagnum* form a thread-like pro-embryo. In some other Mosses too, especially *Andreæa*, *Tetraphis*, and *Diphyscium*, remarkable forms of pro-embryo occur, which, however, can only be alluded to here. In no case does a moss-spore grow directly into a moss-stem.

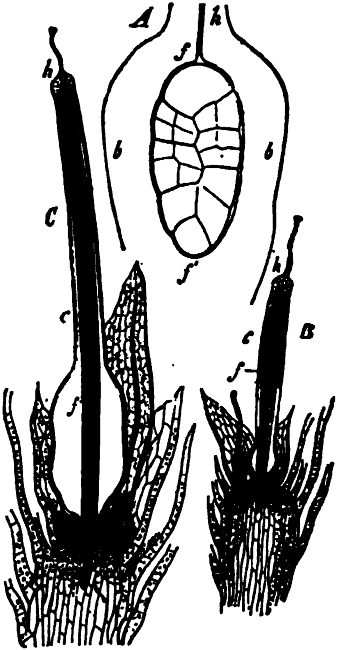


FIG. 14.—*Funaria hygrometrica*. *A*. Rudiment of the sporogonium or embryo *f f'*, in the ventral portion of the archegonium. The embryo is a cellular body, showing at its point a large "two-edged" wedge-shaped apical cell, which forms segments on the right and left. *B* and *C* are further stages of development of the sporogonium *f*, and of the calyptra *c*. The inferior portion of the embryo has penetrated into the tissue of the shoot. *h*, neck of the archegonium.

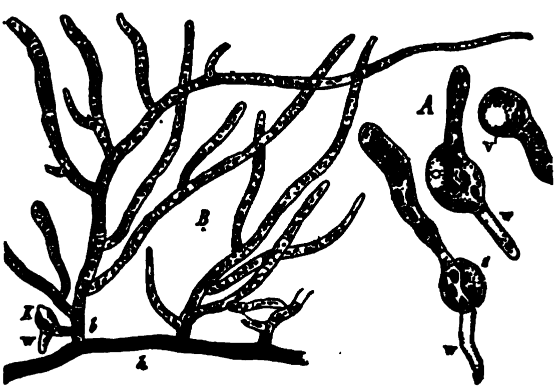


FIG. 15.—*Funaria hygrometrica*. *A*. Germinating spores; *v*, vacuole; *w*, root; *s*, exosporium. *B*. Part of a developed protonema, about three weeks after germination; *h*, a procumbent primary shoot with brown wall and oblique septa, out of which arise ascending branches of limited growth *b*; *K*, rudiment of a leaf-bearing axis with root *w*. *A* is magnified 550, *B* about 90 diameters.

Mosses propagate themselves very extensively, not only by means of spores, but in a vegetative way. Every one of the hair-shaped roots (rhizoids) which spring out of the stem has the power, when exposed to the light, of forming protonema, and moss-buds upon this. On this depends the fact that the Mosses which grow on tiled roofs (*Grimmia* and others) are hardly to be extirpated. Even if the turf is removed, the roots that have made their way into the pores of the tiles still survive, and develop protonema, and new moss-plants upon this. In *Phascum* and *Ephemerum*, which are apparently annual Mosses, the protonema is perennial, and forms new plants in the following year. Gemmæ also arise in abundance on the protonema (*e.g.*, of the species of *Barbula*)—cellular bodies which are surrounded by a dark-coloured membrane, and whose cells are densely filled with a store of material. They are able to endure drought, and on germinating they either form moss-buds directly or protonema in the first place. Protonema may also proceed directly from the cells of the leaves and stems of moss-plants, and thus subserve their multiplication. Portions even of the sporogonium may transform their cells back into protonema. If we cut off young sporogonia and place them in damp sand, there will arise from their interior cells (or the wall of the capsule) threads of protonema, on which new plants spring up. Many Mosses also possess special gemmæ. In *Tetraphis pellucida* they are stalked cellular bodies, enveloped by a leafy calyx, from which at a later period they fall away. In *Aulacomnium androgynum* they spring from the extremity of a leafless prolongation of the stalk, in *Grimmia Hartmanni* and *Barbula papillosa* from the leaves, &c.

CLASSIFICATION OF MOSSES.

1. *Sphagnaceæ.*—The Turf-mosses are characterized as well by their anatomical structure as by the development of their sporogonia. The stem, which at first is unbranched, possesses roots only in its earliest stage. The stems then stand in a thickly-set turf, and receive water through the whole of their surface. The ramification is very abundant. Two kinds of branches are formed in the terminal buds—long whip-shaped "flagellæ" which hang down, and whose duration is annual; and besides these there is formed every year, after the fruit has reached maturity, a side shoot called an "innovation," which acts in the same way as the main stem, and at a later period becomes an independent plant. The sexual organs, antheridia and archegonia, are developed on the side branches. The peculiar structure of the leaves has been already mentioned. That of the stem is analogous to it. The latter possesses a rind, formed out of cells with thin walls, whose protoplasmic contents have completely disappeared. Like the empty cells of the leaf, they are penetrated by openings, and thus form a system of narrow capillary tubes which stand in connexion with each other and open outwards, and through which the water mounts upwards.

The branches that bear the male "flowers" make an approach to those of the Liverworts in the fact that the antheridia do not stand on the summit of the shoot, but singly close to its leaves. On the other hand, the archegonia agree in their position and development with those of the other Mosses. The embryo—the young sporogonium—is at first a pear-shaped body of cellular tissue, the basal portion of which penetrates deeply into the soft tissue of the fruit-branches on which the archegonium is seated. The sporogonium differs considerably from that of the other Mosses. Those cells which give origin to the mother-cells of the spores—termed collectively "archesporium"—form a dome-shaped layer in the upper portion of the embryo; thus they are not traversed by the sterile cellular tissue, the columella. Each mother-cell is divided as usual into four spores. The short stalk of the capsule extends itself at maturity only so far as to cause the sporogonium to break through the calyptra, the place of a stalk being practically supplied by the "pseudopodium."[1] The pro-embryo is a cell-surface.

2. The *Andreæaceæ* are small blackish Mosses growing on rocks. Their antheridia resemble those of the other Mosses. The development of the embryo is anomalous. The archesporium is, as in *Sphagnum*, a dome-shaped layer of cells. On the extremity of the mature capsule is placed the calyptra, which has been torn away, as a delicate cap. The mode of dehiscence of the capsule here reminds us of the Liverworts. This takes place by four longitudinal clefts, which allow the exit of the spores, and are open in dry and closed in damp weather. In this group also the stalk of the sporogonium remains short, its place being supplied by a "pseudopodium."

3. The *Phascaceæ*, which are small and generally annual Mosses, are distinguished from the following division by the fact that the capsule does not open by separation of a lid, but remains closed, and the spores are not set free till the wall of the capsule decays. A remarkably anomalous form is *Archidium*; the development of its embryo reminds us of that of the Liverworts; the mature sporogonium also possesses no calyptra, but breaks through the ventral portion of the archegonium like that of *Sphagnum* and that of the Liverworts. The *Phascaceæ* are termed "cleistocarpous" in contradistinction to the "stegocarpous" Mosses.

4. The *Bryineæ* comprehend by far the greatest number of all the species of Mosses. They are characterized above all by the structure of their sporogonia. Here the parts of the latter are always the longer or shorter bristle-shaped stalk (seta), the capsule, and the calyptra carried up on its summit. That part of the stalk where it passes into the capsule is termed *apophysis*; on its epidermis, as well as on that of the capsule, we almost always find stomata. As regards the structure of the capsule, at a very early period a space filled with air makes its appearance, which divides the interior mass from the wall, which is composed of several layers. This interior complex mass of tissue consists of those cells which give rise to the mother-cells of the spores (the archesporium), of a few layers of cells which surround these only externally, and of an inner mass of tissue, the columella. The latter, however, passes in this case through the cells of the archesporium; these latter form, as in the *Phascaceæ*, a stratum of cells which has the form of a barrel, open above and below (fig. 13), and encloses the columella. The *Bryineæ* are also characterized by the way in which the capsule opens. The upper part of the wall of the capsule is in this case always thrown off as a lid (operculum). This happens in one of two ways: either a layer (or several layers of cells lying upon one another), placed between the inferior portion of the capsule and the operculum, forms a ring (annulus), the cell-walls of which become thickened and partially swollen, so that the annulus becomes loosened and thus causes separation of the operculum and the capsule from each other, or there remains simply a thin-walled annular zone of cells belonging to the wall of the capsule, which splits asunder in dry weather. When the operculum falls away the margin of the open capsule appears in most cases set round with a single or double ring of tooth-like formations, which are termed *peristome*. This is wanting in *Gymnostomum* and *Hymenostomum*. It occurs in its simplest form in *Tetraphis*. Here the epidermis of the upper conical portion falls off as an operculum, while the whole tissue that lies beneath splits crosswise into four valves, which form the peristome. In the other Mosses, with the exception of *Polytrichum*, the teeth of the peristome have an essentially different origin. They are in fact nothing but the thickened portions of cell-membranes, whose unthickened portions have perished and been torn asunder. Fig. 16 shows a portion of a longitudinal section through the upper part of the capsule of *Funaria hygrometrica*.

The capsule possesses a brown epidermis *e*, whose walls are greatly thickened; as is the tissue that lies between the epidermis and the air-spaces *h*, *l* of the capsule; *s* the mother-cells of the spores, and farther inwards follows the columella. Immediately above the air-space rises the stratum of cells which forms the peristome, of one tooth of which a longitudinal section is given in fig. 16. It arises from the great thickening of the outer side of the walls of a row of superposed cells. At maturity the upper portion of the wall of the capsule falls off as an operculum, the cells marked *p* disappear, and only the thickened parts of the cell-membranes remain as the teeth of the peristome. In *Funaria* and in other cases the peristome is double, for those cell-walls (fig. 16, *i*)

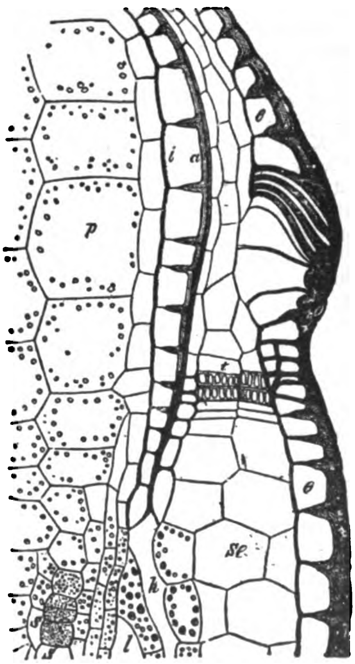


FIG. 16.—Part of a longitudinal section through the upper part of a capsule of *Funaria hygrometrica*. At *i* and *a* are the teeth of the peristome; *t*, pointed cells. (After Sachs.)

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[1] The possession of an elastic stalk has this advantage for the sporogonium, that it promotes the scattering abroad of the spores by means of the wind.

which look inwards of the stratum of cells which forms the peristome have also in these cases become somewhat thickened, and continue as "cilia," while the thin portions of membrane placed at right angles to them perish. In other cases (*Fontinalis antipyretica*) the peristome forms a lattice-work. The number of teeth in the peristome is always four, or a multiple of four. They are very hygroscopic; their function is to close up the opening of the capsule in wet weather, and so to hinder the exit of the spores, which are scattered abroad by the wind. In the same way also any germination of the spores in the interior of the capsule is prevented. The columella shrivels up after the formation of the spores, so that at that time we find nothing in the capsule but the spore-dust. The *Polytrichaceæ* have special arrangements for the protection of the spores. Here the opening of the capsule is covered over by a kind of plate ("epiphragma"), which is supported by thirty-two or sixty-four teeth, consisting of fibre-like cells.

Retrospective View.—Comparing generally the Mosses with the Liverworts, we see that, however great the variety of the forms they comprehend, they still form two connected series. In several of the subdivisions of the Leaf-mosses conditions occur which remind us of the Liverworts. Such are, in *Sphagnum*, the form and position of the antheridia, the tearing open of the ventral portion of the archegonium, and the want of a "calyptra" on the sporogonium which proceeds from it. This last is also found in *Andreæa*, in which the method of opening of the sporogonium likewise reminds us of the Liverworts. Among the *Phascaceæ*, the *Archidium* agrees with Liverworts in the absence of a columella. Some few cells in the interior of the sporogonium are formed into mother-cells of spores, and push aside the rest of the tissue. Here, too, the calyptra is absent.

The simplest Liverworts make a near approach to the Algæ. The sporogonium of *Riccia* is of scarcely higher organization than the mass of tissue which proceeds from the fertilized ovum-cell of *Coleochæte*, a green freshwater Alga. Among plants of a higher order we find no group closely allied to the Muscineæ. It is true that the Ferns have a perfectly analogous alternation of generations, but it is not a sporogonium which is produced from the fertilized oosphere, but the leafy fern-plant. No transitional forms occur between these two sections; the chasm which divides them is the widest with which we are acquainted in the whole vegetable kingdom. (K. E. G.)

MUSES, The, according to the view which prevailed among the Greek writers and has become a commonplace of modern literature, were nine goddesses who presided over the nine principal departments of letters: Calliope, Muse of epic poetry; Euterpe, of lyric poetry; Erato, of erotic poetry; Melpomene, of tragedy; Thalia, of comedy; Polyhymnia, of the hymn as used in the worship of the gods; Terpsichore, of choral song and the dance which formed its necessary accompaniment; Clio, of history; and Urania, of astronomy. They are represented in ancient art as fully draped figures characterized by attitude, dress, and symbols appropriate to the departments over which they presided. In the simpler conception that prevails in earlier literature they were said to be daughters of Zeus and Mnemosyne, *i.e.*, memory personified. In chorus round the altar of Zeus they sing the origin of the world, of gods, and of men, the might and the glorious deeds of Zeus. At the banquets of the gods their joyous music is heard. They honour also the great heroes; they sing at the marriage of Cadmus and of Peleus; their mourning song at the death of Achilles drew tears from both gods and men. They know all things past and future and impart to their chosen poets the knowledge and the skill to write. They are usually maiden goddesses, but some of the mythic poets—Orpheus, Linus, Ialemus—are said to be sons of a Muse.

This conception of the number and character of the Muses is as old as Hesiod and the *Odyssey* (xxiv. 60), yet it is far removed from the genuine religious stratum out of which the poets fashioned it. The religion of the Muses had two chief seats, on the northern slope of Mount Olympus around Dion in Pieria, by the holy springs Leibethron and Pimpleia, and on the slope of Mount Helicon near Ascra and Thespiæ. Nothing is known of the cultus in its older form, but it appears to have been connected with the religion of Dionysus. The Muses must have been originally a variety of the Nymphs (see NYMPHS), the spirits of nature who live in the fountains and forests; hence they are associated with Pegasus, the winged horse of the thunder-cloud. The half-mythic race called Thracian, which is specially associated with the two localities where the worship of the Muses had its seat, survived in Greek memory as a race of bards; and this character of the race coloured its conception of the spirit-life which it saw in nature. The spirits who know or who remember (*Μοῦσα = Μοντια*, from *man*, to think) sang to them in the voice of the water and the trees. At first they gave no definite number or form to their conception of these spirits; the number nine is the invention of a later time and of a different order of thought, and some accounts speak of three Muses or of a single Muse.

MUSHROOM. There are few more useful, more easily recognized, or more delicious members of the vegetable kingdom than the common mushroom (*Agaricus campestris*, L.). It grows in short grass in the temperate regions of all parts of the world. Many edible Fungi depend upon minute and often obscure botanical characters for their determination, and may readily be confounded with worthless or poisonous species, but that is not the case with the Common Mushroom, for, although several other species of *Agaricus* somewhat closely approach it in form and colour, yet the true mushroom, if sound and freshly gathered, may be distinguished from all other Fungi with great ease. It almost invariably grows in rich, open, breezy pastures, in places where the grass is kept short by the grazing of horses, herds, and flocks. Although this plant is popularly termed the "meadow mushroom," it never as a rule grows in meadows. It never grows in wet boggy places, never in woods, or on or about stumps of trees. An exceptional specimen or an uncommon variety may sometimes be seen in the above-mentioned abnormal places, but the best, the true, and common variety of our tables is the produce of short, upland, wind-swept pastures. A true mushroom is never large in size; its cap very seldom exceeds 4, at most 5 inches in diameter. The large examples measuring from 6 to 9 or more inches across the cap belong to *Agaricus arvensis* (Sch.), called from its large size and coarse texture the Horse Mushroom, which grows in meadows and damp shady places, and though generally wholesome is coarse and sometimes indigestible. The mushroom usually grown in gardens or hot-beds, in cellars, sheds, &c., is a distinct variety, known as *Agaricus hortensis* (Cke.). This is a compact and inferior form of the true mushroom, or it may indeed be a hybrid or even a distinct species.

The parts of a mushroom consist chiefly of stem and cap; the stem is furnished with a clothy ring round its middle, and the cap is furnished underneath with numerous radiating coloured gills. In the accompanying illustration (1) represents a section through an infant mushroom, (2) a mature example, and (3) a longitudinal section through a fully-developed mushroom. The cap D, E is fleshy, firm, and white within, never thin and watery; externally it is pale brown, dry, often slightly silky or floccose, never viscid. The cuticle of a mushroom readily peels away from the flesh beneath, as shown at F. The cap has a narrow dependent margin or frill, as shown at G, and in section at H; this dependent frill originates in the rupture of a delicate continuous wrapper, which in the infancy of the mushroom entirely wraps the young plant; it is shown in its continuous state at J, and at the moment of rupture at K. The gills underneath the cap L, M, N are at first white, then rose-coloured, at length brown-black. A point of great importance is to be noted in the attachment of the gills near the stem at O, P; the gills in the true mushroom are (as shown) usually more or less free from the stem, they never grow boldly against it or run down it; they may sometimes just touch the spot where the stem joins the bottom of the cap, but never more; there is usually a slight channel, as at P, all round the top of the stem. When a mushroom is perfectly ripe and the gills are brown-black in colour, they throw down a thick dusty deposit of fine brown-black or purple-black spores; it is essential to note the colour. The spores on germination make a white felted mat, more or less dense, of mycelium; this, when compacted with dry, half-decomposed dung, is the mushroom spawn of gardeners (see HORTICULTURE, vol. xii. p. 284). The stem is firm, slightly pithy up the middle, but never hollow; it is furnished with a floccose ring near its middle, as illustrated at Q, Q; this ring originates by the rupture of the thin general wrapper K of the infant plant. On being cut or broken the flesh of a true mushroom remains white or nearly so, the flesh of the coarser Horse Mushroom changes to buff or sometimes to dark brown. To summarise the characters of a true mushroom:—it grows only in pastures; it is of small size, dry, and with unchangeable flesh; the cap has a frill; the gills are free from the stem, the spores brown-black or deep purple-black in colour, and the stem solid or slightly pithy. When all these characters are taken together no other mushroom-like fungus—and nearly a thousand species grow in Britain—can be confounded with it.

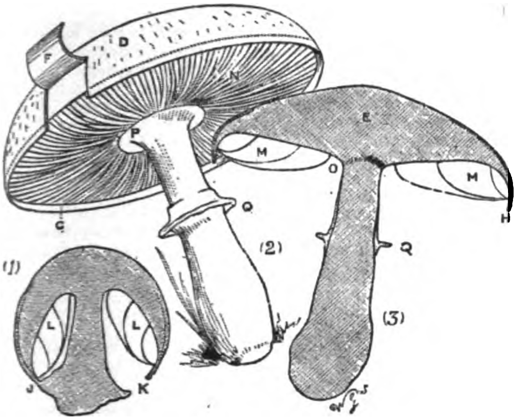

FIG. 1.—Pasture Mushroom (*Agaricus campestris*, L.).

Like all widely-spread and much-cultivated plants, the edible mushroom has numerous varieties, and it differs in different places and under different modes of culture in much the same way as our kitchen-garden plants differ from the type they have been derived from, and from each other. In some instances these differences are so marked that they have led some botanists to regard as distinct species many forms usually esteemed by others as varieties only.

A small variety of the common mushroom found in pastures has been named *A. pratensis* (Vitt.); it differs from the type in having a pale reddish-brown scaly top, and the flesh on being cut or broken changes to pale rose-colour. A variety still more marked, with a darker brown cap and the flesh changing to a deeper rose, and sometimes blood-red, has been described as *A. rufescens* (Berk.). The well-known compact variety of mushroom-growers, with its white cap and dull purplish clay-coloured gills is *A. hortensis* (Cke.). Two sub-varieties of this have been described under the names of *A. Buchanani* and *A. elongatus*, and other distinct forms are known to botanists. A variety also grows in woods named *A. silvicola* (Vitt.); this can only be distinguished from the Pasture Mushroom by its elongated bulbous stem and its externally smooth cap. There is also a fungus well known to botanists and cultivators which appears to be intermediate between the pasture variety and the wood variety, named *A. vaporarius* (Otto). The large rank Horse Mushroom, now generally referred to as *A. arvensis* (Sch.), is probably a variety of the Pasture Mushroom; Sowerby has described it under the name of *A. Georgii* and Dr Badham as *A. exquisitus*; it has also been published as *A. edulis*. It grows in rings in woody places and under trees and hedges in meadows; it has a large scaly round cap, and the flesh quickly changes to buff or brown when cut or broken; the stem too is hollow. An unusually scaly form of this has been described as *A. villaticus* and another as *A. augustus*. Dr Badham has also described a variety under the name of *A. anceps*.

A species, described by Berkeley and Broome as distinct from both the Pasture Mushroom and Horse Mushroom, has been published under the name of *A. elvensis*. This grows under oaks, in clusters,—a most unusual character for the mushroom. The species is said to be excellent for the table. An allied fungus peculiar to woods, with a less fleshy cap than the true mushroom, with hollow stem, and strong odour, has been described as a close ally of the Pasture Mushroom under the name of *A. silvaticus* (Sch.); its qualities for the table have not been described.

Many instances are on record of symptoms of poisoning, and even death, having followed the consumption of plants which have passed as true mushrooms; these cases have probably arisen from the examples consumed being in a state of decay, or from some mistake as to the species eaten. It should always be specially noted whether the fungi to be consumed are in a fresh and wholesome condition, otherwise they act as a poison in precisely the same way as does any other semi-putrid vegetable or putrid meat. Many instances are on record where mushroom-beds have been invaded by a growth of strange fungi and the true mushrooms have been ousted to the advantage of the new-comers; such instances are very perplexing, but they tend to show that a proper supervision should be kept over fungi when used for food as over other vegetables, fruit, meat, and fish. When mushrooms are gathered for sale by persons unacquainted with the different species mistakes are of frequent occurrence. A very common spurious mushroom in markets is *A. velutinus* (P.), a slender, ringless, hollow-stemmed, black-gilled fungus, common in gardens and about dung and stumps; it is about the size of a mushroom, but thinner in all its parts and far more brittle; it has a black hairy fringe hanging round the edge of the cap when fresh. Another spurious mushroom, and equally common in dealers' baskets, is *A. lacrymabundus* (Fr.); this grows in the same positions as the last, and is somewhat fleshier and more like a true mushroom; it has a hollow stem and a slight ring, the gills are black-brown mottled and generally studded with tear-like drops of moisture. In both these species the gills distinctly touch and grow on to the stem. Besides these there are numerous other black-gilled species which find a place in baskets,—some species far too small to bear any resemblance to a mushroom, others large and deliquescent, generally belonging to the stump- and dung-borne genus *Coprinus*. The true mushroom itself is to a great extent a dung-borne species, therefore mushroom-beds are always liable to an invasion from other dung-borne forms. The spores of all fungi are constantly floating about in the air, and when the spores of dung-infesting species alight on a mushroom-bed they find a nidus already prepared that exactly suits them; and if the spawn of the new-comer becomes more profuse than that of the mushroom the stranger takes up his position at the expense of the mushroom. There is also a fungus named *Xylaria vaporaria* (B.), which sometimes fixes itself on mushroom-beds and produces such an enormous quantity of string-like spawn that the entire destruction of the bed results. The spawn is sometimes so profuse that it is pulled out of the beds in enormous masses and carted away in barrows.

Sometimes cases of poisoning follow the consumption of what have really appeared to gardeners to be true bed-mushrooms, and to country folks as small Horse Mushrooms. The case is made more complicated by the fact that these highly-poisonous forms now and then appear upon mushroom-beds to the exclusion of the mushrooms. This dangerous counterfeit is *A. fastibilis* (Fr.), or sometimes *A. crustuliniformis* (Bull.), a close ally if not indeed a mere variety of the first. A description of one will do for both, *A. fastibilis* being a little the more slender of the two. Both have fleshy caps, whitish, moist, and clammy to the touch; instead of a pleasant odour, they have a disagreeable one; the stems are ringless, or nearly so; and the gills, which are palish clay-brown, distinctly touch and grow on to the solid or pithy stem. These two fungi usually grow in woods, but sometimes in hedges and in shady places in meadows, or even, as has been said, as invaders on mushroom-beds. The pale clay-coloured gills, offensive odour, and clammy or even viscid top are decisive characters. A reference to the accompanying illustration (fig. 2), which is about one-half natural size, will give a good idea of *A. fastibilis*; the difference in the nature of the attachment of the gills near the stem is seen at R, the absence of a true ring at S, and of a pendent frill at T. The colour, with the exception of the gills, is not unlike that of the mushroom. In determining fungi no single character must be relied upon as conclusive, but all the characters must be taken together. Sometimes a beautiful, somewhat slender, fungus peculiar to stumps in woods is mistaken for the mushroom in *A. cervinus* (Sch.); it has a tall, solid, white, ringless stem and somewhat thin brown cap, furnished underneath with beautiful rose-coloured gills, which are free from the stem as in the mushroom, and which never turn black. It is probably a poisonous plant, belonging, as it does, to a dangerous cohort. Many other species of *Agaricus* more or less resemble *A. campestris*, notably some of the plants found under the sub-genera *Lepiota*, *Volvaria*, *Pholiota*, and *Psalliota*, but when the characters are noted they may all with a little care be easily distinguished from each other. The better plan is to discard at once all fungi which have not been gathered from open pastures; by this act alone more than nine-tenths of worthless and poisonous species will be excluded.

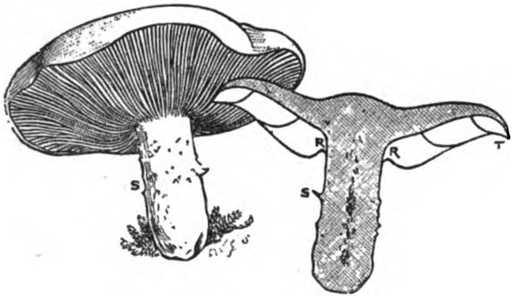

FIG. 2.—Poisonous Mushroom (*Agaricus fastibilis*, Fr.)

In cases of poisoning by mushrooms immediate medical advice should be secured. The dangerous principle is a narcotic, and the symptoms are usually great nausea, drowsiness, stupor, and pains in the joints. A good palliative is sweet oil; this will allay any corrosive irritation of the throat and stomach, and at the same time cause vomiting.

The mode of cultivating mushrooms artificially out of doors and in sheds is described under HORTICULTURE, vol. xii. p. 284. Paris mushrooms are cultivated in enormous quantities in dark underground caves at a depth of from 60 to 160 feet from the surface. The stable manure is taken into the tortuous passages of these caves, and the spawn introduced from masses of dry dung where it occurs naturally. In France mushroom-growers do not use the compact blocks or bricks of spawn so familiar in England, but much smaller flakes or "leaves" of dry dung in which the spawn or mycelium can be seen to exist. Less manure is used in these caves than we generally see in the mushroom-houses of England, and the surface of each bed is covered with about an inch of fine white stony soil. The beds are kept artificially moist by the application of water brought from the surface, and the different galleries bear crops in succession. As one is exhausted another is in full bearing, so that by a systematic arrangement a single proprietor will send to the surface from 300 ℔ to 3000 ℔ of mushrooms per day. The passages sometimes extend over several miles, the beds sometimes occupying over 20 miles, and, as there are many proprietors of caves, the produce of mushrooms is so large that not only is Paris fully supplied, but vast quantities are forwarded to the different large towns of Europe; the mushrooms are not allowed to reach the fully-expanded condition, but are gathered in a large button state, the whole growth of the mushroom being removed and the hole left in the manure covered with fine earth. The beds remain in bearing for six or eight months, and then the spent manure is taken to the surface again for garden and field purposes. The equable temperature of these caves and their freedom from draught is one cause of their great success; to this must be added the natural virgin spawn, for by continually using spawn taken from mushroom-producing beds the potency for reproduction is weakened. The beds produce mushrooms in about six weeks after this spawning.

The Fairy-ring Champignon.—This fungus, *Marasmius Oreades* (Fr.), is more universally used in France and Italy than in England, although it is well known and frequently used both in a fresh and in a dry state in England. It is totally different in appearance from the Pasture Mushroom, and, like it, its characters are so distinct that there is hardly a possibility of making a mistake when its peculiarities are once comprehended. It has more than one advantage over the Meadow Mushroom in its extreme commonness, its profuse growth, the length of the season in which it may be gathered, the total absence of varietal forms, its adaptability for being dried and preserved for years, and its persistent delicious taste. It is by many esteemed as the best of all the edible fungi found in Great Britain. Like the mushroom, it grows in short open pastures and amongst the short grass of open roadsides; sometimes it appears on lawns, but it never occurs in woods or in damp shady places. Its natural habit is to grow in rings, and the grassy fairy-rings so frequent amongst the short grass of downs and pastures in the spring are generally caused by the nitrogenous manure applied to the soil in the previous autumn by the decay of a circle of these fungi. Many other fungi in addition to the Fairy-ring Champignon grow in circles, so that this habit must merely be taken with its other characters in cases of doubt.

A glance at the illustration (fig. 3) will show how entirely the Fairy-ring Champignon differs from the mushroom. In the first place, it is about one-half the size of a mushroom, and whitish-buff in every part, the gills always retaining this colour and never becoming salmon-coloured, brown, or black. The stem is solid and corky, much more solid than the flesh of the cap, and perfectly smooth, never being furnished with the slightest trace of a ring. The buff-gills are far apart (V), and in this they greatly differ from the somewhat crowded gills of the mushroom; the junction of the gills with the stem (W) also differs in character from the similar junction in the mushroom. The mushroom is a semi-deliquescent fungus which rapidly falls into putridity in decay, whilst the champignon dries up into a leathery substance in the sun, but speedily revives and takes its original form again after the first shower. To this character the fungus owes its generic name (*Marasmius*) as well as one of its most valuable qualities for the table, for examples may be gathered from June to November, and if carefully dried may be hung on strings for culinary purposes and preserved without deterioration for several years; indeed, many persons assert that the rich flavour of these fungi increases with years. Champignons are highly esteemed (and especially is this the case abroad) for adding a most delicious flavour to stews, soups, and gravies.

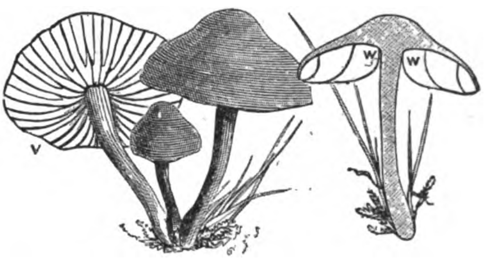

FIG. 3.—The Fairy-ring Champignon (*Marasmius Oreades*, Fr.).

A fungus which may carelessly be mistaken for the mushroom is *M. peronatus* (Fr.), but this grows in woods amongst dead leaves, and has a hairy base to the stem and a somewhat acrid taste. Another is *M. urens* (Fr.); this also generally grows in woods, but the gills are not nearly so deep, they soon become brownish, the stem is downy, and the taste is acrid. An *Agaricus* named *A. dryophilus* (Bull.) has sometimes been gathered in mistake for the champignon, but this too grows in woods where the champignon never grows; it has a hollow instead of a solid stem, gills crowded together instead of far apart, and flesh very tender and brittle instead of tough. A small esculent ally of the champignon, named *M. scorodonius* (Fr.), is sometimes found in pastures in Great Britain; this is largely consumed on the Continent, where it is esteemed for its powerful flavour of garlic. In England, where garlic is not used to a large extent, this fungus is not sought for. Another small and common species, *M. porreus* (Fr.), is pervaded with a garlic flavour to an equal extent with the last. A third species, *M. alliaceus* (Fr.), is also strongly impregnated with the scent and taste of onions or garlic. Two species, *M. impudicus* (Fr.) and *M. fœtidus* (Fr.), are in all stages of growth highly fœtid. The curious little edible *Agaricus esculentus* (Jacq.), although placed under the sub-genus *Collybia*, is allied by its structure to *Marasmius*. It is a small bitter species common in upland pastures and fir plantations early in the season. Although not gathered for the table in England, it is greatly prized in some parts of the Continent. Fries, the greatest authority on the higher Fungi, writes: "In Austria in cibariis magni æstumatur." The odour and taste in fungi when raw are often valuable characters in deciding species.

Morel.—This delicious edible fungus, *Morchella esculenta* (Pers.), is more common in Britain than is generally supposed. It grows after warm rains in the spring or early summer in woody places and in orchards and gardens, often in places where the ground has been burnt. Like the champignon, the morel can be easily dried and kept suspended on strings in necklace fashion for winter use. It is generally 3 or 4 inches high, with a hollow stem and a hollow, irregularly globose, honeycombed head, pale buff in colour all over, and furnished with an agreeable odour. There is more than one esculent species of morel: *M. semilibera* (D.C.) is the next best known, but this is rare in Britain. A large species named *M. crassipes* (Pers.)—the *M. smithiana* of Cooke—attains a height of from 9 to 12 inches. This is a fragrant and delicious species, but only suitable for use in a fresh state; it cannot be readily dried. Another valuable edible species is *Gyromitra esculenta* (Fr.), recognized by its brownish-black globose head; it grows amongst firs and is considered rare.

(W. G. SM.)

MUSIC

PART I.—HISTORY.

MUSIC[1] is the art which employs sounds as a medium of artistic expression for what is not in the province of literature, of sculpture, of painting, of acting, or of architecture. Whereas literature, whether in verse or prose, describes or states emotions, or perceptions, or impressions; whereas sculpture imitates the outward forms of animated beings, and physiognomically, either in the face, or, to speak more broadly, in the moulding and attitude of the entire figure, displays personal character and the effect of passion upon it; whereas painting vitalizes with colour the forms of sculpture, and extends its range of subjects from animate to inanimate nature; and whereas acting adds speech to the written words of the dramatist, and enforces or even qualifies their meaning by vocal inflexion, and illustrates it by changeful gesture, thus giving the mobility of life to the forms of sculpture and painting;—music embodies the inward feelings of which all those other arts can but exhibit the effect. Those other arts are imitative in respect of their reproducing natural objects or circumstances; it is otherwise with architecture, which makes but conventional reference to nature, and wholly arbitrary application of the lines, the lights, and the shadows of the natural world; and in this particular music has an analogy to architecture which it has not to the other fine arts. In the matter of expression also, architecture may be compared with music in the earlier stages of its development, since representing and also prompting a general idea of solemnity, or grandeur, or gaiety; but music left architecture far behind when, in later times, it assumed the power of special, individual, and personal utterance of every variety of passion. The indefiniteness of musical expression furnishes no argument that music is inexpressive, but is one of the qualities that place it on the highest level of art-excellence, enabling it to suggest still more than it displays, and to stimulate the imagination of the witness as much as to exercise that of the artist. The musician is then a poet, whether we regard the term in its primary sense of "maker," the exact translation of the Greek word by which versifiers were styled in early English, or in its applied sense of one who expresses thought and feeling through the medium of highly-excited imagination. Music, then, is that one of the fine arts which appropriates the phenomena of sound to the purposes of poetry, and has a province of its own in many respects analogous to, but yet wholly distinct from, that of each of the other arts. It is common to style it "the universal language;" but the definition is untrue, for in every age and in every clime there are varieties of musical idiom which are unsympathetic, if not unintelligible, to other generations than those among whom they are first current, and, still more, the very principles that govern it have been and are so variously developed in different times and places that music which is delightful at one period or to one people is repugnant at another epoch or to a different community. An attempt will here be made to sketch the progress of the art through Western civilization, to show how it has been changed from artificial or calculated into natural or spontaneous, and to describe some of the chief forms of its manifestation.[2]

To define the special science, and the art which is its application, that is denoted by our word *music*, the Greek language has two other words, *harmonia* or *harmonike* and *melodia*,—*harmonia* implying the idea of "fitting," and so being a term for propriety or general unity of parts in a whole, not in our limited technical sense of *combined sounds*, but with reference to the whole principle of orderly and not specially tonal regulation, *melodia* implying the rising and falling of the voice in speech, and being applied only at a subsequent epoch to a *succession of musical notes*.[3]

We thus owe our three chief musical terms to the Greeks, and in our prevailing system much more besides; they themselves, however, owed all to earlier sources, for the essentials of their knowledge and practice are traced to Egypt.

It has been ingeniously suggested and well sustained by Mr. J. F. Rowbotham that in prehistoric times music passed through three stages of development, each characterized by a separate class of instrument, and the analogy of existing uses in barbarous nations tends to confirm the assumption. Instruments of percussion are supposed to be the oldest, wind instruments the next in order of time and of civilization, and string instruments the latest invention of every separate race. The clapping of hands and stamping of feet, let us say, in marking rhythm exemplify the first element of music, and the large family of drums and cymbals and bells is a development of the same principle. Untutored ears are quicker to perceive rhythmical accentuation than variations of pitch, so the organ of time makes earlier manifestation than the organ of tune, though, musical sound being a periodic succession of vibrations, the operation of the latter is truly but a refinement on that of the former. The sighing of wind, eminently when passing over a bed of reeds, is Nature's suggestion of instruments of breath; hence have been reached the four methods of producing sound through pipes:—by blowing at the end, as in the case of the English flute and the flageolet; at the side, as in that of the ordinary concert flute; through a double reed, as in that of the hautboy or oboe and bassoon; and over a single reed, as in that of the clarionet—all of which date from oldest existing records; and also upon the collection of multitudinous pipes in that colossal wind instrument, the organ. An Egyptian fable ascribes the invention of the lyre to the god Thoth; a different Greek fable gives the same credit to the god Hermes; and both refer it, though under different circumstances, to the straining of the sinews of a tortoise across its shell,—whence can only be inferred that the origin of the highest advanced class of musical instruments is unknown. This class includes the lyre and the harp, which give but one note from each stretched string; the lute, which, having a neck or finger-board, admits of the production of several notes from each string by stopping it at different lengths with the fingers; the viol, the addition of the bow to which gives capability of sustaining the tone; and the dulcimer, finally matured into the pianoforte, wherein the extremes of instrumental fabrication meet, since this is at once a string instrument and an instrument of percussion, having the hammer of the drum to strike the string of the lyre.

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[1] From the Greek μουσική; but this included all arts and sciences over which the Muses presided—the encyclopædia of learning. The science of sounds was particularly involved in that of the stars, and hence the word had special reference to these two in their relation to numbers; and in its comprehensive sense it was employed to denote the entire mental training of a Greek youth. In Latin the word had a more restricted meaning.

[2] William Chappell's *History of Music* is the authority for the correction of errors in the works wherein the history and theory of Greek music were first treated in modern times, errors that have been repeated by intervening writers; and it is the authority for explanation of Greek technicalities that are misrepresented in Latin translations, and falsely understood in our own day.

[3] *Harmonia* had a special signification with the disciples of Pythagoras, who used the word in place of *enharmonia*, of which more hereafter.

Musical intervals are named numerically from any given note, say C as the 1st, the note next to which is thus D the 2d, the one beyond is E the 3d, and so on to another C, the 8th. Beyond the 8th, numerical names are only used for the rare combinations of the 9th, the 11th, and the 13th. This is because the 8th is in some sense a reproduction of the 1st, as all intervals beyond it are reproductions of the 8th below them—reproductions, that is, uniting identity and difference, the relation of tones in the higher octave being just what it is in the lower, while each tone is so or so much more acute than its under 8th, an analogy to which may be sought in the reduction of any visual object to half its size while all its proportions are preserved, the larger and the smaller, as in the interval of the 8th, thus uniting identity with difference. When two voices or instruments produce the same sound they are in unison; the unison or 1st[1] is styled perfect; so too is its reproduction, the 8th; the 8th is unequally divisible into a 5th and a 4th, and these two are classed with the 1st and 8th as perfect. There are many specialities that distinguish the four perfect intervals in music from every other. The two notes of which each is constituted are, save in one instance, of the same quality—as natural, or sharp, or flat; to raise or lower either of the two notes by a chromatic semitone[2] changes a perfect interval into a discord, whereas the other intervals are elastic, that is, they may be major or minor from having a chromatic semitone more or less in their extent, and are not changed from concords to discords, or the reverse, by the modification. To invert a perfect interval by placing the higher note beneath the lower produces another perfect interval, whereas to invert any of the other intervals reverses its character of major or minor. The progression of two parts together from one to another 1st or 8th, from one to another 5th or 4th, has, save in exceptional instances, the bad effect that all musical grammar forbids, whereas the progression of two parts in 3ds or 6ths with each other has a good effect. In the resolution of fundamental discords the progression of perfect intervals is free, whereas that of the imperfect intervals is restricted; and further, in the relation of subject and answer in a fugue, one perfect interval may be changed for another, but never for an imperfect interval. Many technicalities are anticipated in the foregoing which can only be explained in the sequel, but present mention of them is unavoidable in reference to a position now to be stated. The Egyptians perceived the distinction of the perfect intervals from others, if not all the above specialities, and regarded them as typical of the seasons, spring bearing the proportion of a 4th to autumn, of a 5th to winter, and of an 8th to summer. The distinction, then, has been observed for many centuries, but neither ancients nor moderns have adduced any explanation of the phenomenon, and the wondrous fact that perfect intervals differ in constitution and treatment from other intervals appears to defy reason, and not even to incite speculation.

The anciently supposed affinity of music to astronomy was taught by Pythagoras (585 B.C.), who derived the notion from the Egyptians, and exemplified it by comparison of the lyre of seven strings with the planetary system. The Sun, then believed to rotate round the earth, was deemed the chief planet, next to which were, on the one side Mercury, Venus, and the Moon, and on the other side Mars, Jupiter, and Saturn. The strings of the lyre, not the notes they sounded, were thus named:—Mesē (middle), being the principal or keynote, corresponding with our A on the fifth line with the bass clef, and likened to the Sun; Paramesē (next to middle) or B flat, likened to Mercury; Paranētē (next to lowest, *i.e.*, shortest = highest in pitch) or C, likened to Venus; and Nētē or Neatē (lowest) or D, likened to the Moon; these constituted the upper tetrachord or scale of four notes, to which the lower tetrachord was conjoined by having Mesē for its acutest note, which was the gravest of the other tetrachord; next to it was Lichanos (forefinger string) or G, likened to Mars; then Parhypatē (next to highest, *i.e.*, longest = lowest in pitch) or F, likened to Jupiter; and lastly Hypatē (highest) or E, likened to Saturn. The Moon being of all the planets the nearest to, and Saturn the farthest from, the earth, they are analogous to the shortest and the longest string.

The Greek lyre (see LYRE, vol. xv. p. 113) had at first four strings, to which subsequently were added the longest three; then an 8th, corresponding with our E, tuned to an 8th above Hypatē; then three below the latter, which took the scale down in pitch to B on the second line with the bass clef; afterwards three above the former, which took the scale up to A in the second space with the treble clef; and finally Proslambanomenos, corresponding with our A in the first space with the bass clef, extended the "greater system" of fifteen notes to an 8th below Mesē and an 8th above it.[3]

Tradition has it that Pythagoras made his discovery of the ratios of the perfect intervals by listening to some smiths who struck the iron on their anvil with hammers of different weights, and thus produced different notes from the metal. But the narrator of the tale has disregarded the obvious fact that, save for slight variation due to the greater or less heat of its different parts, a metallic bar, like a string, always sounds a note of the same pitch whatever be the weight of the instrument with which it is struck.[4] The smithy wherein Pythagoras worked his musical problems was the land of Egypt, where he is said to have acquired and whence he imported his knowledge. His division of the 1st and 2d degrees and the 2d and 3d degrees of the tetrachord, counting downward in pitch into equal intervals of a major tone, left but a *leimma* (remnant), which was less than a semitone between the 3d and 4th degrees. Aristoxenus (300 B.C.), who has been called the father of temperament, discovered the difference between the major and minor tones, the first having the ratio $\frac{9}{8}$, and the second having that of $\frac{10}{9}$. His followers formed a school opposed to that of Pythagoras, and there was severe contention between the two. Subsequent theorists disputed whether the major or the minor tone should be above the other, and it was Claudius Ptolemy (*c.* 150 A.D.) who enunciated that the major tone should be below the minor, which is the principle that directs the intonation of our present scale. This intonation may account for the difference between the effect in proceeding from the minor chord of the supertonic to the major chord of the tonic, and the effect in proceeding from the minor chord of the submediant to the major chord of the dominant, of which the latter, at the interval of a minor tone, is acceptable and the former, at the interval of a major tone, is repugnant to cultivated ears.

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[1] Literally, the 1st is not a musical *distance*; but, as it is a frequent combination in counterpoint, and as its repetition is not rare in melody, it is conveniently classed as an *interval*.

[2] A chromatic or minor semitone is between two notes of the same alphabetical name, as C and ♯C, or D and ♭D; a diatonic or major semitone is between two notes of different alphabetical names, as C and ♭D, or C and B; the ratio of the latter is $\frac{16}{15}$, and that of the former varies with the place of the interval in the chromatic scale

[3] Terpander (700 B.C.) was the first of whom it is said that "he added a new string to the lyre," but the ascription to him was probably figurative and not literal, for the proverbial expression was applied to any one who discovered a novelty in science or excelled in art.

[4] Not only was this manifest fiction repeated from age to age, but it was transferred from the ancient philosopher to Handel by a writer of some sixty years since, who assumed that the composer derived a melody from the various sounds of smiths' hammers on one piece of iron.

The Greeks had four modes or scales included in their "greater system." The Dorian comprised a series of eight notes from D to D, of which ♭B was the 6th, and had its semitones between the 2d and 3d and the 5th and 6th degrees counting upward. The others were exact transpositions of this, as all our modern scales are transpositions of the scale of C, the identity of intervals being induced by the various tuning of the lyre strings. The Phrygian mode lay between E and E, and had ♯F and ♮B, the Lydian between ♯F and ♯F had ♯G and ♯C, and the Mixo-Lydian between G and G had ♭B and ♭E. These four were styled *authentic*, and were distinguished by having the dominant (or predominant note) at the interval of a 5th above the tonic. Each had a *plagal* or relative mode at the interval of a 4th below the authentic, distinguished by having the dominant a 4th below the tonic, and defined by the prefix "hypo" to the name of the authentic mode, as Hypo-Dorian beginning on A, Hypo-Phrygian on B, &c. To each mode was assigned its special character of subject, which may be accounted for by the different qualities of voices that could sing in lower or higher keys, the majestic being fitted to a bass, who would sing in the Dorian, the tender to a tenor, who would sing in the Lydian, and so forth. In later but still classic times other modes were added to these, but on the same principle of precise notal transposition.

The tetrachords above described—having a semitone between the lowest note and that next above it, a tone between the 2d and 3d, and a tone between the 3d and 4th, the latter of which Ptolemy made smaller than the other, and so left a semitone between the 2d and 1st degrees—were called *diatonic*, as A, ♭B, C, D. To lower by a semitone the 2d note from the highest produced a *chromatic* tetrachord, as A, ♭B, ♮B, D. To tune the 2d string from the top yet a semitone lower reduced it to the same pitch as the 3d string, which was equivalent to its total rejection, and this form of tetrachord was the *enharmonic*, the invention of which was ascribed to Olympus (640 B.C.). If we observe the two tetrachords that occur, for instance, in the Dorian mode—that from D down to A, and that from A down to E—with the addition of the tonic D below, it will be seen that our modern scale of D minor with the omission of the 4th and 7th degrees was in the enharmonic genus, and that the chromatic genus gave the minor and major 3d and the minor and major 6th with still the omission of the 4th and 7th:—enharmonic, D, E, F, A, ♭B, D; chromatic, D, E, F, ♯F, A, ♭B, ♮B, D; and the other authentic modes were transpositions of this. In the harmonic scale of nature the 7th from the generator is too flat, and the 11th (octave above the 4th) is too sharp, for accepted use; the rejection of these two notes indicates a refinement of ear that shrank from the natural and equally refused the artificial intonation of these degrees of the scale. Mr. Carl Engel proves the rejection of the said 4th and 7th from the keynote by nations of high civilization in remote parts of the world; we call a scale that is so formed Scottish, but in China, Mexico, and other places than Great Britain the same arrangement is found to have prevailed in the remotest periods of which we have knowledge. An important principle is here involved which has affected all musical theory directly or indirectly, and is now seen to lie at the foundation of modern rules of harmony or the combining of musical sounds. The Pythagoreans advocated the use of the enharmonic genus, and so received the appellation of Enharmonicists, or were as often called Harmonicists, and hence the twofold application of the term "harmonia."

Anacreon (540 B.C.) sang to the accompaniment of the magadis (doubling bridge), an instrument imported from Egypt to Greece; it had a bridge, across which the strings were drawn at one-third of their entire length, when of course the shorter division sounded the note an 8th higher than the longer. Aristotle (384 B.C.) describes *antiphon* (τὸ ἀντίφωνον) as the singing of a melody by men an 8th lower than it is sung at the same time by boys—in other words, what is miscalled in modern church congregations "singing in unison." The same writer enunciates that the antiphon may not be at either of the other perfect intervals, the 5th or the 4th below a melody, and in this he anticipates a rule till lately deemed inflexible in modern music. Beyond these two instances of the combination of the 8th, no allusion has been found in ancient writings to the use of harmony in the modern sense of the word, and the only three examples of ancient Greek music that are known to exist are melodies (notes in succession), and supposition assigns them to the 3d or 4th century A.D. They are hymns to Apollo, Nemesis, and Calliope, with the respective verses, and their translation into modern notation has only been possible through reference to the verbal accent, because there are no extant rules of that era for purely musical measure. Nevertheless we have Egyptian paintings of the period of Dynasty IV., and Greek sculptures of players on pipes of different lengths which must have produced notes of different pitches, and sometimes in the same party players on string instruments with necks whereon two strings, differently stopped and yet sounded together, would have yielded a combination of different notes; and this, though a speechless, is a strong evidence that the musicians so represented made at least a forecast of modern harmony. One cannot but marvel that, while copious treatises have come down to us upon niceties that have here been adduced, nothing has been brought to light but pictorial testimony as to ancient knowledge of chords; and the three specimens just mentioned are all that have been found of musical composition in any form.

The classic Greeks used music in rhapsodizing or chanting with vocal inflexions the epic poems; they employed it in religious rites and to accompany military evolutions; and prizes were awarded for its performance by voices and on instruments (including, during the last two centuries B.C., the organ) at their Olympic and other games. It belonged essentially to the drama, which had its origin in the dithyrambic hymns; these were gradually developed into the tragedy, which took its name from the tragos (goat) that was sacrificed to Dionysus during the performance. Possibly Thespis (536 B.C.) may have spoken the recitations with which he was the first to intersperse the hymns; but some interpreters of Greek writings affirm, and others while doubting do not disprove, that in the mature drama all the characters sang or chanted, seemingly after the manner of the rhapsodists, and the impersonal chorus sang to instrumental accompaniment during their orchestric evolutions, from which motions or marchings the part of the theatre wherein the chorus were stationed between the audience and the proscenium was called the orchestra. Here, then, was the prototype of the modern opera, the main departure from which is the transplanting of the chorus to the stage and giving to its members participation in the action. Æschylus wrote the music to his own tragedies; Sophocles accompanied on the cithara the performance of his *Thamyris*, if not of other of his plays; Euripides left the composition of the music for his works to another genius than his own, and such was the case with after dramatists.

In ancient Rome the choristers in tragedies were very numerous, including female as well as male singers; they were accompanied by a large number of instruments, among which trumpets were conspicuous. This we learn from Seneca, who employs the idea of multitudinous unity it presents to illustrate figuratively the organization of a state.

How or when the musical system of the Greeks fell into disuse is still untraced; certainly it prevailed and engaged the attention of philosophers for some centuries of the Christian era. The first notices of music in the Western Church refer to the manner but not to the matter of the performance. The name of St Ambrose (384 A.D.) is familiarly associated with the music of his metropolitan church in Milan; but all that is proved of his connexion with the art is that, advised by Flavian of Antioch, he adopted for the first time in the West the practice of dividing the verses of the Psalms between responsive choirs, an usage which has a natural connexion with the so-called "parallelism" of Hebrew poetry, indicated in the English version of the Psalter by the colon that divides each verse. This practice has come to be falsely called antiphonal singing—falsely, because, according to the etymology of the word and to Aristotle's definition, the Greeks used it for singing *together*, whereas the church uses it for singing in *alternation*. St Ambrose regulated the order of the prayers, the ritual, and other matters in the service besides the music; his ordinances prevailed in Milan, and were distinguished by his name; so the term Ambrosian denotes the "use of Milan" in all things in which that differs from the practice of other churches. No proof is given that the melodies so defined belong to the date of St Ambrose.

Boetius (475 A.D.) was the most copious of the Roman writers on music, but his voluminous treatise *De Institutione Musica* proves that the Greek principles of the art had in his time become matter of antiquarianism; nay, it proves further that he did not understand the technical terms he professed to translate. For instance, he mistook the word for the shortest string of the lyre (Nētē), which naturally gave the acutest sound, to signify the gravest note; and he mistook the word for the longest string (Hypatē) to signify the acutest note. It is not necessary here to catalogue this author's many verbal errors;[1] but it is important to mention that he ignored the advance made by Didymus and completed by Ptolemy in the tuning of the scale with the major and minor tones, and the modern semitone of $\frac{16}{15}$, counting upward, and returned to the Pythagorean division of two major tones, inducing a discordant 3d, and the leimma $\frac{256}{243}$.[2] The very eminence of Boetius makes it matter of regret that he ever wrote upon music. His Latin book being accessible when those of Greek authors were not, it was established as a text-book on the art in the English universities, and musical degrees were granted for knowledge of the principles it set forth; musical progress was thus seriously retarded, and the 18th century was far advanced before search for sound theory dispelled reverence for his scholastic dogma.

As St Ambrose ordained a ritual for Milan which bore his name, so also St Gregory the Great (590 A.D.) ordained one for Rome which was called Gregorian. The terms Ambrosian and Gregorian are now erroneously applied to a system of music that came first into use centuries after the dates of the two bishops, and they are applied even to melodies constructed upon that system. This sentence of St Isidore, the friend and survivor of Gregory, distinctly proves that no music of the time of the Roman pontiff was or could be preserved: "Unless sounds are retained in the memory, they perish, because they cannot be written." Whatever the age of the oldest church melodies, belief cannot associate them with the days of St Gregory.

The system of notation by letters of the Greek alphabet had fallen into disuse. A system by neumes (πνεῦμα) or pneumeter, of later date than St Gregory, employed signs over or under the syllables to indicate the rising or falling of the voice but not to define its extent, and, in the manner of modern punctuation, to show where breath should be taken. This was followed by, though for a time practised coincidently with, one in which the Roman letters stood for notes. Afterwards, something like our staff was employed, of which the spaces only and not the lines were used, the syllables being placed in the higher or lower of them to denote to what extent the melody should rise or fall. Of earlier date than anything that has been found of like advance in other countries is a service-book which belonged to Winchester cathedral, and contains music written on the lines as well as in the spaces of a staff of four lines; and this comprises a prayer for Ethelred II., who died in 1016. It has been stated and constantly repeated that staff notation was invented by Guido, a monk of Arezzo, who was alive in 1067, and whose book, *Micrologus*, refers only to writing in spaces, and who throughout his works professes no more than to describe established principles, and these far less advanced than what then prevailed in England. To him is falsely ascribed the first use of a red line for the note F, and a saffron for the note C, and to him, as unduly, the appropriation of the initial syllables—nonsense without the completion of the words—of six lines of a hymn to St John the Baptist as names of the notes—Ut, Re, Mi, Fa, Sol, La.

Hucbald (930 A.D.) invented a system, not of notation, but of scales, wherein the semitone was always between the 2d and 3d of a tetrachord, as G, $\overparen{\mathrm{A}, \flat\mathrm{B}}$, C, so the ♮B and ♯F of the second octave were in false relation to the ♭B and ♮F of the first two tetrachords. To this scale of four notes, G, $\overparen{\mathrm{A}, \flat\mathrm{B}}$, C, were subsequently added a note below and a note above, which made the hexachord with the semitone between the 3d and 4th both up and down, as F, G, $\overparen{\mathrm{A}, \flat\mathrm{B}}$, C, D. It was at a much later date that the 7th, our leading note, was admitted into a key, and for this the first two letters of the last line of the above-named hymn, "Sanctus Johannes," would have been used, save for the notion that as the note Mi was at a semitone below Fa, the same vowel should be heard at a semitone below the upper Ut, and the syllable Si was substituted for Sa. Long afterwards the syllable Ut was replaced by Do in Italy, but it is still retained in France; and in these two countries, with whatever others employ their nomenclature, the original Ut and the substituted Do stand for the sound defined by the letter C in English and German terminology. The literal musical alphabet thus accords with the syllabic:

A	B	C	D	E	F	G
La,	Si,	Ut or Do,	Re,	Mi,	Fa,	Sol.

In Germany, however, a remnant of Greek use prevails in having the note above A at the interval of a semitone, namely ♭B, as was the classical Paramesē above Mesē, and the Teutons employ the 8th letter H to denote the sound we call ♮B, and the Italians and French Si. The gamut, which, whenever instituted, did not pass out of use until the present century, regarded the hexachord and not the octachord, employed both letters and syllables, made the former invariable while changing the latter according to key relationship, and acknowledged only the three keys of G, C, and F; it took its name from having the Greek letter gamma with Ut for its lowest keynote, though the Latin letters with the corresponding syllables were applied to all the other notes.

A system of modes had already been established for ecclesiastical music which differed essentially from the Greek modal system in having no notes inflected by sharps

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[1] See Chappell, *op. cit.*

[2] The ratios of the three may thus be stated with reference to modern notation, the last being the temperament now in use:—

	C	D	E	F
Pythagoras . .	576	648	729	768
Didymus . . .	576	640	720	768
Ptolemy . . .	576	648	740	768

or flats, and consequently a different distribution of tones and semitones in each mode from that in all the others. The sole exception from this was the permissible ♭B in the second octave, the toleration of which was for the sake of avoiding the interval of the augmented 4th between ♮B and F below it, but the inflected note was admitted in the fifth mode only. Here the numbers of the modes must be explained and the later misapplication to them of the Greek names. The two classic forms of authentic and plagal were employed in the structure of melody, that having its dominant above the tonic or final, this having its dominant below it. The four authentic modes bore the uneven numbers—first beginning its scale from D, third from E, fifth from F, wherein the ♭B might be used, and seventh from G. The four plagal modes bore the even numbers, which showed their parallelism or relation to their respective authentic modes—second beginning from A, fourth from B, sixth from C, and eighth from D. In the latter half of the 9th century, Notker, abbot of St Gall, applied the Greek names to these, regardless of the distinction that by use of inflected notes the classic modes had all the same disposition of tones and semitones, whereas by the omission of sharps and of flats the church modes varied from each other in the arrangement of intervals. The confusion of F for the church Lydian with ♯F for the Greek Lydian is obvious, and the reader may easily trace the discrepancies between the systems if he consider the diverse principles on which the two are based. Some centuries later, the ninth and tenth modes, Æolian and Hypo-Æolian, beginning respectively on A and E, were added, and later still, the eleventh and twelfth, Ionian and Hypo-Ionian, beginning respectively on C and G. The mode or scale that comprised ♭B was called *mollis*, and those which had ♮B were each called *dura*, and hence the sign "b" to indicate a flat, the word *bémol* to define the same in French, the word *be* or its first letter to name a flat, and the terms *moll* and *dur* to express minor and major in German. Lastly, as bearing on the aversion from the augmented 4th between F and B, and on the omission of the 4th and 7th in several characteristic national scales, it must be added that, whenever the 5th above or 4th below a tonic or final was B, C instead of this note was dominant of the mode.

Coincidently with the church practice of constructing unrhythmical melody in one or other of these unnatural and arbitrarily devised modes, and of singing the same without accompanying harmony, the people of Northern nations had the habit, as has been proved in many districts, of singing tunes with the accompaniment of different parts performed by other voices. Among what tradition has preserved of these tunes, some indeed are in one or other of the church modes, as was inevitable in the productions of people who had experience of this artificial system in the music of the daily service; but many approximate far nearer to the scale of present use, and are thus susceptible of just harmonic treatment, which is incompatible with the modal system. So devoted to their song-tunes were the English people in the later Saxon times that churchmen, as is well attested, would often sing these to attract the public to divine worship, and after the Norman settlement it was a frequent custom to write words of hymns to fit secular tunes, which tunes and their titles are preserved through this appropriation only, with the Latin words written under the notes.

The appropriation of popular tunes to church use was followed by the adoption of the harmonic practice or part-singing of the people in many English districts, and probably in other Northern lands. At the end of the 11th or beginning of the 12th century, a part added to another received the name of *descant* (*dis-cantus*, something apart from or extra to the song), and rules were gradually framed for its extemporaneous invention. It was preceded by *faburden* (the singing of a single note or drone throughout a given melody), and this latter term was retained with a wider contrapuntal signification whence difficulty has arisen as to its primary meaning. To "bear the burden" was to sing the bass below either a single part or fuller harmony; when the bass was a single note, which was of course the tonic, this being generally F or Fa, it constituted the faburden or drone; that the term is translated *fauxbourdon* and *falsobordone* in French and Italian may have referred at first to its being a single note or drone, and not a part changing with the changeful harmony.

The assertion that previously to the period now being considered there prevailed a church custom of accompanying melodies with a transposition of the same at the interval of the 5th or 8th above or below is disproved by Aristotle's injunction that the antiphon might be at the 8th below, but not at any other of the perfect intervals; and the blundering of Boetius could not eradicate the fact, though it might obscure the rule. It is also disproved by the habit of the peoples of the North to sing in harmony, showing unschooled perception of the principles of combining sounds, and making it impossible that either they or their priests (who must casually have heard their natural performances) could have tolerated the cacophonous progression of parts at perfect intervals from each other. It is disproved by the identity of human perceptions to-day with those of a thousand years ago, and by the certainty that men of old positively could not have sung with satisfaction, or heard with respect, things that are in the highest degree offensive to us all. An explanation may be speculatively ventured, that the manuscripts wherein two parts appear to be written in 5ths or 4ths with each other are not scores showing what was to be sung in combination, but the parts for separate choirs, showing what was to be sung in response; thus, when $\left\{\begin{matrix}D\\A\\D\end{matrix}\right\}$ stand as the initials of three melodies, the top or the bottom may have been intended to be sung alone, the middle to follow, and the other to succeed. In this is to be seen the germ of the fugue, if we may suppose that the part which first held the cantus was continued in descant, when the cantus was sung a 5th higher by another part. Music written as here described is defined as *diaphony*,—a term at least as appropriate to the successive as to the simultaneous singing of a melody at the interval of a 5th above or below.

One of the most inscrutable things to the modern student is the lateness at which notation was devised for defining the relative length of musical sounds. The rhythmical sense is the earliest of the musical faculties to be developed, and is often the strongest in its development among individuals and nations. Still, the ancients have left no record that they had signs of indication for the length of notes, and centuries rolled over Christendom before there was any chronicled attempt to find a principle for supplying this musical necessity. Here again conjecture will insist that the practice of singing longer and shorter notes with stronger and weaker accent must have prevailed before a system was framed for its regulation; and in this supposition offers that the instincts of the people must have given example for the canons of the schoolmen. Franco of Cologne, in the 12th century, is the first writer who codified the uses of "measured music," and all he enunciates is expanded in the treatises of Walter Odington, a monk of Evesham who was appointed archbishop of Canterbury in 1228. At this period and afterwards, bar-lines were drawn across the whole or a portion of the staff to show the end of a musical phrase in accordance with that of the line or verse which was to be sung to it, and the number of notes between these bar-lines was more or less, according to the number of syllables in the verse. It was not, however, till more than three hundred years later that music was first divided into bars of equal length, and not until a still later date that these were applied to their most valuable purpose of showing the points of strongest emphasis. Prior to this invention the distribution of accent was styled *perfect* or *imperfect time*, according to whether the strongest note was to be the first of three or the first of two, or according to whether three or two should follow during the continuance of one, corresponding with present division into triple or duple time. Our compound times were denoted by such directions as "imperfect of the first and perfect of the second," which may be translated by our sign $\frac{6}{4}$ or $\frac{6}{8}$, meaning that a bar is divisible into two equal notes (dotted minims or dotted crotchets), and each of these into three equal notes (crotchets or quavers). It is not only that early music is, on account of this vague notation, difficult to interpret, but writers seem to have had undefined notions of where their accent should lie; and hence we have varying versions of melodies, partly because the transcribers may have doubted how to express them, and partly because composers, when choosing them as themes against which to construct other parts, lengthened or shortened any of the notes at the prompting of their own fancy. It was not until the 18th century that the plan was fully accepted of having the strongest note on the first of every bar, and of having, with rarest exceptions, the close or cadence or conclusion of every phrase on this note of strongest accent. To induce such termination of a phrase many a strain must begin with a half bar, or with a shorter or longer fragment, and the exceptions from the rule are so few as to be easily mastered, and so clear as to aid in strengthening the principle.

Descant, which has become a term of general use for disquisition on a stated subject, has been shown to owe its first meaning and musical application to the words *discantus*. A like meaning belongs to the word *motet*, which seems to have come from *motetus*, to denote a florid or moving part against a fixed theme in longer notes.[1] It may be supposed that the term anthem had reference originally, similarly to the word motet, to a free part constructed against or upon the plain-song. The word descant has passed out of use as a musical definition; motet now generally signifies a composition to Latin text for the Roman Church, and it is also applied to the works produced in North Germany in the centuries next following the Reformation which were elaborations of the choral melodies; and anthem is applied to pieces designed for use in the Church of England.

When descant ceased to be improvised, and with the advance of notation the writing of a carefully-planned accompanying part became more and more practicable, such a part was defined as *counterpoint*—point or note against note. Counterpoint is simple when each melody is in notes of the same length as those of an accompanying melody; it is florid when one melody proceeds in longer or shorter notes than another melody. At first the use of perfect concords only was allowed in counterpoint, but of these never two at the same interval, as two 5ths or two 8ths, in succession. 3ds and 6ths were afterwards introduced. Then discords were admitted under either of two conditions: (1) that they were approached and quitted by step and not by leap, and were always unaccented; (2) that they were suspended from a note of a previously-sounded chord, or from a note without harmony, and that they were resolved by passing to a concord while the harmony lasted against which they were discordant. Subsequently one more class of discords was employed; these were elements of the harmony, being added to, not substituted for, the notes of a chord, and they were resolved, with the change of the entire chord, upon notes of that chord whose root was at the interval of a 4th above the root of the discord. It is from the institution of the art of constructing counterpoint that the history of the music we know, and the capability to produce it, are truly to be dated. Throughout the period of transition from what must be regarded as an instinct of the people to what was truly a scholastic problem, there were English writers on music in such numbers as to prove the high consideration in which it was held in Britain, and the great pains spent there to evolve principles for its regulation.[2] John of Dunstable is especially to be noted, of whom Tinctor the Netherlander (*c.* 1460 A.D.) wrote, in discussing the art of counterpoint: "Of this new art, as I may call it, the fountain and source is said to have been among the English, of whom Dunstable was the chief." Contemporaneous with Dunstable, but far behind him in esteem, was Egide Binchois, a musician of Picardy.

The first essays at composition in harmony were in the form of *canon*—that is, in which successive parts have the same melody, but begin each at a stated period after its precursor. When the first part completes a rhythmical sentence prior to the entry of the second part and continues the melody as accompaniment to the second, and so on with regard to the third or fourth parts if there be so many, the composition has in England always been styled a *round* or *catch*, as distinguished from the closer canon, in which the successive parts enter without regard to the close of a phrase; but elsewhere than in England no distinction is made between the catch and the canon. The term round refers to the return to the beginning by the first part, while the other parts respectively continue the melody. The term catch springs from each later part catching up the tune during its continuance by the others. The term canon relates to the problem of finding the one or more points in a melody whereat one or more successive parts should begin the same tune. Very early allusion is made to the singing of catches by the English people, which continued in practice until after the Restoration; every trade had its characteristic catch; there were many on pastoral subjects; those which engaged composers in the time of Charles II. are mostly of a bacchanalian cast; and the form was appropriated in the later Georgian era to sentimental subjects, when the practice of singing catches had passed from the people at large, but was preserved in some convivial clubs that consisted of men of fortune, who paid and listened to, but took no part with, professional singer

Quite distinct from the canon is the *fugue* (*fuga*). In it a short complete melody *flies* (hence the name) from one part to another, while the original part is continued in counterpoint against it. To suit the different compass of high and low voices, this melody is transposed into the key of the dominant (the 5th above or 4th below) when assigned to the second entering voice; in the first instance it is called the *subject* or *dux*, in the second it is called the

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[1] Among other grounds for this derivation a strong one is that in the 13th and 14th centuries the word *motetus* often defined a florid part next above that which was styled *tenor*, because it *held* the chief melody, the word *motetus* being subsequently changed for *medius* or *mean* when that part stood midway between the *tenor* and the third part above it or *treble*. Bass, or base of the harmonic column, was then designated the *burden*.

[2] John Cotton (referred to as Johannes Anglicanus by the almost fabulous Guido) was the earliest to indicate the good effect of contrary motion between two simultaneous melodies.

answer or *comes*, and they were formerly also distinguished as masculine and feminine. A subject is *real* when it admits of exact transposition into the key of the dominant; it is *tonal* when it needs modification to be fitted for this change, and then, if authentic, its answer must be plagal, and, if the subject be plagal, the answer must be authentic. The copious rules of fugal development needed many years for their ripening, but the beginning of this art-form dates from very primitive times, and a speculation has been already offered as to its origin (p. 81).

The earliest piece of music for several voices that has been found in any country is an English "six men's song," contained in a manuscript which best judges assign to the period prior to 1240. It is a canon for four voices, with independent parts for two more, which stand as a foot, or burden, or ground bass to support all the others. The original words are a description of summer; these are proof of the secular origin of the music, but there are also written to the notes the words of a Latin hymn, which prove the practice above noticed of utilizing the people's songs for church purposes. The Arundel MS., which had lain unnoticed in the library of the Royal Society and has lately been transferred to that of the British Museum, comprises several compositions in two-part and three-part counterpoint, and it belongs to the year 1260—a new addition to the many proofs of the earlier and greater advance of music in England than in other countries. In the Parisian library are some pieces by Adam de la Hale, the Hunchback of Arras, which consist of a secular tune as bass with its original words, and two florid parts above it with sacred Latin words. The reputed author lived in the later half of the 13th century, but it is surmised that the contrapuntal parts may have been added to his tune at a subsequent period by another hand; if this be so, the English pieces are the first, and seem to be the only extant specimens of counterpoint of the period.

Thus far the advance of music was earlier and greater in England than elsewhere. In the 15th century Flanders produced the musicians of most esteem and greatest influence. Early among these was Ockenheim or Ockeghem of Hainault (*c.* 1420-1513), who was surpassed in fame by his pupil Josse Després (more commonly known by what must have been his pet name of Josquin) of Hainault. He practised the art in his own country, in Italy, in France, and in Austria, and was everywhere regarded as its highest ornament. Though not credited with the origination of principles, he is highly extolled for his practical application of those already acknowledged, and the renown of many of his scholars shows him to have been as good a teacher as he was a voluminous composer. In his works, however, the artificiality of the prevailing style is obvious; many of them have some secular song for "cantus fermus" which supports the florid melodies set to sacred texts that it was the musician's highest aim to engraft upon them. Some of them are notable for a pleasantry or even a jest framed on a punning application of the names of the notes, or on the choice of a text that was pertinent to the occasion for which they were written. Others are distinguished for the multiplicity of their parts. All are of a character to elicit admiration of their ingenuity rather than induce delight by their beauty.

Tinctor, already mentioned, founded in Naples the first musical conservatory, and coincidently Willaert, another Fleming, founded one in Venice, their object being, as implied in the definition, to conserve the art of music from corruption. Not only in these exclusively musical schools and in similar institutions which sprang up in the same and other cities was the art cultivated, but in the academies of general learning that were established in all the Italian cities when study of the classics became the passion of the age there was generally provision for the teaching of music.[1]

In the 15th century and later, because musical erudition was still applied entirely to the service of the church, and because Italy was the ecclesiastical centre, musicians of all lands went to Italy, and especially to Rome. It was, however, in England first, and it has been only in England until America adopted the practice, that academical honours have been given to musicians. John Hamboys (*c.* 1470), author of some treatises on the art, is the reputed first doctor of music. The record exists that in 1463 the university of Cambridge conferred the degrees of doctor and bachelor respectively on Thomas Seynt Just and Henry Habyngton. Probably these degrees were granted on the strength of pedantic lore formally required. In the following century a musical composition also was exacted from candidates for graduation. It may seem an anomaly that art-excellence should be tested by academical regulation, since by some supposed to soar above rule; but, rise as it may, to be art it must be founded on principle, and, if in its working of to-day it overstep its limits of yesterday, it is for ever unfolding new exemplifications of those natural laws whereon it is based, and the greatest artist of any time is he who can most deeply probe, and is thus best able to apply, the phenomena; upon these grounds, then, it is not beyond the province of the schoolman to test and to declare the qualifications of an artist.

The knightly calling, in the age of chivalry, not only referred to heroic acts and deeds of arms, but regarded skill in verse and melody, in singing and accompaniment. Princes and nobles of highest rank practised these arts, and were then styled troubadours, who were sometimes attended and assisted by jongleurs to play to their singing. See TROUBADOURS. Their music seems to have been rhythmical, as was necessary to fit the verses, and the perfect, or ternary, or triple time is said to have prevailed in it more commonly than that which we should now write as two or four in a bar. A similar race of knightly songsters in Germany were the minnesänger (see vol. x. p. 525). They set great value on the invention of new metres, and he who produced one with a melody to suit it was called a *meister* (master), while he who cast his verses in a previously accepted metre or adapted them to a known melody was styled *tondieb* (tone thief). For the most part, their pieces comprised a fore-song, a far longer section in several stanzas, to each of which the same melody was repeated, and an after-song, all three divisions having their own separate melody. Their music is said to have been in the church style of the period, but was distinctly their own composition. The exercise of the gentle arts by the nobility declined with the decline of chivalry, and as it fell into disuse among them it was adopted by the burgher class in the guilds of meistersänger (see vol. x. p. 526). One of the most meritorious and by far the most prolific of the whole craft—his compositions being numbered by thousands—was Hans Sachs of Nuremberg (1494-1576). He was by trade a shoemaker, and all the members of the guild followed some such calling, and devoted themselves to the study and practice of song as recreation from their daily labour. They cultivated the arts of both composition and performance of song in its twofold aspect of verse and tune, for which, according to tradition, they enacted most rigid and perhaps pedantic laws. None of their work has come down to us, but the name they have left affords an instance of the aspirations of the common people to that intellectual condition which is not the exclusive prerogative of the church nor the privilege of the wealthy. Guilds of meistersänger were also established in other towns of North Germany. The title and its application generally declined until the 17th century, but lingered feebly in a few places until 1836, when the latest-lived guild was dissolved at Ulm.[1]

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[1] As belonging to this branch of the subject, the principal schools for musical education that have been instituted of late, and are now in existence, may here be named:—the Paris Conservatoire, 1795, and its five provincial branch schools; the Conservatoire of Brussels; the Conservatorio of Naples, an offspring of earlier institutions; the Royal Academy of Music, London, 1822; the Conservatorium of Leipsic, instituted in 1843, mainly through the instrumentality of Mendelssohn; the Conservatorium of Vienna, and like institutions in Dresden, Cologne, Stuttgart, Munich, and Frankfort, and also in Milan and Bologna; and the Hochschule für Musik, a branch of the Academy of Arts, Berlin.

The dawn of the 16th century is marked by the appropriation of musical scholarship to secular writing. It was about that time that the *madrigal* came into vogue. The etymology of the word is obscure, but the class of music to which it is applied is clearly distinguished. It is stamped with the imitative character of the canon, but is free from the rigid continuance of one melody by the successively entering voices; and it has as much resemblance yet unlikeness to the fugue in having the flight of a musical phrase from one to another of the vocal parts, but not being steadfast to one subject throughout its design,—nay, imitation sometimes ceases in the madrigal when particular words need special emphasis. The *villanella*, *villancico*, *chanson*, or the *part-song* of the period is distinguished from madrigal by the definite rhythm, a quality excluded from this latter by the response in one part to the uncompleted phrase of another; and the lighter species of composition was so arranged as to suit a single voice with a lute accompaniment when a voice to each part was not available for the performance. Still more marked in rhythm and more slight in structure was the *ballet*, so named because it was sung as an accompaniment to dancing (*ballata*, from *ballare*), or the *fal-la*, so named because often set to these two syllables. All these classes of music were as often played as sung, and in English copies are generally described as "apt for voices or viols." The Flemish masters have left as many and as admirable specimens of secular work as of church music; Italian musicians, who rose from the teaching of the Flemings, successfully emulated the twofold example; but in England secular composition seems to have been the indigenous development of national intuition, and at its outset at least to have had a style of its own. This is exemplified in the pieces comprised in the *Fayrefax MS.*, which are mostly of a pastoral and always of a tuneful character; of these, Dr. Robert Fayrefax the collector, Sir Thomas Phelyppes (a priest), Newark, Theryngham, Turges, Tudor, Browne, Gilbert Bannister, Richard Davy, Cornyshe, and others were the composers.

The renowned Roman school, to which we must now pass, owed its existence to the precept as much as to the example of foreigners, chiefly from Flanders. Claude Goudimel (*c.* 1510-1572), known as a Fleming, though his birth be assigned to Avignon, was the first to open a seminary for musical tuition in Rome, and the most famous musicians of the century were its pupils—Palestrina (*ob.* 1594), Orlando di Lasso (*ob.* 1594), the brothers Animuccia, the brothers Nanini, and many more. Lasso, Lassus, or Latres of Mons is signalized among these for the great number and great beauty of his works, and for the wide area over which he spread his labours. In his own land, in Rome, in France, in England, and chiefly in Bavaria, he was active as a choir-master and as a composer, and did as much to advance art by making his music express the words to which it was set as by teaching the executants to realize this expression in performance. He is praised for breaking from the long previous practice of writing prolix florid passages to single syllables, a weakness manifest in the music of his countryman Desprès and of intervening writers.

Several musical treatises by Spanish writers of this period are extant, which are not regarded highly for the novelty of their views, nor for more than usual perspicacity in the statement of them. It might have been supposed that Spain would have been as favourable to the production of musical talent as Italy has always been. That the contrary is the fact is, however, patent; but the explanation lies with the ethnologist rather than with the musician.

Though the church from time to time appropriated the secular art-forms from their rise to their maturity, its chief authorities were always jealous of these advances, and issued edicts against them. So in 1322 Pope John XXII. denounced the encroachments of counterpoint, alleging that the voluptuous harmony of 3ds and 6ths was fit but for profane uses. So too the twelfth or Ionian mode—the modern scale of C major, the only one of the church modes, save under special conditions the fifth or Lydian mode, that accords with the tonality of present use—was stigmatized as "lascivious" and proscribed from the sanctuary. More accordant with present views of propriety was the many-sided objection to the employment of tunes of the people in place of the church's plain-song as bases on which to erect counterpoint, and the construction of this counterpoint in the most ornate of the several florid species. Enlarging on the primitive practice of adapting Latin words to popular tunes, the best approved masters, in the two centuries preceding the epoch now under notice, took tunes of this class, to which it is stated the original words were commonly sung by congregations at least, and even by some members of the authorized choir, while other of the singers had such extensive passages to execute that to make the sacred syllables distinct was impracticable. The whole custom of composition and performance was rigorously condemned by the council of Trent, in consequence of which Palestrina was commissioned in 1563 to write music for the mass that should be truthful to the spirit of devout declamation and aim at the utmost approach to musical beauty. To this end he made three experiments; the first two were declared successful, and the third was accepted as the fulfilment of all that could be desired for religion and for art; it was named, after the preceding pope, "Missa Papæ Marcelli." This great work was set forth as the standard to which all ecclesiastical composition was required to conform; and so it did conform until a new musical idiom arose, until the popular ear thirsted for new forms of expression, and until musicians sought and found favour in meeting the general demand. In the three hundred years between that time and this, pontiffs and conclaves have again and again enacted statutes to conserve the purity of ecclesiastical art, but art as often has run out of control and proved that every succeeding era adds to its capabilities.

Despite the unbroken continuance of their use in the Roman service, great ignorance now prevails as to the church modes and their permitted modification. Ears trained by modern experience recoil from the uncouth effect of the melodic progressions incidental to some of these artificial scales, while antiquaries protest the infallibility of extant copies of music constructed in those modes, and insist on the authority of such manuscripts to secure purity of performance. A *Treatise on Counterpoint* by Stefano Vanneo of Recanati (1531), however, expressly states that the notes in the modes were subject to inflexion, that accomplished singers necessarily knew what notes should be raised or lowered by sharps or flats, and that these signs were never written but for the direction of boys and other executants who had not attained to mastery of their art. The treachery of tradition is exemplified in the loss of the rules for this once generally understood practice of notal inflexion; but the inference is strong that, could these rules be recovered, many of the melodies now called Gregorian might resume a musical character of which they are robbed by strict adherence to their written notes.

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[1] Late in the 13th century a society somewhat similar in its object was established in London, consisting of the wealthier merchants. It was called the Puy (the name also given to the poetical festivals in honour of the Virgin in some Norman towns; see Littré, *s.v.*). Admission to its ranks was possible only through manifestation of musical or poetic merit. Severe judgment decided on the claims of contesting candidates for honours, which were great and public when desert was found.

In England during the 16th century choral music kept pace with the age. This is evidenced in the works of Tallis and Byrde (Bird, or Byrd), who wrote for the Roman ritual, and continued their labours for the Anglican service as modified by the Reformation, which exercised the genius of many another, of whom Orlando Gibbons was the crowning glory, for the few of his works that are accessible in comparison with what he is believed to have produced are classed among the masterpieces of their style and their period. The same musicians, or most of them, are as notable for their secular as for their sacred writings.

It was in the middle of the 16th century that the class of composition now ranked as the highest was originated. The *oratorio* dates its existence and its name from the meetings held by San Filippo Neri in the oratory of his church in Rome, at first in 1556, for religious exercise and pious edification. He was the confessor and friend of Giovanni Animuccia, whom he engaged to write music to be interspersed throughout his discourses. Originally this consisted of *laudi* or short hymns, the extent of which was afterwards enlarged; by and by the spoken matter was replaced by singing, and ultimately the class of work took the form in which it is cast by present composers. Such is the source of the didactic oratorio; the dramatic oratorio is an offshoot of the same, but is distinguished by its representation of personal characters and their involvement in a course of action. The first instance of this kind of writing was the production of Emilio del Cavalieri, *La Rappresentazione dell' Anima e del Corpo*, which, like its didactic precursor, was given in the oratory of a church in Rome (1600).[1]

To the beginning of the 16th century is due a more significant matter than the secularization of studied music, than the reform of the music of the church, and even than the labours of those musicians of whose great names only the most notable have been cited. The matter in question refers not to art-forms nor to artists, but to the fact that music has its foundation in the natural laws of acoustics, and thus it lays open the principle for which Pagan philosophers and Christians had been vainly groping through centuries, while a veil of mathematical calculation hung between them and the truth. Jean Mouton of Holling in Lorraine (1475-1522) is the earliest musician in whose works has been found an example of the phenomenal chord of the dominant 7th approached with the full freedom of present-day practice. The discovery is usually ascribed to Claudio Monteverde, of whom and of his great art services much will be said when treating of the ensuing century. Like others of the wonders of nature, the chord and its application seem not to have come suddenly into knowledge, much less into acceptance, but to have been experimented upon with less or more of hardihood by one musician after another, until good effect had silenced dispute and authorized the adoption of this beautiful harmony into the language of music. The discovery of the grounds of its justification is to be traced to a still later time. The speciality of the chord consists in its comprising between its 3d and 7th the interval of the diminished 5th, the two notes of our diatonic scale which are omitted by many primitive nations—the 4th and 7th from the keynote—and which perplexed the considerations of theorists and practitioners, as has in the foregoing been repeatedly shown. Speculation as to the new delight the first hearing of this combination must have occasioned is precarious; the opposition with which it was encountered by the orthodox is certain.

Yet another prominent feature in musical history dates from the beginning of the 16th century, the practice of hymnody. Luther is said to have been the first to write metrical verses on sacred subjects in the language of the people, and his verses were adapted sometimes to ancient church melodies, sometimes to tunes of secular songs, and sometimes had music composed for them by himself and others. Many rhyming Latin hymns are of earlier date whose tunes are identified with them, some of which tunes, with the subject of their Latin text, are among the Reformer's appropriations; but it was he who put the words of praise and prayer into the popular mouth, associated with rhythmical music which aided to imprint the words upon the memory and to enforce their enunciation. In conjunction with his friend Walther, Luther issued a collection of poems for choral singing in 1524, which was followed by many others in North Germany. The English versions of the Psalms by Sternhold and Hopkins and their predecessors, and the French version by Marot and Beza were written with the same purpose of fitting sacred minstrelsy to the voice of the multitude. Goudimel in 1566 and Le Jeune in 1607 printed harmonizations of tunes that had then become standard for the Psalms, and in England several such publications appeared, culminating in Ravenscroft's famous collection (1621); in all of these the arrangements of the tunes were by various masters. The English practice of hymn-singing was much strengthened on the return of the exiled Reformers from Frankfort and Geneva, when it became so general that, according to Bishop Jewell, thousands of the populace who assembled at Paul's Cross to hear the preaching would join in the singing of psalms before and after the sermon.

The placing of the choral song of the church within the lips of the people had great religious and moral influence; it has had also its great effect upon art, shown in the productions of the North German musicians ever since the first days of the Reformation, which abound in exercises of scholarship and imagination wrought upon the tunes of established acceptance. Some of these are accompaniments to the tunes with interludes between the several strains, and some are compositions for the organ or for orchestral instruments that consist of such elaboration of the themes as is displayed in accompaniments to voices, but of far more complicated and extended character. A special art-form that was developed to a very high degree, but has passed into comparative disuse, was the structure of all varieties of counterpoint extemporaneously upon the known hymn-tunes (chorals), and several masters acquired great fame by success in its practice, of whom Reinken (1623-1722), Pachelbel (1653-1706), Georg Boehm, and the great Bach are specially memorable. The hymnody of North Germany has for artistic treatment a strong advantage which is unpossessed by that of England, in that for the most part the same verses are associated with the same tunes, so that, whenever the text or the music is heard, either prompts recollection of the other, whereas in England tunes were always and are now often composed to metres and not to poems; any tune in a given metre is available for every poem in the same, and hence there are various tunes to one poem, and various poems to one tune.[2] In England a tune is named generally after some place—as "York," "Windsor," "Dundee,"—or by some other unsignifying word; in North Germany a tune is mostly named by the initial words of the verses to which it is allied, and consequently, whenever it is heard, whether with words or without, it necessarily suggests to the hearer the whole subject of that hymn of which it is the musical moiety undivorceable from the literary half. Manifold as they are, knowledge of the choral tunes is included in the earliest schooling of every Lutheran and every Calvinist in Germany, which thus enables all to take part in performance of the tunes, and hence expressly the definition of "choral." Compositions grounded on the standard tune are then not merely school exercises but works of art which link the sympathies of the writer and the listener, and aim at expressing the feeling prompted by the hymn under treatment.

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[1] The correspondence of this account with that of the rise of Greek tragedy is obvious.

[2] The old tune for the 100th Psalm and Croft's tune for the 104th are almost the only exceptions, unless "God save the King" may be

On the verge of the 17th century a novelty in music was originated that was as pregnant of consequence as anything that has yet been noticed; this was *recitative* with its special characteristics. Vincenzo Galilei was one of a band of Florentine nobles and gentry who devised the appropriation of music to free declamation, and they engaged authors and productive and executive musicians to put the conception into practice. Galilei had already come prominently into public notice in a controversy with Giuseppe Zarlino, the most esteemed of all the writers on music in his age, who was the author of a treatise that expounded and justified the Ptolemaic division of the scale with the major and minor tones, and the former below the latter; this was answered by Galilei in support of the Pythagorean doctrine of equal tones, which is confuted by the phenomenon of harmonics, and Zarlino in turn replied to him. During two and a half centuries the art of music had been untouched by the New Learning, which had had the effect of regenerating all the other arts, and had wrought the intellectual change now known as the Renaissance. The members of the Florentine association thought it possible to apply ancient principles in modern practice, and so to reproduce the effect to which the newly-revealed writings of Greece testified, but of which these gave no such technical description as could be the groundwork of any reorganization. Obviously, the poetic power of Greek music must have lain in the force it gave to declamation; in exalting speech into song it must have given to words a clearer yet more varied significance than they could else have had, and to the passions words embody it must have given an otherwise impossible medium of expression. There existed two classes of music at the time under notice. The music of the people consisted of concise rhythmical tunes that were either composed to accompany dancing, or so constructed that, though made for singing, they were applicable to that other use; and these tunes, being repeated again and again to the almost countless stanzas of some ballad poems, could have in themselves no quality of expression beyond a vague character of sadness or gaiety; for, what might have been expressive of the prevalent feeling at one stage of a long story would necessarily be fallacious in the subsequent diversities of the tale. The music of the schools consisted of ingenious contrivances of wholly artificial nature, either to assign the same melody to several successive voices in canonic continuance or fugal imitation, or else to multiply more and more the parts for simultaneous execution; in the former case definition of rhythm is annulled, as has been shown by the entry of one part with a phrase while that phrase was uncompleted in another part, and in the latter case the manifold melodies so obscured the sound of one another that none could be distinguished,—a fact that must be self-apparent if we think of the sound of twelve, or twenty-four, or so many as forty simultaneous currents of song. In this music there could neither be expression nor even articulation of the words, and hence, our Florentines assumed, the purpose of music was perverted and its inherent poetical essence was abused. Such combination of diverse melodies is now styled *polyphony*, a term that might better be applied to simple counterpoint in which the many sounds are onefold in accent than to the florid counterpoint it is employed to define, wherein the many parts have various movement. With the idea before them of the ancient rhapsodists the association proposed the setting of music to verses with the main, nay, only object of expressing the words. This music was not to be rhythmical, but was to consist of longer or shorter phrases in accordance with the literary sense; its intervals were not to be chosen with regard to their melodic interest, but in imitation or idealization rather than exaggeration of the rising and falling of the voice in ordinary speech, the speed being hurried or relaxed by the exigency of the passing sentiment; and the accompaniment of the singer was to be on some unobtrusive instrument or, later, some combination of instruments, that should, as did the lyre of old, verify the intonation and, in the new era (what had not been in the classic), enhance the vocal expression by some pungent harmony. Applied solely to recitation, the new invention was called *recitativo* (recitative), *musica parlante*, or *stilo rappresentativo*. The first instance of its composition is said to have been a *cantata*—that is, a piece for a single voice with instrumental accompaniment—*Il Conte Ugolino*, composed by Galilei, but of this no copy is known to exist. Doubt prevails as to whether *Il Combattimento d'Apolline col Serpente* by Giulio Caccini or *Il Satiro* by Emilio del Cavalieri was the earlier production; they were both given to the world in 1590, were both in dramatic form, and both exemplified the new, if not the revived, classic style of music. Caccini was fitted to make the experiment by practice and excellence as a vocalist more than by contrapuntal erudition, and he was soon associated with Jacopo Peri, a musician of his own class, in the composition of *Dafne*, a more extensive work than the foregoing, indeed a complete lyrical drama, which was privately performed in the palace of one of the Florentine instigators of the experiment in 1597, or, according to some, in 1594. These two again worked together on the opera of *Euridice*, which was publicly represented in Florence at the nuptials of Henry IV. of France with Maria dei Medici in 1600, its production having been preceded by that of Cavalieri's posthumous oratorio in Rome, *La Rappresentazione dell' Anima e del Corpo*, before noticed. That the first public performance of a dramatic oratorio and of a secular opera, both exemplifying the recently-devised declamatory power of music, should have occurred in the same year is a remarkable coincidence. That the first experiments in the novel art of lyrical declamation were confided to practised executants who brought their experience as vocalists to bear upon composition for a hitherto untried phase of vocal effect was excellent for the purpose of proving the proposition. The success of the experiment was, however, to be established when a composer already renowned as such, one who had drawn exceptional attention by his then new views of harmony, gave the force of his genius and the weight of his name to the novel class of writing. Such was Monteverde (1568-1643), who in 1607 brought out at the court of Mantua his opera of *Arianna*, followed in 1608 by his *Orfeo*. In these works, and in those of the same nature that he subsequently produced at Venice, is anticipated the principle (and, so far as the resources of the time allowed, the practice also) which was revived by

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classed under hymnody. In Scotland, also, the tune for the 124th Psalm is associated with its proper text.

Gluck some hundred and fifty years later, and of which the votaries of Richard Wagner in the present day assume their hero to have been the originator,—the principle, namely, that the exigencies of the action and the requirements of the text should rule the musical design in a lyrical drama, and that the instrumental portions of the composition should, quite as much as those assigned to voices, illustrate the progress of the scene and the significance of the words. The last speciality is exemplified in the harmonies and figures of accompaniment, and in the appropriation of particular instruments to the music of particular persons, so as to characterize every member of the action with special individuality. Such must be the true faith of the operatic composer; it has again and again been opposed by the superstition that feats of vocal agility and other snares for popular applause were lawful elements of dramatic effect; but it has ever inspired the thoughts of the greatest artists and revealed itself in their work, and no one writer more than another can claim to have devised or to have first acted upon this natural creed.

Monteverde had been attacked by Giovanni Battista Artusi for his use of what are now known as fundamental harmonies, which the composer might have learned from the music of Mouton (already named), but which he more probably rediscovered for himself; he had defended the practice, and his theoretical assailant had retorted. Polemics ran high as to the relative rights of contrapuntal legislation which had been developed through the course of ages, and the freedom of thought which had as yet neither rule nor tradition; for every separate use of an unprepared discord was tentative as to effect and speculative as to reception by its hearers. It will presently be shown that the discovery (no lighter term will suffice) of Mouton and Monteverde has its bass in the laws of nature; here it is enough to say that it was a turning-point in the history of music, the throwing open the resources of the modern as opposed to the limitations of what may justly be called the archaic. The distinction of these two styles was not clearly defined till long afterwards; but a writer may here be named, Angelo Berardi, whose work (1657) more fully than any other sets forth the contrapuntal code and enunciates the requirements in fugal writing, such as the affinity of subject to answer, and whatever else marks the style and the class of composition.

The opera now became a fixed institution in Italy, its performance was no longer restricted to the palaces of princes and nobles, and it became the best-esteemed entertainment in public theatres. The dramatic oratorio was transferred from the church to the secular stage, becoming in every respect a sacred opera, and only specimens of this class were suffered to be represented during the season of Lent.

Conspicuous, as much for the merit as the multitude of his productions, was Alessandro Scarlatti (1659-1725), who gave to the world 115 secular operas, many oratorios, and, besides these, which might well have been a long life's labour, a far greater quantity of ecclesiastical music, some of which is characterized as most dense and massive. He is accredited with three novelties in his dramatic writing: the repetition, *Da Capo*, of the entire first part of an aria after the second part, of which, however, some specimens by earlier writers are said to exist; the accompanied recitative, wherein orchestral interludes illustrate the declamation and figurative accompaniment enforces it, as distinguished from speaking recitative, wherein the accompaniment does little more than indicate the harmony whereon the vocal phrases are constructed; and the *sinfonia* or *overture* which is often associated with his name, as distinguished in plan from that which was first written by Lully, his being sometimes styled the French and Scarlatti's the Italian form of instrumental preface to an extensive work.[1] Alessandro Scarlatti is little less famous as a teacher than as an artist; he was at the head of all the three conservatories then flourishing in Naples, and the long list of his pupils includes his son Domenico and most of the other chief Italian notabilities of the next generation. Conspicuous among his contemporaries were Cavalli and Cesti.

Opera was first introduced in France by Cardinal Mazarin, who imported a company of Italian performers for an occasion. The first French opera, *Akebar, Roi de Mogul* (1646), was composed by the abbé Mailly for court performance. So was *La Pastorale* (1659), by Cambert, who built his work on the Florentine model, and, encouraged by success, wrote several others, on the strength of which he, with his librettist Perrin, instituted the Académie Royale de Musique, and obtained a patent for the same in 1669, exclusively permitting the public performance of opera. Jean Battiste Lully[2] (1633-1687) procured the transfer of this patent in 1672, and by it gained opportunity not only for the exercise of his own genius but for the foundation of the French national lyrical drama, which to this day is wrought upon his model.

The ballet had been a favourite subject of court diversion since Beaujoyeaulx produced in 1581 *Le Ballet Comique de la Royne*, a medley of dancing, choral singing, and musical dialogue. Lully, in his course to the summit of royal esteem, had composed several pieces of this order, which were performed chiefly by the courtiers, and in which the king himself often sustained a part; and, experienced in the taste of the palace, and indeed of the people, our musician incorporated the ballet as an essential in the opera, and so in France it still remains. It was not singly in the structural intermixture of dancing with singing that Lully's operas were, and those of his French successors are, unlike the works of the same order in other countries, he gave such care to and exerted so much skill in the recitative that he made it as interesting as the rhythmical matter, nay, varied it often with metrical vocal phrases and accompanied it constantly with the full band, whereas, until Rossini's *Otello* in 1818, speaking recitative (recitativo parlante, recitativo secco) was always a main element in the operas of Italy.

In Germany the seed of opera fell upon stony ground. Heinrich Schütz wrote music to a translation of Peri's *Dafne*, which was performed for a court wedding at Torgau in 1627; but only importations of Italian works with Italian singers came before the public until nearly the end of the century.

In England the lyrical drama found an early home. The masques performed at Whitehall and at the Inns of Court were of the nature of opera, and were largely infused with recitative. Eminent among others in their composition were Nicholas Laniere (*c.* 1588-1664), born of an Italian father who settled in England in 1571; Giovanni Coperario, who during his sojourn in Rome had thus translated his patronymic of John Cooper; Robert Johnson, who wrote the original music for *The Tempest*; Dr Campion, Ives, and William and Henry Lawes. The name of Henry Purcell (1658-1695) figures brightly in this class of composition; but, except his *Dido and Æneas*, written when he was eighteen, his so-called operas are more properly spoken dramas interspersed with music—music of highly dramatic character, but episodical rather than elemental in the design. This is due to an axiom of Dryden, the principal and indeed the model dramatist of the day, that music is not the natural medium of speech, and hence may only be assigned in dramatic representation to preternatural beings, such as spirits, enchanters, and witches,—maniacs also, through the abnormality of their condition, being admitted into the privileged category of those who may sing their conceits, their spells, their charms, and their ravings. The "frost scene" in *King Arthur*, the "incantation" in the *Indian Queen*, and the cantatas for Altisidora and Cardenio in *Don Quixote* are masterpieces of lyrical art that give warrant of the success that might have been achieved had Purcell's librettists given range in the province of humanity for his vivid imagination.

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[1] The Italian "sinfonia" mostly begins with an allegro, which is succeeded by a shorter adagio, and ends with a second quick movement that is sometimes the resumption of the first and is sometimes independent of it, and it is exemplified in the overtures to the *Seraglio* of Mozart, the *Euryanthe* of Weber, and several of Auber. The French "ouverture" (the original form of the word, which still remains in France) generally begins with a majestic movement, which is followed by an allegro, often of a fugal character, and concludes with a march or gavotte or some other description of dance, and it is exemplified in the overtures of Purcell and nearly all of those of Handel.

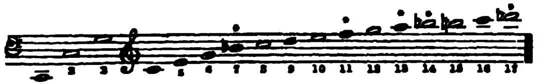
[2] This is the French form of his names Giovanni Battista Lulli, adopted after he was taken from Florence to Paris as a page.

Earlier in the history of English opera was the production of *The Siege of Rhodes*, an entirely musical composition, the joint work of Dr Charles Colman, Captain Henry Cook, Henry Lawes, and George Hudson, which was performed at Rutland House in Charterhouse Square in 1656, under the express licence of Cromwell to Sir William Davenant, and retained the stage until some years after the Restoration; the existence of its music is unknown, but a copy of its libretto in the British Museum amply details its construction. Separate mention is made of this remarkable historical incident as serving to refute the common supposition that Puritan influence impelled the decadence of music in England. In truth, this influence stirred the spirit of opposition in persons of a different tendency and was virtually the cause of a very powerful counteraction, and through this of many highly-significant things as to the perpetuation of our music of the past, if not of the continuance of our music in the future. It was during the Commonwealth that John Playford printed *Ayres and Dialogues*, a book that comprises with many pleasant pieces the first three that ever were defined by the word *glee*,—a term that later times have wontedly acknowledged and boasted as the designation of a class of music specially English. It was during the Commonwealth that the same publisher issued several editions of *The Dancing Master*, each being a variation of the foregoing; and this is the work to which we owe the preservation of all the beautiful English ballad-tunes of earlier date that are, many of them, not to be found in previous print or manuscript. It was in that very opera, *The Siege of Rhodes*, that Mrs Colman, daughter-in-law of one of the composers, sustained the character of Ianthe, she being the first female who ever took part in a public musical or dramatic performance in England.

Notice must not be omitted of the application of recitative to other than theatrical purpose. The cantata of Galilei has been cited; it was followed by many a piece under the same designation, dramatic monologues in which the mainly prevailing declamation was relieved by occasional rhythmical strains, and in the composition of these Carissimi, Stradella, Clari, Purcell, and Blow have left admirable specimens. Later, the term acquired a widely-changed meaning, it having been applied in Germany to compositions comprising matter for solo voices and for chorus, expressly for church use, and in England to works equally extensive on sometimes sacred, sometimes secular subjects. Cantatas are sometimes didactic, sometimes narrative, and sometimes dramatic, though never designed for theatrical use.

The music of the English Church might demand a separate history, because of its importance by the side of the art of other lands, because of the longer permanence of its examples than of works in other branches, and because of its unbroken succession of contributors, covering a period of beyond three centuries, whose style has varied with the age in which they wrought, but who in this department have ever aimed to express themselves at their highest. Here, however, only the names of the most noted writers, with an approximation to chronological order, can be given —Tallis, Byrde, Farrant, Orlando Gibbons, Dr Child, Dr Benjamin Rogers, Dean Aldrich (as distinguished in logic and in architecture as in music), Dr Blow, Michael Wise, Pelham Humphrey, Henry Purcell, Dr Croft, Dr Greene, Dr Boyce, Dr Nares, Dr Cooke, Battishill, after whom the art sank in character till it received new life from the infusion of the modern element by Attwood, coeval with whom was Samuel Wesley, and lastly are to be noted Sir John Goss, Dr S. S. Wesley, Dr Dykes (popular for his hymn-tunes), and Henry Smart, who bring the list down to recent personal remembrance. Well esteemed among living representatives of this department of music are Barnby, J. B. Calkin, Sir G. J. Elvey, Gadsby, Dr Garrett, Dr Gladstone, Dr H. Hiles, Dr Hopkins, Dr E. G. Monk, Dr W. H. Monk, Sir F. A. G. Ouseley, Dr Stainer, Dr Steggall, Sir Arthur Sullivan, and E. H. Turpin, to which names many might be added. It must be owned, however, that the vast increase of facilities for publication within recent years have multiplied church music almost immeasurably, and exercised the pens more than the wits of writers who prove themselves to be amateurs less by love of music than by love of composing, and still more by love of notoriety, which is gratified in the circulation among their own connexions of works that gain no acceptance by the world at large. The style, in strictly technical sense, of music for the church is and always has been, in England and elsewhere, identical with that which characterizes contemporaneous music on lay subjects. Some English musicians have of late aimed at, or perhaps only spoken of, a distinction of styles for the church and for the chamber, and this under a supposition that to be archaic was to be sacred, a supposition seemingly founded on the present use of, and high respect for, more ecclesiastical music of early date than of secular music of like age. The supposition overlooks the facts, however, that the church appropriated the tunes of the people eight hundred years ago, while the people framed some of their tunes on the peculiar church modes, that harmony was practised by the people before it was employed by the church, that the style of madrigals appears coincidently in sacred writing, that recitative was first applied to the opera and to the oratorio in the same year, that Monteverde's innovations in musical combination were at once adopted by church composers, that Purcell, Handel, and Bach wrote in onefold style for both situations, that the glee-writing of the latter half of the 18th century is undistinguishable from the services and anthems of the period, that Attwood had no different phraseology for the cathedral and the theatre, and that even now, though disguised to the glance by the antiquated notation of minims instead of crotchets, the thoughts expressed and the idiom which is their medium belong not more or less to the one than to the other purpose. Though contention be strong for the contrary, this is true art, presenting the feelings of the time in the time's own language and not making the sanctuary walls a boundary between art and artifice.

Attention must now be directed to the natural as opposed to the artificial basis of music. Marin Mersenne had great love and much practical knowledge of music; he directed his profound learning and rare mathematical attainments to the investigation of the phenomena of sound; and his treatise *Harmonie Universelle* (1636) first enunciated the fact that a string yields other notes than that to which its entire length is tuned. The discovery was extended by William Noble and Thomas Pigot, respectively of Merton and Wadham Colleges, Oxford, to the perception of the mode in which a string vibrates in sections, each section sounding a different note. The ancient musicians tested by calculation the few phenomena of sound then discovered rather than by observation of the principles these exemplify. The measurement of major and minor tones was, after the distinction of perfect intervals, the subject dearest to their consideration, and it seems the furthest limit to which their knowledge attained. All the laws for melody, all the rules for counterpoint, were founded on this mathematical method. The step or the leap of stated intervals was prescribed; combinations of sounds were reckoned by intervals from a named note, as 5th, or 6th, or 3d, not as constituting complete chords traceable to a common source, and intervals which are discordant were permissible only if softened in effect by the previous sounding of their discordant note; the canons for the progression of a single part and for the union of several parts were arbitrarily devised, peremptorily fixed, and rigidly enforced. Mouton and Monteverde found the good effect of musical combinations for which there was no account in the theory of their time, and employed them in their works; the innovation was stigmatized by musical grammarians, but it gave delight to the public and was adopted by subsequent composers. No explanation was, however, given of the natural source of fundamental harmonies, as chords of this class are now defined, and their employment was still exceptional, still an act of daring. In 1673 the two Oxonians above named, simultaneously, but independently, noticed the beautiful fact that a stretched string yields a different sound at every one of its nodal divisions, and the same is true of a column of air passing through a tube. The sounds so generated received from Sauveur[1] the name of *harmonics*, by which they were known for nearly two centuries, but they have of late been renamed partial tones or over-tones.[2] Here is a table of seventeen of the series:—



The figures under the notes show the number of each harmonic, counting from the generator or prime as the 1st. The notes marked * differ in intonation from the corresponding notes in our tempered scale, the 7th and 14th, and also the 13th, and likewise the 17th being slightly flatter, and the 11th being slightly sharper than our conventional notes; but the matter of temperament must rest for later consideration. The 8th above any note is double the number of that note; thus every higher C is double the number of the C below it, namely, 1, 2, 4, 8, 16; and so with every higher G, namely, 3, 6, 12; again with the higher E, namely, 5, 10; and with the higher ♭B, namely, 7, 14. The number of each harmonic is the same as that of its relative number of vibrations in any given time as compared with those of the variously-numbered harmonics, namely, the 8th above has two vibrations to each one of the note from which the interval is reckoned, the 5th has three vibrations to two, and so forth throughout the series. From ♭B to E, the 7th and 10th, is the interval of the augmented 4th, which was shunned in classic times, ignored by the Chinese, the Mexicans, and the Scots, ruled against by contrapuntists, and avoided in melody and harmony until employed by the Fleming and the Italian with such good effect that the world accepted it under the conditions of accompaniment with which those men employed it, and felt that a new element of beauty had been incorporated in the resources of the artist. The occurrence, in the harmonic series, of the two notes that are separated by this interval accounts for the discord they produce when sounded together, not needing the artifice of preparation which is required to mitigate the harshness of other discords; they are brought into being when the generator is sounded, and their assignment to voices or instruments in performance is but to make more articulate, or, so to speak, to confirm what nature prepares—in fact, what is induced by the generator. As light comprises all the colours and every gradation between each colour and the next, but yet seems spotless, so every musical sound comprises all other sounds, but yet seems to be one single note; the blue, or the red, or the yellow, or any other ray is separated from its prismatic brotherhood and seems then a complete and independent object to the vision, and so any sound is separated from the harmonic column and then seems all in all to the sense of hearing. Let the reader observe in the musical example that the intervals become closer and closer as they rise, and that when the 8th or double of a note occurs, if there be any break in the numerical succession between such 8th and the note that would, by example of the lower octave, stand next below it, then some new harmonic appears whose number adjusts the broken order; between the lowest C and the next is no break; between this C and the one above it, 2 and 4, what would else be a blank is filled by G, the third harmonic; between 4 (C) and 6 (G) what would be a blank is filled by E, the fifth harmonic, and so on throughout the series. No division of an interval is ever equal, the lower portion being always the larger; the interval between 2 and 4 is divided into a 5th and a 4th, that between 4 and 6 is divided into a major 3d and a minor, that between 6 and 8 by an interval less than a minor 3d and a 2d, and that between 8 and 10 by a major tone and a minor tone. It may be well to pause at this point, as it is the natural justification of what Ptolemy calculated, but Pythagoras failed to perceive. Thus much having been noticed, readers may be left to trace the same principle of larger and smaller division throughout the series. Beyond the 17th harmonic (the note known as the minor 9th when forming part of a chord) the series continues on the same principle of ever lessening distance, ever finer gradation, until the intervals become so small as to be almost impossible of articulation and of perception. What has here been adduced of the natural preparation of the discord of the harmonic 7th applies as truly to the discords of the major 9th, the 11th, the major 13th, the minor 9th, and the minor 13th, which last is too high in the harmonic series for convenient exemplification by gradual ascent in this place, and these notes are now all used in combination by composers.

Scientific discovery has seldom been made singly. When time has been ripe for the revelation of a phenomenon, several observers have coincidently witnessed its existence, and simultaneously or nearly so displayed if not explained it to the world. In the instance under consideration, art foreran science, and its votaries continued the employment of harmonies which as yet could alone be justified by their beautiful effect, and even musical theorists did not for ages to come perceive the important, the all-powerful bearing of the principle of harmonics upon the subject they treated. What Mouton first ventured to write must be styled the starting-point of the modern in music, and one cannot too much marvel at the strong insight into the beautiful which those after-minds possessed,—that, with no theory to guide, without star or compass, they made wider and wider application of the principle he had exemplified, and displayed in their works its utmost power of expansion. Three of the world's greatest musicians may be cited to show the force owned by genius of piercing to the utmost depth of a natural law, while having but their own delicate sense of propriety to restrain them within its bounds. Henry Purcell and his two colossal successors, George Frederic Handel (1685-1759) and Johann Sebastian Bach (1685-1750), wrote every combination of musical notes that down to our own latest times has ever been employed with good effect; and the more the works of these masters are studied the more are they found to foreshadow the supposed novelties in harmony employed by subsequent artists. This refers but to the technical materials of which their music is wrought; it is impossible in the present article to discuss fully the form and excellence of their works.

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[1] See Poggendorff, *Geschichte d. Physik*, p. 808.

[2] See Helmholtz, *Die Lehre von den Tonempfindungen*.

Purcell's voluminous and superb works for the church, his many compositions for the theatre, his countless convivial pieces, and his far less numerous instrumental writings are now but little known, and the ignorance of the age is its loss. They have a wealth of expression that cannot be too highly esteemed, and a fluency of melody that proves the perfect ease of their production. The idiom of the period in which they were written is perhaps a partial barrier to their present acceptance, and the different capabilities of instruments and of executants upon them of those days from the means at a modern musician's command make the music written in the earlier age difficult sometimes to the verge of possibility, and yet weak in effect upon ears accustomed to later uses.[1]

Handel's music has never, since he wrote, been wholly unknown or unloved, at least in England. He was engaged to come hither as a dramatic composer because of his Continental renown; this was immensely increased by the large number of Italian operas he wrote for the London stage, but, excellent of their kind as are these, the change of structure in the modern lyrical drama unfits the wonted witnesses of the works of the last hundred years to enjoy the complete performance of those of earlier time, and hence we hear but detached excerpts from any of them. It is upon Handel's oratorios and his secular works cast in the same mould that general knowledge of his mighty power rests, and these are a monument that cannot perish. The *Messiah* and *Israel in Egypt* are didactic oratorios, with which may be classed *L'Allegro, il Penseroso, ed il Moderato*, and *Alexander's Feast*. The others were defined by himself each as an "oratorio or sacred drama," and *Acis and Galatea*, *Semele*, and *Hercules* are similarly constructed. *Esther* (his earliest English oratorio) and *Acis and Galatea* were composed for performance in the mansion of the duke of Chandos in 1720 and 1721, and were publicly produced with the author's sanction in 1732, but then, as was expressly notified, without dramatic action. Their success established the class of work and form of representation in English use, for, though Handel subsequently wrote Italian operas, he from time to time engaged a theatre for the performance of complete works in concert wise, and yearly composed some new piece for production in this manner. In 1741 he visited Dublin, taking the *Messiah*, which had been written with a view to the occasion, and this masterpiece was first heard on the 13th April 1742 in the Irish capital. The reverence with which the work is regarded in England all but equals that for its subject, and the countless repetitions of its performance have made it so familiar to all hearers that the unversed in musical knowledge, little less than the profoundest musicians, feel its sublimity and listen to it with such awe as no other work of art induces. No master has ever excelled Handel in verbal declamation (as at the descent on the last word of "sheds delicious *death*" in the air of Acis, at that on the last word of "so mean a triumph I *disdain*" in the air of Harapha, and the extraordinary use of an almost toneless low note of the tenor voice on the last word of "He turned their waters into *blood*" in *Israel in Egypt*), in poetic expression (as in the choruses "He sent a thick darkness" in *Israel*, and "Wretched lovers" in *Acis and Galatea*), or in dramatic characterization (as in all the personages in *Jephtha*, who are each distinguished from the others far better in their musical than their verbal phraseology); but the quality in his music which compels the epithet sublime is the broad, simple grandeur of the choral writing, which, rich in the devices of counterpoint, never fails in clearness, never in the melodious flow of each of its parts, and is hence as pleasant to executants as it is perspicuous to auditors. He wrote under the sway of contrapuntal law, from which theorists had not yet defined the exceptions, but the force of his genius broke occasionally through its despotism, and so, in his works as in Purcell's, the principle of fundamental harmony and the application of the chromatic element are freely demonstrated.[2]

Bach was one of a very large family of musicians, who for two centuries practised the art, in many instances with great success; the family glory culminated in him, and was scattered among his many sons, in whom it became extinct. Bach was a more assiduous student than either his predecessor or his contemporary who are here classed with him. It was later in life than they that he issued his earliest works, for his youthful renown was more as a player than as a producer. Having no theoretical instructor, he made searching study of all the music of earlier times and of his own.[3] Whatever Bach learned of the principles of counterpoint from profounder musicians, he owed his views of plan or design in the structure of a composition to his familiarity with the concertos of Antonio Vivaldi and Tomaso Albinoni, both Venetian violinists who visited Germany, and he gained this familiarity by arranging for the organ many of the concertos for several instruments, as also much that the same authors wrote for a single violin. His arrangement consisted in adding parts to the original, which he kept intact, and so retained the plan while enriching the harmony. To his latest days he was wont to retouch his own music of former years, doubtless with the purpose of improvement, and he thus showed himself to be still a student to the very end of his career. A class of oratorio of which Luther had planted the earliest germ, the recitation of the Divine Passion, had grown into extensive use in North Germany prior to the period of Bach, and to this belongs his largest if not most important work. This is his setting of the portion of St Matthew's Gospel which narrates the incidents, interspersed with reflective passages, some taken from the chorals of common use in the Lutheran and Calvinistic churches (the tunes proper to which have special harmonic treatment when here appropriated), and some set in the form of airs, duets, and choruses to verses written for the occasion. Bach set also St John's version of the Passion, and others. He wrote likewise for church use cantatas peculiar to every Sunday's requirement in the Lutheran service, and left five series of these, each for an entire year. He produced other sacred and many secular cantatas, a mass of such colossal proportions that it is unavailable for the purpose of celebration. other pieces for the Roman Church, very much for the organ alone that has never been equalled in its intrinsic qualities or as a vehicle for executive display, many concertos and suites for the orchestra of the day, and a vast number of pieces for the harpsichord or clavecin. Among these last must be signalized *Das wohltemperirte Clavier* (1722), and a sequel to the same, *XXIV. Preludien und Fugen durch allen Tonarten, sowohl mit der grossen als kleinen Terz* (1740).[1] These two distinct works are now commonly classed together as *Forty-eight Preludes and Fugues*. To describe their purpose reference must be made to the discrepancies between the tuning of intervals by 3ds, or by 8ths, or by 5ths. The B♯, which is reached by successive 3ds above C, has 250 vibrations in the same period that the C, which is reached by 8ths from the same starting note, has 256, and in the same period that the B♯, which is reached by 5ths from the original C, has 259 and a fraction. The same is true of every other musical sound as of C, namely, that tuning by 3ds, or 8ths, or 5ths, yields a different note from the other two. Hence it results that notes which are in tune in one key are out of tune in other keys, and consequently musical composition was of old limited to those very few keys that have several notes in common with the key of C.[2] The organ Handel presented to the chapel of the Foundling Hospital, London, had the raised or black keys divided, with each half to act on pipes different from the other half, and thus gave different notes for C♯ and for D♭, and the like; and other organs of the period were similarly constructed. Bach's notion was so to temper the intonation that, while the tuning of no key should be perfect, the discrepancies should be divided so nicely between all keys that no one would be offensive to the hearer, and to illustrate this he wrote in his 38th year a series of pieces in every one of the keys in its major and minor form, calling it "The clavier with equal temperament." This bears on a supposition, once diffidently advanced and since confirmed by men who soundly studied the subject, as much as by constant ob tion of him who first conceived it, although disput others; it is, that the ear receives tempered sounds a should be, instead of as they are, perceiving a dif effect from the note whose tonal surroundings pr to be G♭ from that which is yielded by the same stri a pianoforte when it is required to represent F♯. is the practical application in modern use of the enharmonic with reference to keyed instruments w means the giving different names to one note; on the however, and on bowed instruments the smallest grad of pitch are producible, and so all notes in all keys c justly tuned, which, among others, is one reason fo exceptional delight given by music that is represent either of these means. The enharmonic organ and monium of Mr Bosanquet are provided with a key of a general nature in which the restriction to closed c of 5ths is avoided. Systems reducible to series of 5 any character can therefore be placed on this keyb As the relative position of the keys determines the arr ment of the notes, the fingering is the same in all and depends only on the intervals employed. The m use of the word chromatic has already been stated, a only remains to say of the other of the three Greek ge diatonic, that the term now defines music consisti notes according to the signature of the prevailing key. return to Bach, his orchestration is completer than Ha though yet needing the addition of an organ part th did not write, but his scores are liable to misrepresent in modern performance because several of the instru are obsolete for which they were designed; Bach's o tral treatment differs from that of later days in h often a special selection of instruments for a single ment in a work, which are engaged throughout that with small variety of interchange, and likewise in h mostly the separate counterpoint for every instru employed instead of combining instruments of diff tone in one melody. But seldom Bach wrote in o other of the ecclesiastical modes, as did Handel rarely, and he used more freely than his contemporar extreme chromatic discords. He may indeed be reg as a double mirror, reflecting the past in his contrap writing and forecasting the future in his anticipati modern harmonies.

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[1] Here must be defined the chromatic genus in its modern application, which is signally exemplified in this master's music; it admits of notes foreign to the signature of the key, but which induce no modulation, or, in other words, change of tonality. Notes expressible only by accidentals are as essential to the chromatic scale of any prevailing key as are those elemental in the diatonic scale which are indicated by the key-signature. Chromatic chords were used by Purcell and his nearest followers, chromatic passing-notes (notes that form no portion of chords) came little into use until after the middle of the 18th century.

[2] A custom of the age is largely and, we now feel, sadly exemplified in Handel's art legacies, namely, the writing in many instances but an outline of the score which was to be filled up extemporaneously by a player on the organ or harpsichord with counterpoint that is necessary to the effect, and even essential to the idea. So long as the composer lived to make these improvisations, we know they added interest and we doubt not they added beauty to the music; but after-organists lack the ability or courage or both to supply the deficiency. Mendelssohn wrote for *Israel* such an organ part as he would have played in the performance of the oratorio, diffidently deliberating on what originally was trusted to the fortune of the moment, and the like has rarely been done by other musicians for other works. Mozart wrote for the *Messiah*, *Acis*, *Alexander's Feast*, and the *Ode for St Cecilia's Day* wind-instrument parts comprising such matter as might have been played on the organ had one been in the hall wherein these pieces were first performed in Vienna; but they modernize the character and often alter the idea, while they complete and perhaps adorn the music. That these parts exist, and that their merit induces their adoption when the works are performed, have been a licence for the production of "additional accompaniments" to many a masterpiece of Handel, when such genius as Mozart had has not inspired the writer. The former custom and the later licence are both to be deplored, particularly in our age, when with regard to other arts the aim prevails to purify the works of older time from additions by strange hands that have accumulated to disfigure them.

[3] Among the masters from whose example he deduced his own principles, some of the most famous are Girolamo Frescobaldi of Ferrara (*b.* 1587), his pupil Johann Caspar Kerl (1628-1693), Dietrich Buxtehude (1637-1707), Johann Jacob Froberger, another pupil of Frescobaldi (*ob.* 1667), Georg Muffat (*ob.* 1704), whose son was even more prolific and perhaps more noted than he, Johann Pachelbel, Georg Boehm, and most probably Johann Joseph Fux (1660-1741), whose work on counterpoint, *Gradus ad Parnassum*, was the text-book by which both Haydn and Mozart taught, and is still held in high respect.

Notice of these two extraordinary men would be i plete without an attempt to parallel if not compare Born within a month and within walking distance o other, speaking the same tongue, professing the religious tenets, devoting themselves to the same a to the same productive and executive branches of art with success that cannot be surpassed, they we different in the character of their works as in their pe traits and their courses of life. The music of Hand its simple, massive, perspicuous grandeur may be li to a Grecian temple, and that of Bach to a Gothic e for its infinite involution of lines and intricacy of d The greater complexity of the one makes it the more cult of comprehension and more slow in impression, the sublime majesty of the other displays itself single glance and is printed at once on the mental v Handel wrote for effect and produces it with cert upon thousands; Bach wrote as a pleasurable exercis mastery, and gives kindred pleasure to those who stu work in the spirit that incited him to produce it.

Contemporary with the working of these two gl Saxons were the labours of Jean Philippe Rameau (

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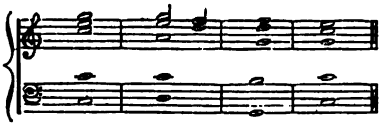
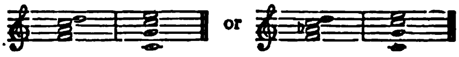
[1] Supposed by some to have been completed in 1744.

[2] It is supposed that early organs were tuned with true 3ds and flattened 5ths (the "mean tone" system of Zarlino and Salinas), and Mersenne enunciates, though obscurely, a rule for this division.

[3] Some theorists use the generic terms in limited sense :—di proceeding by 2ds; chromatic, proceeding by semitones; enhar changing the name of a note.

1764), a native of Dijon, who made his mark on history. He wrote many operas and ballets which are held in less esteem than those of Lully, some cantatas and sacred pieces, and a large number of compositions for the organ and clavecin, but, notwithstanding the merit of these and their success, it is more as a theorist than as an artist that he is now regarded. He published several treatises, embracing principles of performance as well as rules of harmony and a system of composition, and the original views these enunciate have obtained high regard. He distinguishes what he styles the "basse continue" from what he names the "basse fondamentale" in tracing inverted chords to their roots, and differs in this from writers on counterpoint who treated only of intervals from each actual bass note. Thus he looked in the direction of later theories of fundamental harmony, but scarcely obtained sight of the object. He speaks of a chord of the 11th apart from the suspension of the 4th; but his examples show this to be the double suspension of the 9th and 4th, to be resolved on the root and minor 3d of a chord of the prepared 7th, which further has to be resolved on a chord whose root stands at a 4th above its own, and so this chord, having nothing exceptional in structure or treatment, needs no distinctive title. Another point is indeed original, and has obtained somewhat wide acceptance; this is his theory of the chord he defines as the "great 6th," which is named the "added 6th" by his English followers. It consists of a common chord (usually of the subdominant) with a 6th added, and its resolution is on the chord whose root is at a 4th *below* that of the discord, the 5th in the former chord being retained as the root in the latter.





Against this view it may be urged that all harmonic intervals are at uneven numbers from the generator, the even numbers standing for the octaves above any of these, as $\frac{8}{1}\ \frac{10}{3}\ \frac{12}{5}$, or else for their inversions, as $\frac{6}{3}\ \frac{4}{5}\ \frac{2}{7}$, and hence the 6th (D in the above example) is not an original but an inverted interval; further, whatever note may be added in a column of harmony does not affect the concordance or discordance of the notes below it, but is itself the discordant element in the chord, whereas the addition of the 6th to a common chord changes its concordant 5ths into a discord, and therefore the 6th must be otherwise traced. Other theorists have, more in the direction of truth, defined this chord as a first inversion, reckoning the 6th from the bass as the inverted root, but giving no account of its exceptional resolution. It was not till the following century that the theory for this chord was propounded with the seeming of truth, showing that the 7th below its given bass (G under the F in the above) is the real generator, and showing this to be an incomplete inversion of the chord of the 11th, of which Rameau invented but misapplied the name. The subject will be more fully discussed when the period is treated to which this last theory belongs.

Benedetto Marcello (1686-1739) was a Venetian of wealthy parentage. He was pressed by his father into the pursuit of the law, and held lucrative appointments in his profession, but his love was for music, and in music he has some renown, partly for his compositions, the best known of which are the settings for one or more voices of fifty of the Psalms in an Italian version, and partly for his writings on music, especially a satirical pamphlet, *Il Teatro alla moda* (1720), as remarkable for the justice with which it censures the corruptions that cankered dramatic art as for its humour. This treatise quotes the principles of the Florentine assumed musical revival in 1600, and is regarded as the precursor of the practical reform effected by Gluck.

The renowned Jean Jacques Rousseau (1712-1778) is often accredited as a musical theorist because of his several publications on the subject, especially his *Dictionnaire de Musique*, which was finished in 1764, licensed in 1765, but not published till 1768. Its repute must have been gained by the grace of his language rather than by the soundness of his views, which are elegantly stated but rarely stable when they look to either side of the beaten track of accepted principles. He wrote violently against French music and the French language as a musical medium, being prominent in the literary disputes known as the "Guerre des Bouffons," but recanted when Gluck's genius was exercised on French opera. Rousseau produced some slight musical dramas, but proof has been adduced that they were the works of other hands.

Padre Martini (1706-1784) worked to far higher purpose than the last named, and the deeper impression he made on music is due to the depth of his knowledge. He was a mathematician and a scholar in other branches of learning, all of which he brought to bear upon his musical studies. He composed for the church and for the theatre vocal and instrumental chamber music, and pieces for the organ. He enunciated no new theory, but rendered great service by the collected publication of many art rarities exemplifying the musicianship of earlier times, and proving his ability to estimate their merit by the inclusion of a large number of canons of his own, which latter are presented in the enigmatic form of ancient use wherein the primary part or parts alone are given, and the reader has to discover the canon that fixes the period and the interval at which the response is to enter. He issued at different dates three volumes of a *History of Music*, and did not live to complete the fourth, which would have brought the subject only down to the Middle Ages. He was revered by the musicians of all lands, and he is honoured by those of our own time for the penetration with which he discovered the excellence of the boy Mozart, and the encouragement that aided largely to confirm the self-reliance of this everlasting prodigy.

German opera owes its birth to Reinhard Keiser of Weissenfels (1673-1739). His first dramatic effort, *Ismene*, was produced at the court of Brunswick. Success induced him to further exertion in the same field, and its continuance enabled him to undertake the management of the Hamburg theatre, in which, between 1694 and 1734, he produced 116 operas. Even these were but a portion of his works, for he wrote several dramatic oratorios, and made more than one setting of *The Passion*, which last preceded the compositions of the class by Handel and Bach. Little of his music survived him, but his influence on the art of his country was enduring. Matthison distinguished himself in Keiser's theatre, which also was the scene of the young Handel's first dramatic essays. Karl Heinrich Graun, a singer, and Johann Friedrich Agricola belong to the next generation of writers of German opera, both of whom won large renown.

It is now time to revert to dramatic music in Italy. Giovanni Battista Buononcini (1672-1750) and his brother Marc Antonio were famed in and out of their own country. They both visited London, where the former opposed Handel, and the rivalry between the Italian and the German musician is notable in the history of the time. Nicola Antonio Porpora (1686-1767) owes his fame more to the success of his pupils in singing, of whom Farinelli and Caffarelli were the most distinguished, than to the merit of his numerous compositions. Leonardo Leo

(1694-1746) wrote largely for the stage, but is most prized for his church music, which is of a character so different from his other productions that he is entitled to the twofold estimation of being a light and a severe composer. Johann Adolph Hasse (1699-1783), though born in the neighbourhood of Hamburg, wrote all his many operas, except the first, to Italian words for Italian singers, and may therefore be best classed among the composers of that country, where also he received his musical education. His excellence as a tenor singer, his skill as a clavecinist, and his marriage to Faustina Bordogni, the renowned vocalist, all helped to bring him and his music into note. His remark, when at the age of eighty he superintended the production of his last opera at Milan coincidently with Mozart's bringing out of his *Ascanio in Alba* when fourteen years old, that "this youngster will surpass us all," says as much for his penetration as for the diffidence of one who had passed a long life with success. Giovanni Battista Gesi (1710-1736), being born at Pergola, was called by his schoolmates Il Pergolese, and is known by all the world under this instead of his family name. Little acknowledged while he lived, he accomplished during his almost momentary career such work as places his name among those of the most famous of his countrymen. His comic opera *La Serva Padrona*, little noticed when first given in Naples, had such success when reproduced in Paris that it was shortly afterwards played in every country in Europe. If this piece did not initiate it confirmed the application of music as much to subjects of real as of heroic life, and therefore, though slight in structure and brief in extent, it is historically conspicuous. This and his setting of the *Stabat Mater* for female voices, which occupied him during his last illness, are the compositions by which he is best remembered. Nicolo Jomelli (1714-1774) was born and died in the Neapolitan territory; he produced many operas in Naples, several in Rome, Bologna, and Venice, and he held for fifteen years an engagement in Stuttgart, where his genius was active; he is particularly esteemed for his expression of sentiment, in which quality some of his critics account him the forerunner of Mozart; much as he wrote for the stage, his predilection was for church music, but the amount of his erudition or his power to apply it scarcely justified this preference. This composer may close the present list, as being the first to break through the example of Alessandro Scarlatti, and to write airs without the "Da Capo" which general approval of that example had rendered conventional if not indispensable. The plan claims respect as proving and fulfilling design, but it is inconsistent with truthful treatment of a subject which naturally proceeds in a continuous course and does not admit of the plenary recapitulation of feeling that has already been developed after this has passed into a different direction; as a matter of effect, the "Da Capo" is rarely charming and often tedious, it is less inappropriate in instrumental than vocal music, and even there some modified allusion to previously stated ideas is far more interesting than the unqualified restatement of what has already been set forth. One characteristic must be named that marks the whole period under present survey—the subordination of dramatic propriety to the display of vocal specialities; these were classified in distinct orders, and custom became tyrannic in exacting that every singer in an opera should have an aria of each class, and that the story must be so conducted as to admit of their timely or untimely introduction. The entire action of the Italian opera of the period is conducted in spoken recitative, with few exceptions of accompanied recitative in the most impassioned situations, and the arias or rhythmical portions of the work are episodical, being expatiative or reflective on the circumstances. The volubility that then was esteemed the main, if not the highest, qualification of a vocalist had its imperative exercise in all works for the stage, and the original purpose of dramatic music was thus foiled in making the business of the scene to wait upon the exhibition of the representative.

Instrumental music now began to assume the importance which at present it holds by universal suffrage. Compositions for the organ by Italian and German masters had been numerous, but executancy on bowed instruments was little advanced, and music written for them was accordingly limited in its style and construction. Vivaldi has been named as a pioneer in the art of design, and to the precedent set by him must be attributed the power of unfolding and arranging musical thought which gives to the orchestral and chamber works of after time a supreme position as intellectual and imaginative exercises. The name of Arcangelo Corelli (1653-1713) figures prominently in the annals of violin playing, but, whatever the merit of his tone and his style, he employed but a limited portion of his instrument's compass; and this is proved by his writings, wherein the parts for the violin never proceed above D on the first string, the highest note in the third position; it is even said that he refused to play, as impossible, a passage which extended to A in altissimo in the overture to Handel's *Trionfo del Tempo*, and took serious offence when the composer played the note in evidence of its practicability. His compositions are still highly esteemed; they consist of *concertos*—a term which at the time defined concerted pieces for a band, not, as now, pieces for a solo player with orchestral accompaniment—and sonatas, some for one, some for two violins with a bass; they are melodious, but their harmony is not always pure, and, strange to say, though they were written in Italy, where the laws of rhythm and accent were first established, these are slighted in the music; indeed, the longevity of Corelli's works must be due to some other cause than their merit.

Giuseppe Tartini (1692-1770) greatly advanced the art of the violinist, as is testified by his compositions for the instrument and his treatise on its capabilities, and is further proved by the eminence of many of his pupils. Tartini contributed to science as well as to art in his discovery (1714) of "resultant tones," often called "Tartini's tones," and yet some writers ascribe the first perception of the phenomenon to Storge, a German, who described it sixteen years later. The phenomenon is this:—when any two notes are produced steadily and with great intensity, a third note is heard, whose vibration number is the difference of those of the two primary notes. It follows from this that any two consecutive members of a harmonic series have the fundamental of that series for their difference tone—thus, $\frac{E}{C}$, the fourth and fifth harmonic, produce C, the prime or generator, at the interval of two octaves under the lower of those two notes; $\frac{E}{G}$, the third and fifth harmonic, produce C, the second harmonic, at the interval of a 5th under the lower of those two notes. The discoverer was wont to tell his pupils that their double-stopping was not in tune unless they could hear the third note; and our own distinguished player and teacher Henry Blagrove (1811-1872) gave the same admonition. The phenomenon has other than technical significance; an experiment by the Rev. Sir F. A. G. Ouseley showed that two pipes, tuned by measurement to so acute a pitch as to render the notes of both inaudible by human ears, when blown together produce the difference tone of the inaudible primaries, and this verifies the fact of the infinite upward range of sound which transcends the perceptive power of human organs. The obverse of this fact is that of any sound being deepened by an 8th if the length of the string or pipe which produces it be doubled. The law is without exception throughout the compass in which our ears can distinguish pitch, and so, of necessity, a string of twice the length of that whose vibrations induce the deepest perceivable sound must stir the air at such a rate as to cause a tone at an 8th below that lowest audible note. It is hence manifest that, however limited our sense of the range of musical sound, this range extends upward and downward to infinity.

The pianoforte owes its invention to the period now under review. This instrument may be styled the voice of the musician, the only means whereby unaided he can give complete utterance to his thoughts, the only vehicle for the communication of musical ideas in their entirety. This is not said in depreciation of other instruments of various excellence which have qualities impossible to the pianoforte, but has reference to the totality of musical speech that is possible, and to the convenience with which this is produced on the instrument in question. The characteristic difference between this instrument and earlier ones of a similar class is that the strings of the pianoforte are struck by hammers impelled by the keys under the performer's finger, and yield louder or softer tone according to the force he uses, whereas its predecessors yielded variety of loudness only by mechanical instead of personal means, and hence were not the living exponents as it is of the executant's impulse. Whether one speak of the happiness kindled in the homestead by this most facile and most self-sufficient instrument, or of the fuel of such happiness, namely, the measureless amount of music of every style and quality that has been written for the pianoforte, its existence is to be accounted as an influence all but infinite upon society as much as upon art. The term "pian e forte" is applied to a musical instrument by Paliarino or Pagliarini, a manufacturer of Modena, in 1598, but no particulars have reached us of its structure or effect. Some instruments which foreshadow the chief essentials of the modern pianoforte, made by Bartolomeo Cristofori, a Paduan then working in Florence, are described in letters of 1709, and must have been made some years earlier, and pianofortes by this ingenious inventor still exist bearing date 1720 and 1726. Marius, a Frenchman, submitted plans for an instrument with hammer action to the Académie Royale des Sciences in 1716, and Schröter, a German, claimed to have devised two models in 1717 and 1721; but the first pianofortes made away from Italy were by Gottfried Silbermann in 1726, who worked from the designs of Cristofori.[1]

Let us now revert to the opera, in which vast modifications were germinated towards the middle of the 18th century, and ripened before its close into noble maturity. Allusion has been made in the notice of Pergolese to the appropriation of the lyric element to comic subjects. At first wholly unregarded as a sphere for art uses, then admitted for interludial purposes in a fabrication styled *intermezzo* that was played between the acts of a serious composition, comedy became in course of time the basis of the most highly important, because the most comprehensive and truly the grandest, and further because the most especially musical, application of the art to dramatic ends. The class of writing here to be considered is that structure of concerted vocal music through which a continuous action proceeds, involving the embodiment of the characteristics of the several persons concerned, with their opposition and combination. Handel had been remarkably happy in uniting in one piece the utterances of three, four, and even five distinct persons; he did not, however, make these several individualities interchange speech in dialogue, but caused them to sing, as it were so many monologues at once, each independent of the others, and Handel was not singular in his occasional practice though he was in his excellence. Nicolo Logroscino (1700-1763), a Neapolitan, who never would write but to the dialect of his own country, was so exclusively comic and so surpassingly successful as to gain the cognomen of "Il Dio dell' opera buffa." It was he who first enchained a series of pieces (technically styled movements) in unbroken sequence, during which different persons entered or left the scene, discoursed in amity or disputation, or united either in the outpouring of a common sentiment or in the declaration of their various passions. For some time this form of lyrical dramatic art was only applied to comic subjects; Paesiello is said to have been the first musician who introduced its use into serious opera; it reached perfection under the masterly, magical, nay, superhuman touch of Mozart, whose two finales in *Figaro* and two in *Don Giovanni* are models which should be the wonder of all time and yet can never be approached. The spoken drama is limited to the onefold utterance of a single person, for, however rapid the colloquy, if any two spoke together, each would eclipse the other's voice—retort may be instantaneous, but cannot be simultaneous. In a painting the different characters and emotions of the persons presented are shown at once, but, as if under the glance of Medusa, they are fixed for ever in one attitude with one expression. In an opera finale the manifold passions of as many human beings, vivified by the voices of the same number of singers, come at once on our hearing with prolonged manifestation, and this is the wielding of a power that is not in the capability of any other of the fine arts.

Christoph Willibald Gluck (1714-1787) was a Bohemian by birth, and a wanderer by habit. He was a grand reformer, or rather restorer, of dramatico-musical art, yea, and a prophet, for he not only revived the principles enunciated in Florence on the threshold of the 17th century, which had been superseded by the vocalisms that had usurped the throne of truth, but he fully forestalled by this revival all that is good in what is nowadays denoted by the cant term "music of the future." As was the wont of his age, Gluck went to extend his art experience, perhaps to complete his education, to Italy, and there produced so many meritorious works in the style of the time as to establish a high reputation. This led to his engagement to write for the Italian Opera in London, whither he came in 1746. The work he composed for this occasion and one he then reproduced met with small favour, and a "pasticcio" from his previous works, *Piramo e Tisbe*, had no better fortune. The failure brought the conviction that, whatever the abstract merit of music, a piece that was appropriate to one character in one situation could not be fitted to another personage under different circumstances, and that admired pieces culled from different works could not be concocted into a whole with appearance of unity. Gluck therefore resolved to abandon the prevailing customs in writing for the stage, and to devise a system of dramatic composition wherein the musical design should grow out of the action of the scene, being ever dependent upon and illustrative of it, and yet being always a design faithful to the principles of what may be named musical architecture. As did Monteverde and his contemporaries, so did this composer aim to distinguish his dramatic persons by assigning music of different character to each; he required that the overture should announce the cast of feeling and thought that was to pervade the work, and he strove to make the whole of the music appropriate to the individuals, to the situations in which they were concerned, and to the words they uttered. He did not reject the essential of rhythmical melody, which is ever necessary to a musical work, and which stands in relation to passages of pure declamation as metaphor in poetical speech stands in relation to circumstantial statement. An orator will pause in the disclosure of facts to enforce them by the mention of a similitude, or brighten them by reflexions from his own mind, and it is an application of the same art when a character in a drama stays to comment on the scene in which he is involved, and show in words the passion that is seething in his heart. Analogous to this is the occasional arrest of intercourse between the musical persons for the expression of the feeling by which one is swayed, and such is a song in an opera during which, if the action be stagnant, the character more than elsewhere proves its vitality. Plan in a musical work consists (1) in uniform or contrasted rhythm, (2) in the relationship and enchainment of keys, (3) in the development and elaboration of phrases, and (4) in their occasional recurrence. Some plans have by frequent appropriation become to a great extent conventional, and their philosophic basis accounts for and justifies the fact that much music is framed upon them; it is the special province, however, of the writer for voices, and still more so of the writer for the stage, to ignore convention, though never to neglect design, and to construct his plans according to the situations they are to fill and to the materials with which he has to work. For sixteen years Gluck pondered the prevalent improprieties and the possible proprieties of dramatic art, and prepared himself by technical study and polite conversation to strike the blow which was to effect a revolution, the while, strange to say, he wrote several operas in his old style for production in different towns of Italy, Germany, and other countries. At length in 1762 what he meant to be the representative work of his then matured principle, *Orfeo ed Euridice*, appeared in Vienna and made strong impression. Some lighter pieces filled the interim between this, which without exaggeration may be regarded as an event in musical history, and the production in the same city of *Alceste* (1767). The opera was published, as also was *Paride ed Elena* (1769), each with a statement of the artist's views; and these two essays have since been regarded as constituting a grammar of dramatic music. Gluck was not content with the Viennese reception of the works on his new model, and was less so with the accessories that city afforded for giving theatrical effect to his compositions. He went, therefore, to Paris, wrote music to an adaptation of Racine's *Iphigénie en Aulide*, which fulfils his purpose in a higher degree than his previous pieces, and brought it out with extraordinary success. *Orphée* (1774), *Alceste* (1776) (both rearranged from the Italian versions), *Armide* (1777), and lastly *Iphigénie en Tauride* (1779) rose each to a loftier level, and met with just acceptance.

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[1] These dates have been gathered and verified by Mr A. J. Hipkins, to whose exhaustive papers on this class of instruments and their best esteemed makers readers are referred. See also PIANOFORTE.

It must be owned that other forces concurred with musical merit in Gluck's Parisian triumphs. He had taught singing to Marie Antoinette before she became dauphiness, and she now was an ardent partisan of her former instructor. Mme. Du Barry held a rival court to that of the young princess, her jealousy of whom and of her state was evinced by every possible means. Accordingly she invited to Paris Nicola Piccini (1728-1800), and strove to establish him in opposition to the German master. His *Roland* set to a libretto by Marmontel was brought out in 1777, anticipating the subject of Gluck's *Armide*; it was followed by other French operas, and the contest ended with the production of his *Iphigénie en Tauride* (1781), subsequently to that with the same title, the masterpiece of his opponent. This musical warfare much resembled that of some forty years earlier between Handel and Buononcini in London, when the king headed the partisans of the German and the Prince of Wales those of the Italian artist; but the Parisian feud was waged with far the greater violence, for, not only were the courts of the two ladies involved in it, but every literatist of note sided with one or the other faction, and hurled poems, or pamphlets, or essays, or critiques at his antagonists, that were crammed with remorseless invective. It pretended to be a dispute as to national style, but was a quarrel between two leaders of fashion. Piccini's music is marked by the melodious grace for which his country claims pre-eminence, Gluck's by the graver thought by which the Teutonic muse is more distinguished. Gluck, however, was not profound, he was no contrapuntist, and his often grand and always expressive harmony sprang more from intuition than knowledge; Piccini had dramatic power, and he advanced greatly Logroscino's invention of continuous concerted music conformable to the business of the scene, but applied this only to comic operas, and so turned it to no account in his compositions for Paris. His most successful production, *La buona Figliuola* (1760), passed from its birthplace, Rome, to every European capital, and is not even now forgotten.

The origin, development, and supreme importance of the *symphony* next claim our attention. The term is and always has been used in Italy to define the instrumental preface, which elsewhere is called an overture, to a long vocal work. Handel and others, early in the 18th century, defined by it an instrumental piece incidental to such a work, generally depicting some supposed action, such as a battle, or a multitudinous entry. The term is also applied to the prelude and interludes in a single vocal piece of however small extent. Its significance is far more comprehensive in the application now to be described. Its nearest analogy among earlier compositions is to what of old was called a concerto, and the two names, derived respectively from Greek and Latin, have at root the same meaning. Like the antecedent concerto, the symphony is a composition, consisting of several movements or self-complete divisions, for a full band; unlike its predecessor, the plan of at least its first movement has in the course of years been so distinctly organized that musicians shrink from applying the definition symphony to any work wherein there is not the aim to fulfil this design. At first the term was loosely employed, for even so late as Haydn's visits to London in 1791 and 1794 the symphonies he wrote for first performance there were sometimes announced as such, sometimes as overtures, and sometimes as "full pieces." Its structural requirements especially connect it with works for the chamber, which, if for one or two solo instruments, are styled *sonatas*, if for three or four or more, *trios* or *quartets*, or what not, according to the number of parts they comprise. The word "plan," always used by that distinguished teacher Cipriani Potter (1792-1871) as meaning musical design, happily, because positively, expresses the arrangement of ideas according to a purpose, to which, being intangible and invisible, the word "form" is but metaphorically applicable. Sebastian Bach, Corelli earlier, and Purcell before them, designated compositions as sonatas which, however, are not modelled on the plan of the modern symphony.[1] Bach in some of his later preludes and in other instances has the incipient germ from which the plan has been evolved, and sonatas by Domenico Scarlatti (1683-1757) comprise movements wherein it is more developed. These musicians were by no means the first, however, to strike the vein of ore for which divination seems to have been carefully in search long prior to their labours. This justifies the belief that its source is in nature, that it was discovered, not created, by man's genius; and the work of successive generations of artists has been to rear and mature that which, having once been found, is the heirloom of the present and the future. The practice of all ages proves common consent that a musical composition must begin and end in one and the same key, and this statement refers not more to our own time than to that of the ancients, whose modes are comparable though not identical with the keys of modern establishment. Continuance of one key throughout a piece of considerable length would be monotonous; to relieve this, modulation is effected into other keys in the course of a composition. To obtain tonal variety without violence, the choice of alternative keys must be made first and chiefly from those which have the nearest tonal relationship to the primary key. After the harmonic 8th (which is a miniature of the 1st) the harmonic 5th is next in prominence, from this note a chord rises as complete as that of the generator, from this chord a second key proceeds by natural evolution; the note, the chord, the key, are each named the dominant, since dominating, commanding, or defining the tonality of the fundamental note. The key of the dominant is hence the one most often chosen for the principal alternative to the primary key if the latter be major; but the key of the 3d and that of the 6th are occasionally selected instead by a further application of the harmonic system. If the primary key be minor, the choice of the chief alternative key is often made in the contrary direction; the tonic itself is assumed to be a harmonic 3d or else a 6th, and the chief modulation is made to the key at one of these intervals below the original keynote, having reference to the submediant or the mediant as the source whence the minor form of a key is derived. Besides the chief alternative, other keys, more or less frequent, more or less remote, according to the greater or less length of a piece, are also employed in the course of a composition. The distribution of keys constitutes the ground-plan and the elevation of a musical structure; the style of harmony, whether diatonic or chromatic, whether contrapuntal or massive, is its material; the ideas, or subjects, or themes, or phrases, or figures, or—as of late they have been whimsically named—motives, stand for the ornamentation, such as portico, frieze, statuary, and carving, which are sometimes essential in a design. This, then, is a brief summary of the plan of the first movement of a symphony—a first subject in the primary key, which consists of a single idea, or of several connected by tonal identity though melodically distinct; a second subject in the chief alternative key, which also may be onefold or manifold in its matter; and these first and second subjects complete the first part. Thus far has been but a simple statement of ideas, which is here followed by a working of the same matter, drawing from it what varieties of expression it may yield through compression or expansion by means of any or every resource of the musician's art; the second part is aptly often named the free fantasia, because unrestricted to a fixed course of modulation, the composer's creative power being at full liberty as to course of keys and manner of development; then for the first time the music reverts to the primary key for a retrospect of the entire matter of the first part, with, however, all that belongs to the second subject transposed from the chief alternative key into that which is the origin and centre whence all the modulations radiate; lastly, there is often, but by no means always, a coda, which is a summing up of the whole argument, or a valediction to the hearer. The first movement, always cast in this mould, is succeeded generally by one in a slow tempo, sometimes planned like a first allegro, sometimes otherwise, according to outlines that cannot here be detailed, and this exhibits the sentiment of the artist, as did the preceding his scholarship and ingenuity. Then follows generally (again one must say, for there is no necessary prescription) a movement of lighter character than either of the foregoing, sometimes having the musical shape of a dance such as the minuet, sometimes having an arbitrary plan which still is based upon harmonic, and therefore natural, and consequently philosophical, principles. To conclude, there is a movement that is sometimes constructed like the first and is sometimes as complicated, but in other instances has an arbitrary design. Such is the highest class of musical composition: firstly, because it is wholly musical, springing entirely from the artist's imagination without the prompting of words, needing no words to express its meaning to the auditor, being in itself poetry; secondly, because it may comprise every means within the author's power to wield melody,—counterpoint, harmony, modulation,—all that but for the symphony would be special to the fugue, orchestration, and, above all, the arrangement of ideas in a consistent logical method with reference to principles that are the very foundation of art. Let it be hoped that this outline of the elements, essence, and plan of the symphony justifies the use of the words supreme importance in reference to the class of composition at the outset of these remarks.

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[1] The earliest use that has been traced of the term sonata or suonata is in its application to some pieces for the organ by the uncle and nephew Gabrieli, who wrote in Venice towards the end of the 16th century. They form portions of larger works of which the rest is vocal; they are brief, solemn, and slow, and are seemingly designed to pour *sound* in long continuance or in large masses. Similar pieces by early German masters have the same definition, and the next generation extended the plan by appending a quick movement.

Haydn (1732-1809) is commonly styled the father of the symphony. If truly, then Carl Philip Emanuel Bach (1714-1788), the second of the many sons of the great Sebastian, stands as grandfather in the genealogy of that species of music; and its remoter ancestry may be traced to all but forgotten men in whose works is certainly a forecast of the plan above described. C. P. E. Bach wrote 18 symphonies, and upon those and upon the instrumental chamber music of the same author, Haydn avowedly modelled the plan of his compositions. The earlier writer had not the profundity of his father, nor the grace of Haydn, but his music represents the transition from one to another use in instrumental writing, and it fixed the plan which, however it may be expanded, can never be disestablished from the canons of art. Haydn produced the marvellous number of 125 symphonies (some of them, indeed, were overtures for theatrical use), besides 77 quartets for bowed instruments (the last one unfinished), 52 pianoforte sonatas, and pieces that are almost countless for various combinations of instruments; and in these one knows not whether to wonder more at the infinite fluency of melody or at the artistic mastery. In summing up the enormous amount of his works regard must also be given to his 3 oratorios, his 14 masses, his operas, and his many detached pieces for one and several voices, and then it is hard to believe that all this can have been accomplished in a single life.

Next in chronology as a symphonist stands Mozart (1756-1791). Particular comparison must be made of these dates with those of Haydn, as illustrating the relation of the mighty musicians to each other, and the influence each may be supposed to have exercised on his friend—for warmest friends they were and truest estimators of each other's powers. If the young Mozart profited by Haydn's example, as doubtless he did, the old Haydn learned greatly from Mozart's, for there is so obvious a rise in the character of his music from the beginning to the end of his long career as shows that he was under a continuous course of self-schooling. It is because his was self-schooling, and because he seems to have had no distinct principle of harmony, but to have experimented without infallible success on every unusual combination he wrote, and because likewise in orchestration his writing often appears to have been tentative rather than proving intuition of an effect and a means for its production—it is for these reasons, in spite of his prodigious command of counterpoint, that he may without disrespect be classed after the man whom circumstances compel us to regard as his rival. Mozart wrote 48 symphonies, some of them in the tenderest years of childhood, and repeated the design in many chamber works for several or for a single instrument. These differ in merit, mainly, it may be assumed, because some were written to meet the exigencies and the limitations of particular occasions; but, every one compelling admiration, the last three are conspicuous among the music of all time for the excellence of each and for their difference in character from one another, and these were composed in less than seven weeks, between 26th June and 10th August 1788, during which interval several other lesser and larger pieces also were produced, some for voices and some for instruments. The symphony in E flat, No. 46, is notable for sweetness and playful grace; that in G minor, No. 47, is a torrent of passionate fervour; and that in C, No. 48 (in England named Jupiter), is a combination that has never been surpassed of all the means possible to a musician. In the final movement of this last, a fugue is wrought on the symphonic plan, which is also the case in the overture to the author's latest opera, *Die Zauberflöte*, a completer fusion than has elsewhere been made of the two most distinguishable art-forms, and the formalism is hidden under the beauty of the ideas.

History now steps on to the great name of Beethoven (1770-1827), who in his 9 symphonies, his 6 concertos (which are pieces on the same plan with the addition of a part for a solo instrument), and his priceless bequest of chamber music commands the world's adoration. It is the shallow practice of the present day to depreciate his two great predecessors, especially Mozart, in his favour; but comparative criticism is to ill purpose if it can only exalt one master by the dethronement of another. Beethoven enlarged the symphony, in some respects changed its character, and perhaps advanced its consideration; above all, after writing for a while in the idiom of those two masters, he stamped his own individuality upon music. One finds, however, a prototype for each thing critics describe as particularly Beethovenish in the writings of Mozart, so that the manifest originality of the later musician lies in the new aspect given by happy expansion to prior existences more than in the creation of new forms of thought. Though he often strove at fugal excellence, he was a child at counterpoint as compared with the two adults who preceded him, and he lost rather than gained fluency in this branch of art as his life proceeded. The ideas of a great artist bear the impress of his age, which is remarkably the case with the musical thoughts of Beethoven, and as his age was nearer to our own, so is his frame of mind more congenial with that of present hearers than are those of Haydn and Mozart. The figure may be reversed; the individuality of an artist is the matrix in which the feelings and thoughts of his age, and still more of the age that next follows him, are moulded, but there must be affinity of temperament between the one and the many for this interchange of impressions to be possible. We of to-day have Beethoven and the consequences of Beethoven, and the influences of these have been active in the interval between our time and the period previous to the French Revolution; and the political, moral, and artistic changes that have been wrought by the ones upon the many as much as by the many on the ones indispose us to the recognition of the beautiful under its earlier aspect. Let us delight in Beethoven—who can fail?—but let us also love Mozart and revere Haydn. Two points are notable in Beethoven's instrumental music—(1) the linking together of the several movements of a work which usually are separated by an interval of silence; but such union is in some of Mozart's early symphonies and some also of Emanuel Bach's; (2) the expression of feelings excited by subjects external to the music and entitling works accordingly, as *Sinfonia Pastorale*, and sonata, *Les Adieux, l'Absence, et le Retour*; but Dietrich Buxtehude of Lübeck had a century earlier produced seven pieces characteristic of the seven planets, and Vivaldi had represented the four seasons in as many concertos, to say nothing of the chaos which opens Haydn's *Creation*. Beethoven's professed purpose in this last particular was to give utterance to impressions rather than to present pictures, and such is the legitimate scope of music, which is not an imitative but an expressive art.

Next in time came Spohr (1784-1859), whose deliciously-phrased rich-toned symphonies have lost regard in late years, but not beauty. Of his seven symphonies, four bear titles which refer them to an objective purpose; but they are still subjective, for the personality of the writer is expressed in every bar. Mendelssohn (1809-1847) did less but achieved more than Spohr; far less numerous, his instrumental writings for the concert-room and for the chamber have vitality and permanence which are not in those of the other master; they belong as much to hereafter as to now, while those of Spohr are already of the past. Mendelssohn too made musical pictures, owning that "as Beethoven had opened the road it was impossible not to follow;" his two finest symphonies, those in A and in A minor, represent, though not so entitled by him, his impressions of Italy and Scotland, and his characteristic overtures are translations into sound of the poems after which they are named. He also, in more than one instance, joined the several movements of a work, and he employed other devices—his own by felicity of appropriation more than by first use—for enforcing the relationship of the several portions of a musical structure. Schumann (1810-1856) has suffered through the persistence of his partisans in comparing him with another instead of displaying and extolling his own merit. Party spirit and the opposition it kindles has passed, and the delicacy, often subtle in its refinement, the grace, the deep feeling, the ingenuity, but rarely grandeur, that mark his symphonic and chamber music, are now fully perceived. Johannes Brahms is a living worker in this class of art who has already planted his foot in the future and given warrant for transmitting to the coming generation the great model he received from the past, which, because of the masterpieces that have been cast in it, justly bears the name of classical. Cherubini (1760-1842) is the one Italian known to have written a symphony, and this work gives small reason for regret that it stands thus alone; he arranged the same as a violin quartet and wrote two original pieces of this class. Méhul (1763-1817) is the French representative of the symphonic art best known and best esteemed.

The Englishmen who have best succeeded in this highest form of music are Dr Crotch (1775-1847), Cipriani Potter, J. Henry Griesbach (1798-1875), Henry Westrop (1812-1879), and Sterndale Bennett (1816-1875). The last-named cannot be passed with a mere mention. The wide recognition of Bennett's genius at home and in Germany distinguishes him; far more so does the quite individual charm of his music, and most of all does the tender age at which he wrote his best works and the facility with which he produced them. Three of his pianoforte concertos, one of his symphonies, and four of his concert overtures may be cited as representative pieces, wherein sometimes the plan, always the phraseology, and, in those for the pianoforte, the treatment of the instrument are peculiar to the author in sweetness and elegance; the eternal riddle of the beautiful is propounded in every cadence, and still defies analysis, still remains unsolved. As living writers in this department, Aguilar, Banister, J. F. Barnett, Cowen, Davenport, Walter Macfarren, Hubert Parry, Prout, Stanford, Stephens, and Sullivan must be named.

To have spoken of orchestral music compels notice of instrumentation as an element of the art that has high significance. It is analogous to colouring with the painter, being extra to the composition or plan of his work, but essential in vivifying and varying its effect. Its root is the appropriation of passages to the capabilities of instruments for which they are designed, and this is planted in the earliest as much as the latest essays in composition. Its trunk and branches are the combinations of voices and instruments of the same or different qualities of tone, so as to give greatest prominence to the chiefest parts in a musical texture, so as to produce effects of sound which cannot be yielded by the means separately used, but are liable to infinite diversity from the manifold compounds in which they are clustered, and, most of all, so as to secure distinctness of every part in the complex woof which strikes the ear as onefold. Instrumentation may be styled the chemistry of sound, which by the synthesis of distinct tones produces new organisms; it is the blending of any of the rays of the musical prism which produces previously unheard colours. Mozart was the first to evince the very fine sense which perceives the parity and disparity of qualities, how some sounds will mix with and some will penetrate through others, how some instruments by pouring forth a stream of harmony may enrich or nourish a melody that floats on its surface in another quality of tone. Prior musicians had used instruments in alternation for variety of effect, or in combination for the sake of loudness; but it was Mozart that both originated and perfected instrumentation as above described, and it has been practised with more or less success in so far as his principles have been fulfilled, with more or less failure in so far as his principles have been abandoned. In two centuries instruments have undergone large modification, and their treatment has been modified accordingly. Writing for the harpsichord is widely different from that for the pianoforte, which also has been changed in character from generation to generation of composers, not only because of improvements in the manufacture of the instrument, but because of enlarged insight into its capabilities; hence the music of Emanuel Bach, Mozart, Dussek, Beethoven, Clementi, Cramer, Hummel, Moscheles, John Field, C. M. von Weber, Mendelssohn, Chopin, Schumann, Liszt, Thalberg, Sterndale Bennett, and Anton Rubinstein forms a continuous scale of development in aptitude and diversity. The transformation of the viol of various sizes into the violin, violoncello, and double bass of present use is a subject for special history, but its course is inseparably associated with the names of the great Cremonese manufacturers, Andrea Amati (1540), his two sons and his grandson, the family Guanarius, and Straduarius, who all practised their craft as an art more than as a trade, setting each the stamp of his own genius on the instruments he produced and leaving models that have never yet been equalled. The extended resources of bowed instruments have come wholly through extended skill of executants, especially of Viotti, Rudolphe Kreutzer, Rode, Baillot, Paganini, Spohr, De Beriot, Molique, Ernst, Blagrove, Sivori, Sainton, Vieuxtemps, Joachim, and Carrodus on the violin; of Crosdill, Cervetto, Lindley, and Piatti on the violoncello; and of Dragonetti and Bottesini on the double bass. The entire construction of flutes and reed instruments was changed by Theobald Boehm (1794-1881), and all makers now work upon his principle. Facilities have been increased on each of these classes of instruments, but on horns and trumpets modern use has in some respects diminished them; that is, employing only notes of the harmonic scale, players of the time of Purcell, Handel, and Bach practised so constantly in the upper register that they easily produced the 12th harmonic and above this sometimes notes up to the 18th, and these they executed with volubility akin to that displayed on fingered instruments; it is now the custom to exercise the lips on the lower notes and on longer continued sounds, and hence the passages written by the elder masters are difficult to the verge of the impossible to present practitioners, and a totally different character distinguishes modern from earlier music for brass instruments. On the other hand, Charles Joseph Sax (1791-1865), and far more his still living son Adolphe, have devised such systematic changes in the fabrication of all brass instruments as to give them an entirely new place in the orchestral category; by means of the pistons of their sax-horns, cornets, and saxophones, these instruments yield the complete chromatic scale, which, superficially, appears to be an advantage; but, save for military bands, the alteration is a serious evil and has an incalculably pernicious effect upon the orchestration of the day. This strong but careful statement is justified by the beautiful effects in music written earlier than the use of valves, from the characterization, firstly, of particular keys in a musical composition; secondly, of certain chords in the keys; and, thirdly, of special notes in each of these chords through appropriation to them of selected sounds from the limited harmonic series, whereas composers who apply Sax's invention to orchestral use reduce the band to a one-toned machine that has the same quality throughout its range. Let proof be drawn from example; in the andante in A flat in Beethoven's symphony in C minor, the horns and trumpets are crooked in C, they can therefore be used but for peculiar notes in the primary key of the piece, but they give especial tone to the key of C, into which the music thrice modulates, that distinguishes it from the entire context; in the finale of the same master's symphony in F the return to the primary key from the remote tonality of F sharp minor is marked by the tone of the F trumpet, whose keynote is the enharmonic of the E sharp of the foregoing harmony; and yet again, in the "dona nobis" of the same master's mass in D, the phrases for the trumpets in B flat are distinguished from what surrounds by the tone and the key, and thus give technical significance to the author's purpose, "a prayer for peace in the midst of war." Inability to resist the temptation of the semitonic scale, and so to use "sounding brass" as freely as instruments of more delicate tone and greater natural volubility, is exemplified in the writings of many a living musician, and regretted by many of his admirers.

A class of opera, defined in French as *opéra comique*, dates ostensibly from 1715. The definition is unsound, because, whatever the subjects of the first pieces so styled, it is often applied to works of a romantic, serious, or even tragic nature. The separation of this from the grand opéra lies in the latter having music throughout, its rhythmical pieces being divided by accompanied recitative, while the opéra comique consists of music interspersed with spoken dialogue. The distinction arose from what was considered an infringement of the patent of the Parisian Opera House by a company who performed musical pieces at the Théâtre de la Foire, and an agreement between the two establishments was authorized at the date above cited to the effect that the assumed intruder must have speaking in every piece it presented. The name of Rameau is the earliest of note among composers of this class of work, and his success in *L'Endriague*

(1721) and *L'Enrolement d'Arlequin* (1726), which were comical enough in plot to sanction the definition, procured hearing for his larger and graver dramatic efforts. Most conspicuous of those who later have gained fame as composers of opéras comiques are Monsigny, Dalayrac, Grétry, Méhul, Boieldieu, the profound Cherubini, Halévy, Auber, Ambroise Thomas, and Gounod, many of whom also produced masterly pieces in the other class of opera. The *singspiel* is the German parallel to the opéra comique, and its examples comprise some of the greatest works that adorn the lyric stage. Among these are the *Entführung aus dem Serail* and the *Zauberflöte* of Mozart, the *Fidelio* of Beethoven, which stands above comparison with all dramatic music save only the *Figaro* and the *Don Giovanni* of Mozart, and suffers not in being placed side by side with these prodigies of genius and mastery, the *Faust* and the *Zemira und Azor* of Spohr, the *Freischütz* of C. M. von Weber, and *Heimkehr aus der Fremde* of Mendelssohn. It was a novelty of Weber to break from set forms in his dramatic monologues and frame from the promptings of the situation a special plan for each, which has frequent variations of tempo but always coherence of key, and which never fails to manifest a conceived and fulfilled design; and this successful innovation, as much as their musical merit, gives historical importance to his works for the stage. Spohr, with *Jessonda* (1823), was the first to appropriate continuous music with full orchestra to the German stage, and he wrote in the journals to defend his innovation, which had been preceded in Italy by Rossini with *Otello*, wherein the "recitativo parlante" was for the first time in that country discarded. Spoken dramas profusely interspersed with music and called operas have had vogue in England since the time of Purcell, whose genius was cramped by the literary conceit that music was unfit for expression of human feelings on the stage. The principle was superseded, but the form resulting from it was preserved in the *ballad operas*, which from 1727 for more than a century were the sole vehicles for music in our theatres; but these had the speciality that for the most part their music consists of the popularities of the day and rarely includes original composition. Dr Arne, Stephen Storace, Shield, Dibdin, and Sir H. R. Bishop wrote all the music for pieces of this class, and the last appropriated, or modified, or restored to its pristine form the glee in his dramatic works, and by specimens of this he is and will be chiefly remembered. In 1834 a new impulse was given to English opera by the warm welcome of John Barnett's *Mountain Sylph*, which, though it has speaking, is far more essentially musical in structure than its predecessors, and it has been followed by many a work of merit by the same hand, by Balfe, E. J. Loder, Wallace, and others, several of these being wholly lyrical, according to the requirements of French grand opéra.

Side by side with the activity in other countries just reviewed was the progress of opera in Italy. Important contributors to this were Giovanni Paesiello (1741-1815) and Domenico Cimarosa (1749-1801), who both wrote extensively, succeeded greatly, and impressed the art with their specialities. Of vastly greater consequence in the future was Mozart, who produced many Italian operas, and, of all musicians that have ever composed for the theatre, brought dramatic music the most nearly to perfection in fitness to the scene, delineation of character, and technical design. The name of Rossini (1792-1868) is conspicuous in the history of opera from the once universal fashion to admire his writings, from the new manner of vocal flourishes he introduced, which strongly tended to revive the inconsistencies against which Gluck had striven, from the ardent imitators who at the time of his triumphs emulated his peculiarities, from his entire change of style in his later productions, and from his all but ceasing to produce during nearly forty years. The languishing Bellini (1802-1835) and the spirited and far more prolific Donizetti (1796-1848) proved their artistic strength by avoiding the Rossini idiom, but neither can be accredited with asserting a style. Giuseppe Verdi has proved melodic creativeness equal to either of theirs, with a stronger power of characterization and a better regard for the exigencies of the scene.

A new species of composition has sprung into being within these thirty years, which in France is defined as *opéra bouffe*, and in England as *comic opera*, but is totally distinct from the opera buffa of Italy or the opéra comique of France, while less unlike the intermezzo of Italian use in the 18th century. It may be described as burlesque, sometimes of stories that have held mankind's respect for ages, sometimes of modern social absurdities, but having the ridiculous for its main quality, and extravagant in every essential. It consists of an intermixture of lightest and most frivolous music with spoken dialogue, and depends as much on its literary sprightliness as on its musical tunefulness, for success. It may be said to have been originated by Offenbach (1819-1882) of Cologne, who settled in Paris when young, where in 1855 he engaged a theatre for the production of his lyrical caricatures, initiated them with *Les Deux Aveugles*, and wrote in all sixty-nine pieces. He has several imitators in the country of his adoption, and is represented in England by Sir Arthur Sullivan.

Operatic history may be epitomized in a few sentences. The Greek tragedy was essentially lyrical, and it portrayed the characters and the incidents with which all who witnessed were intimate. It fell asleep with the other forms of classic art, to be awakened at the end of the 16th century; but those who aimed at restoring it to the active world chose subjects from the antique which stirred the wonder more than the sympathy of their audiences. Regard for the gods and heroes of ancient myths, or for the figures of mediæval chivalry, who were little less outside general familiarity, long gave an artificial air to theatrical writing. It was the comic branch of opera that first broke from the trammels of the pedagogue, and in representing people of its own time applied the grandest attribute of music—the expression of passions common to us all under circumstances experienced by us all in phraseology familiar to us all. In the pieces for the Countess and the Count in *Figaro* Mozart rose to earnestness, and in those for Donna Anna, Ottavio, and the Commandant in *Don Giovanni* still higher to the grandest tragedy, and always on the lips of persons in a period so near to our own that we recognize our own feelings in their utterances. The preternatural is also shown to be within the range of this art in the music of the Statue in *Don Giovanni*, which may confidently be compared for effect with the ghost scenes in *Hamlet*, in answer to those who raise quarrelsome questions as to the relative power of music and speech to embody analogous situations. All musicians since Mozart have chosen subjects, however serious, from modern history or from still later modern life, and the preternatural has exercised the imagination of Spohr, Weber, Marschner, and Barnett, to whom Mendelssohn must be added on account of the fragments of *Loreley*.

During the last thirty years Richard Wagner (1813-1883) has striven to revolutionize the lyrical drama by his polemical writing, by his compositions for the theatre, of which he is the twofold author of words and notes, and by his extraordinary means of bringing these conspicuously before the public. His principles were all gathered from antecedent reformers; their application was his own. His works of art are, by himself and his supporters, professed to be neither dramas nor music, but this cannot exempt them from dramatic and musical censure. The very remarkable commotion he has made in the world of art might be compared with that excited by the rivalry between Buononcini and Handel in London and that between Piccini and Gluck in Paris, but that these were in each instance the contention between one musician and another, whereas in the present case it is the opposition of one writer to all the musicians in the world, save the few members of the profession who, believing in the man, his doctrine, and his power to apply it, undertake propagandism as a duty, and endeavour to make proselytes to their faith. Wagner's recent death has left judgment free as to his theoretical and practical merit; a few years will determine the permanence or evanescence of his productions, and an article on his name in the present work may be written far enough from now to chronicle the result.

Within the present century the oratorio has undergone large modification, somewhat in structure and more in style. Haydn's *Creation* is planned on the model of the several settings of music to the recitation of the Divine Passion which were frequent from the date of the Reformation till the 18th century was one-third advanced. Its text consists of a Bible narrative interspersed with reflective verses which have no pretension to be defined as poetry. The work was said to have been suggested to the composer by his hearing some of Handel's oratorios during his two visits to England, but it differs in character as widely from these as was natural in coming from a musician whose genius, however great, was wholly unlike that of his predecessor. *The Seasons*, by the same master, has a secular subject which is secularly treated, and in this, equally with the other, the manner of the author, as evinced in his instrumental music, is ever apparent. Beethoven's *Mount of Olives* is in dramatic form, though changed into narrative in several English versions. The portions of this that have most interest are those which are the least sacred—for instance, the chorus of the soldiers who come to seek and then to arrest the Accused of Iscariot. *The Deluge*, by Schneider, is also a drama by a modern hand. It and the *Moses* of Marx have sent only the reputation of their esteem into England. Spohr's three oratorios—especially *Die letzten Dinge*, known here as the *Last Judgment*—bear so strongly the impress of his speciality in the constant prevalence of the chromatic element throughout them, and in the rich but always transparent orchestration, and they were so largely imitated by contemporaries, that they may be said to have opened an epoch which, however, was early closed. Far more important in themselves and in their influence are the two works of the class by Mendelssohn, with which may be associated the *Lobgesang* (Hymn of Praise), written to commemorate the 400th anniversary of the invention of printing. In these the dramatic, the narrative, and the didactic elements all appear, the first so conspicuously and so grandly in consonance with the spirit of the time that it specially distinguishes the works as they do the master who, through them, holds a rank in England as a sacred writer all but parallel to that of Handel. The influence of Mendelssohn's oratorios is obvious in the works of other musicians, and public approval attests it to be an influence for good. Compositions styled oratorios have been produced by Liszt and Gounod which seem to aim largely at novelty, but a future generation must judge whether they have struck the mark. In England, Crotch's *Palestine* emulated Handelian precedent, and stood for long alone as a native production. Many years later Sir Sterndale Bennett's *Woman of Samaria* won wider sympathy. The living writers who have courted and gained fame in England by longer or shorter oratorios are J. F. Barnett, Sir J. Benedict, Sir M. Costa, and Sir A. Sullivan.

With some pleasure and some regret must be mentioned the active exertions of John Curwen (1816-1880), a Nonconformist minister, with a large staff of adherents, in the promulgation of a professedly new musical system under the title of "Tonic Sol-fa": pleasure, because of the wide extension of musical study resulting from his indefatigable zeal; regret, because perhaps a larger and certainly a better result would have rewarded like energy in the propagation of musical knowledge in the shape that has grown into maturity through eight centuries, and possesses the whole world's acceptance. He who is honoured as the founder of the system professed to have derived it from Miss Glover of Norwich, whose method he but modified and expanded; but hers was based upon the ancient gamut already described, omitting the constant recital of the alphabetical name of each note, together with the arbitrary syllable that indicates its key relationship, and omitting too the recital of two or more of these syllables when the same note is common to as many keys, as "C, Fa, Ut," meaning that the note C is the subdominant of G and the tonic of C. The notes are represented by the initials of the seven syllables still used in Italy and France as the fixed names of the seven notes; but in "Tonic Sol-fa" the seven letters refer to key relationship and not to pitch. Further, the system has a wholly different terminology from that in universal use. It would be uncandid not to state that many men of greatest eminence outside the musical profession and many musicians support the system; here may only its bare principles be stated and not its merits discussed. A somewhat analogous action has, at the same time, been busy with regard to musical notation in France. Émile Chevé (1804), a surgeon in the French marine service, having married Nanine, the sister of Aimé Paris, learned from her the views of her brother (who had adopted them from Galin) as to another new system of musical notation, and he, Chevé, in 1844 applied himself to its dissemination. The system bears the name of "Galin-Paris-Chevé," and, like the other, refers the notes to key relationship and not to pitch, but employs the first seven numerals as their symbols. This invention, if so it may be called, was strongly discouraged by the most esteemed musicians of Paris, but its advocates persevere in its propagation.

As a summary of all the precept and example that has been cited in this survey of the centuries let the writer state his convictions on musical theory, which are, that the *Treatise on Harmony* (1845) by Alfred Day (1810-1849) comprehends whatever is practically available, and reconciles the previously apparent discrepancies between principle and use. The laws of the primitive diatonic style had never been repealed; the discovery by Noble and Pigot of generated harmonics had been held as belonging to science and not pertaining to art; composers had employed what may be classed as natural in distinction from arbitrary combinations, but each only on the prompting of his own genius and only with the justification of their effect. The author now cited was the first to classify the ancient, strict, uniform, diatonic, contrapuntal style, apart from the modern, free, exceptive, chromatic, massive style, to separate the principles that guide the one from the laws that control the other, and to place a subject that is at once sublime and beautiful in a light of unfailing clearness. He showed that one or another beautiful chord and the progressions thence were not capricious violations of rule, permissible to genius though unallowable to ordinary writers; he showed that such things were acceptable not only because great masters had written them, and so small musicians might repeat the trespass; he proved this by demonstrating the self-perfection of the ancient canon and the also perfect modern system that rests on a basis totally distinct from that of the other. He classed diatonic harmony, with its uniform treatment of all the notes in a key, into concords which include not the 4th from the bass, and three species of discords, namely, passing notes of several varieties, suspensions resolved on a note of the harmony in which they are discordant, and essential or elemental discords resolved with the progression of the whole chord to a chord whose root is at a 4th above the root of the discord. In this style discordant notes have identical treatment according to the number of their interval (as 7th or 9th), unaffected by its quality (as major or minor). He traced all the notes of the scale available in the diatonic style to the tonic, the 5th below it, and the 5th above it, as their roots, having thus a minor tone between the dominant and submediant in the major form of a key. Present composers with ability for its production may, by observance of this ancient canon, make music in the style of the 16th century with as good likelihood of beauty as had the great masters of that period, but without imitating them, since working by their method and not necessarily by their example. Day showed that peculiar treatment of certain notes of the diatonic scale, together with the inclusion of the chromatic element which has crept into use during the later centuries, constitutes a style totally distinct from the other, and justly to be called exceptional. The basis of this system is the derivation of harmonics from specified fundamental notes or generators in every key. Thus exceptionally the 4th above the bass is a concord, when it is the root inverted above the 5th in the triads of the tonic, the subdominant, and the dominant. Thus exceptionally the 3d in the dominant triad has peculiar poignancy to which modern ears are sensitive, and the dominant triad is imitable on the supertonic by employment of its chromatic major 3d that has the same special character as the 3d of the dominant. Thus exceptionally the 7th may be added to the dominant triad. This combination may also be imitated on the supertonic, and the addition likewise of a chromatic minor 7th to the tonic triad makes another chord consisting of the same intervals as the dominant 7th, namely, perfect 5th, major 3d, and minor 7th, the last two being at a diminished 5th asunder. Again exceptionally the minor or the major 9th may be added to each of these chords of the 7th, the 11th to the chords of the 9th, and the minor or major 13th to the chords of the 11th, beyond which the ascent by 3ds proceeds no more, as the 15th is the double octave of the root. The 9th, 11th, and 13th are susceptible of resolution each on a note of its own chord, which is not so with the 3d and 7th; or they may, like the 3d and 7th, be resolved on some note of another chord when the entire harmony changes. The chords of the 9th, still less of the 11th, and of the 13th least, rarely appear complete, the root being frequently, and other notes occasionally, omitted. In this style the discordant notes (3d, 7th, minor or major 9th, 11th, and minor or major 13th) are identical in quality to whichever of the three roots they belong; but they vary in treatment according to their source; and in these two specialities they are distinguished from diatonic discords. Broadly it may be stated, but subject to amplification, that the natural resolution of dominant discords is upon the tonic concord, that the natural resolution of supertonic discords is either upon a tonic concord or upon a dominant discord, and that the natural resolution of tonic discords is either upon a dominant discord or upon a supertonic discord, the several elements of each harmony proceeding variously according to what note must follow it in the ensuing chord. The term fundamental discords is aptly applied to these which are traced to their harmonic generator, and their pertinence to one key is established by their all being resolvable on chords peculiar to the same tonality. The theory steps a degree further in proving that the harmony of the augmented 6th $\begin{smallmatrix}\sharp F\\ \flat A\end{smallmatrix}$ with its several varieties of accompaniment consists of the primary and secondary harmonics of a common generator, and that the dominant and tonic are the notes in any key whence this harmony is derived, yielding respectively the augmented 6th on the minor 6th of the chromatic scale, and the augmented 6th on the minor 2d. The bold venture of Mouton, repeated by Monteverde and defended by the latter against the fierce disputation of the orthodox, is theoretically justified in this system on the principle of natural harmonics first enunciated in Oxford, and the ingenious searchings after truth by Rameau are shown in this system to have been on a false track and so to have passed round instead of to their mark. Day's *Treatise*, on its appearance, was denounced by the chief musicians in London, and a single believer for some time alone maintained and taught its enlightened views. These have now the acquiescence of many more musicians than originally opposed them, they are upheld by several eloquent supporters, and they are widely disseminated throughout England. They have not yet been promulgated beyond that country; but the advance they have made there in thirty-eight years may be taken as augury of their admission elsewhere when time and circumstance may be opportune for their presentation.

Music, in the modern special sense of the word, was with the early Greeks regulated declamation to the accompaniment of instruments with stretched strings that were plucked or struck. With the Greeks it was also produced from pipes of metal or wood or horn, with reeds or without, as signals or incentives in war and for domestic amusement. Far later, and in imperial Rome, it acquired a more definite form of what is now called melody. The transition of its principles from those which ruled in the classic ages to those which had been slowly developed in the course of after centuries is veiled with a mist like that which obscures the setting of paganism and the dawning of Christianity. Many fallacies are still entertained as to the dated organization of music in the church, and none greater than its ascription to St Ambrose and St Gregory, and the credit given to Guido for the enunciation of its rules. From the end of the 10th century music was in England in advance of other nations until its rise in Flanders in the 15th, when still our forefathers kept abreast of their contemporaries. Throughout the ecclesiastical reign of scholarship, the untutored people had a music of their own, which in its tonal and rhythmical affinity to that of later date commands present sympathy, and which, throughout the North, having the element of harmony or the combination of sounds, was the foundation of all to which science and art have together attained. The Flemings planted schools in Rome, Naples, and Venice, and the rise of the art in Germany was due to their influence. Adopted from the people by the church, the art of harmony was reduced to a system under the name of counterpoint. Its artificial ordinances were broken through at the end of the 16th century, against violent opposition but with permanent success. Coincident with this innovation of principles was another innovation in the form of applying them, which was intended as a revival of antique use, but which issued, working together with the first-named change, in the establishment of the modern in music; these two were the discovery of fundamental discords and the originating of free musical recitation. The acoustical phenomenon whereon fundamental discords are grounded was first perceived in England, and this in the last quarter of the 17th century. Empirical rules drawn from the tentative practices of great musicians were from time to time enunciated; but no theory till that described in the last foregoing paragraph probed the natural principles upon which, unknowingly, masters have wrought, nor distinguished between these and the ingenious artifices whereby in former times musical etymology and syntax were regulated. The development of plan or design in musical composition has been the fruition of the last two centuries, and, in spite of all dispute as to its paramount necessity, hope points to it as the everlasting standard of genuineness in art.

To distinguish allusions to the present time in comparison with former dates throughout this article, and to mark the period to which its narration reaches, statement must be made that it is completed in 1883. (G. A. M.)

PART II.—SCIENTIFIC BASIS.

Musical sounds reach our ears through the air. This is proved by showing that a sounding body placed in a space void of air, as under the receiver of an air-pump, is unable to emit sound. It will be sufficient for our present purpose to admit that musical sounds are transmitted through the air with substantially unchanged quality, even to great distances. The law according to which the apparent intensity of a musical sound diminishes as it spreads itself over an increasing surface of air is as yet uncertain: we can only say with certainty that it does diminish.

The origin of musical sound consists in the regular periodic vibration of some surface in contact with air, whereby motion is imparted to the air, and thus transmitted to the ear. Experience tells us as follows:—

1. Regular repetition is characteristic of those motions which give rise to musical sounds.
2. The pitch of the note produced depends on the time in which the motion takes place.
3. The loudness or intensity of the note depends on the magnitude of the motion and on the pitch.
4. The quality of the note depends on the form or shape of the motion, that is to say, on the manner in which it is executed within the time in which it takes place.

1. Regular repetition characterizes musical notes; irregularity in the movements in successive periods characterizes unmusical noises. This is most usefully illustrated by cases in which *false* notes are obtained. Strings, for instance, sometimes cannot be tuned. In these cases the motion can frequently be seen to be irregular.

2. The time in which the motion takes place is defined conveniently by the number of times the whole motion is repeated in a second. The number which expresses this may be called the vibration number, or the frequency of the note. Pitch, then, is defined by frequency. Notes of different frequencies present sounds to the ear which are essentially different from one another. The physical analogy based on frequency would compare notes of different pitch to light of different colours; this analogy does not, however, extend to the nature of the perceptions. The notes of a uniform instrument present a closer analogy with a definite colour in virtue of their uniform quality, so far as perception goes. And from this point of view there is nothing in the perception of colour analogous to the perception of difference of pitch in music. In speaking of the perception of combinations of notes we shall see that the ear possesses, in a more or less perfect form, the power of analysing combinations and hearing the notes separately. If we admitted the physical analogy between pitch and colour this would correspond to a power of seeing compound colours analysed into their constituents. This of course does not exist. Though we may know by experience what a compound colour consists of, no amount of experience will enable us to see the components separately in the same way in which we hear the notes of a combination separately. The modes of perception are therefore wholly different in the two cases.

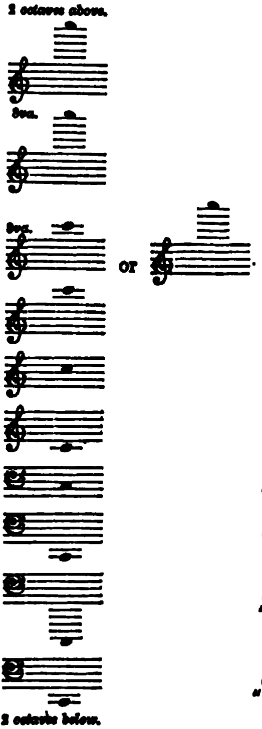
When one note is produced by a motion whose frequency is twice that of another, a relation subsists between the sounds of the two notes which appears not to be capable of further explanation. They are said to form octaves with one another. It is easy to give some account of the formation of the octave regarded as a concord, but the inexplicable peculiarity of the relation consists in a sort of quasi-identity between the sounds of the two notes. Many persons cannot distinguish with certainty two notes an octave apart, particularly if the quality of tone employed be one in the use of which the observer is not practised, and this is the case even with ears of considerable acuteness and cultivation; but it does not apply to those ears of the highest class which possess the power of the recollection of absolute pitch. Such ears can usually distinguish octaves with certainty. But in all cases the similarity of effect between notes differing in pitch by one or more octaves will be admitted. It is a purely mental phenomenon, and no explanation can be given of it. If for a moment we recur to the physical analogy of colour simply for the purpose of illustration, the whole range of visible colour corresponds to less than an octave. The musical phenomenon of the similarity of octaves is as if part of the invisible spectrum, say in the ultra-red, excited a sensation having some similarity to the sensation of its octave in the visible spectrum, the two sensations being such that there is a continuous change from the one to the other. Nothing of the kind actually exists in the case of light. The actual impression on the nervous system of the ear which is concerned with the perception of pitch is believed to be substantially the same in different individuals. But the mental processes attached to this perception differ so widely that for all practical purposes the results are different in different individuals. The chief difference appears to consist in the different development of the memory of the actual sound of definite notes, which we may speak of as the perception of absolute pitch. This is developed in all degrees: from almost complete absence, in which case we have a want of musical ear arising from the failure to retain the pitch of a note heard even for the shortest time, to that highest degree of perfection in which the memory retains permanently the sound of every note that is once heard. It is not believed that the possession of this memory is capable of cultivation to any considerable extent. It appears rather to be a natural gift, as it usually appears at once in childhood where it is possessed at all. Roughly speaking, and in the absence of reliable statistics, we may say that the possession of the perception of absolute pitch is distributed as follows:—say 1 per cent. possess it, 1 per cent. are entirely destitute of it, so as to be said to have no ear, and the remaining 98 per cent. or so possess it in a more or less modified form. Of this usual condition we may take as a type cases in which the mental effect of a musical note can be retained in the memory for some minutes.

We have to consider the musical perception of the class possessing the power, and of the numerically much larger class who only possess it in a modified form. A simple tune or melody produces the same effect in all cases as far as we know, except that those who have the perception of absolute pitch know what notes are employed, while others are only conscious of the intervals, *i.e.*, of the relative pitch. All the analytical perceptions are as a rule much better developed in the case of those who possess the perception of absolute pitch than in other cases. In those whose perceptions fall below a certain mark the analysis of combinations of notes by the ear fails more or less entirely. In this particular, however, cultivation is generally possible. And this agrees with the assumption that the mechanism of the ear is generally the same. For the perception of differences of pitch is conceived to be due to a mechanism universally present, which effects the analysis of combinations by the same means by which the pitch is distinguished. The phenomena which give rise to this belief may be stated as follows. If we sound two notes together and cause one of them to change its pitch, we can examine the sensations produced by all sorts of binary combinations. If the two notes have the same pitch at starting, then when they separate beats are heard. Up to a certain point, which is not very far from the point where the two notes are half a semitone apart, the effect in the ear is as if one note was heard, having the alternations of intensity which constitute beats and a pitch generally intermediate between the constituent notes. At this distance of about half a semitone the ear begins to perceive the two separate notes beside the beats. As the distance between the constituent notes increases the two notes become more prominent, the beats grow fainter, and ultimately, when the constituent notes are a little more than a whole tone apart, the beats disappear and the two notes are recognized as separate and distinct sensations.

Now this observation is explained by Helmholtz's hypothesis of the existence of a resonant mechanism in the ear. Just as a harp, or a piano with the dampers raised, will have the strings corresponding to any sound that reaches it set in vibration, so we suppose that there exists a collection of resonant bodies in the ear which respond to vibrations of pitch nearly coincident with their own. The question then arises, Is the range of sympathy, the distance at which a certain response is excited in the vibrating mechanism of the ear, the same in all cases?

It is easily seen that, if the above phenomena are substantially the same in all cases, the character of the mechanism must also be the same. The interval at which the two notes of a binary combination begin to be separately distinguished can be observed with considerable accuracy, and is critical in the matter. So far as such observations have been hitherto attempted, this interval is very nearly the same in persons of the highest type of ear, who have the perception of absolute pitch in an advanced degree, and in persons occupying a position not high among those who only possess the power of relative perception. In all cases, moreover, where beats are observed, the beats are the same to all persons, so far as our present knowledge goes. And as some of these beats arise within the ear itself, they depend upon the properties of its mechanism. The result is that, so far as ordinary observation goes, the main features of the mechanism of the ear may be safely pronounced to be the same,—in the great majority of cases, at all events. Some slight differences in this respect have been observed; but there can be little doubt that the great differences which exist in the endowment of the ears of different persons do not arise from differences in the receptive mechanism, but have their source in the nervous or mental actions which lie behind the mechanism. In this we are not referring to the differences which exist between the range of hearing in different individuals. These undoubtedly arise from what may be spoken of as differences in the compass of the receptive instrument in different individuals. These differences exist both at the upper and lower extremities of the scale. Those in whom the upward range is defective fail to hear the noises of certain insects, and are also unable to hear organ-pipes of very high pitch. The absence of the lower range of hearing is less well established.

The complete range of audible musical sounds comprises about nine octaves. It extends from the 32-foot C, two octaves below the lowest note of a bass voice, to somewhere about three octaves above C in alt. The upper notes of this range are not audible to some persons. Organ-pipes are made having notes covering this whole range, except about the top half-octave. The position of notes is so frequently referred to the length of the corresponding organ-pipe that it is convenient here to give these lengths, with the usual notation for the notes to which they correspond.



C^{vi}		¾ inch.
C^{v}		1½ inches.
C^{iv}	c in altissimo.	3 inches.
C^{iii}	c in alt.	6 inches.
C^{ii}	c treble.	1 foot.
C^{i}	c middle.	2 feet.
C^{0}	c tenor.	4 feet.
C	Great c.	8 feet.
$_{,}C$ or $\underline{C}$		16 feet.
$_{,,}C$ or $\underline{\underline{C}}$		32 feet.

N.B.—The letter notation is continued from each C upwards through the octave, and changes at the next C above.

The normal perception of pitch does not, however, cover all this range. Its extent varies much in different individuals. We cannot assume that pitch can be completely perceived in the normal manner in either the uppermost octave or the lowest octave of the foregoing range. The lower half of the uppermost octave is easily examined, wherever an organ is available, by drawing the fifteenth alone and sounding the notes of the upper half octave of the keyboard. These notes will generally be heard as sounds, but if a bit of a melody be sounded on them, for instance a simple scale passage, it will generally be found unrecognizable. The same is the case with the lowest octave lying between the 16-foot and 32-foot notes. There has been considerable doubt as to the reality of the notes which profess to occupy this position. All instruments sound notes of a complex character, which include sounds of a higher pitch than the nominal note, in fact the harmonics, of which the nominal note is the fundamental. And doubts have been raised, which have in some cases proved to be well founded, whether the deep notes in question really contain any of the nominal note or fundamental at all, and do not rather consist entirely of harmonics, or of sounds whose real pitch is much higher than the nominal one.

These doubts have been settled in the case of the low notes of the organ by the process of analysis by beats. Where two notes differing slightly in pitch form beats, the number of beats in a second is equal to the difference of the frequencies. If, then, the frequencies of the notes sounded differ by one vibration per second nearly, there will be one beat per second; if they differ by two or three per second there will be two or three beats. The frequencies of the two lowest notes of the 32-foot range are sufficiently nearly—

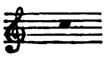
$$C = 17$$
$$C\sharp = 18.$$

If, therefore, C and C♯ are true notes they should give about one beat per second. The octaves of these notes give about two beats per second, and the twelfths give about three beats per second. The notes of large-scale open 32-foot pipes when thus tested give one beat per second. The notes of stopped pipes vary very much according to the scale and voicing, but in these low notes no fundamental has as yet been detected. They always present the three beats characteristic of the twelfth.

This is contrary to the statement, long accepted on the authority of Helmholtz, that large-scale stopped pipes give nearly pure tones. It does not appear that that statement was ever verified, and it appears not to be correct. 32-foot stops are not very common, but these principles can be illustrated with 16-foot stops. Here the fundamental beat is about two per second, the octave four, and the twelfth six for adjoining semitones at the bottom of the range. The same results are easily found. As a rule the large open 16-foot stops of the pedal give their fundamentals quite pure, while stopped pipes professing to speak the same notes almost invariably present the six beats of the twelfth, sometimes with and sometimes without fundamental. The conclusion we may draw is that the enormous power laid on to the lower notes of the organ enables the test of audibility to be made under most favourable circumstances, and that under these circumstances the limit of audible sounds can be carried down to a point close to the 32-foot C, or to a frequency of about 17.

The determination of the frequency or vibration number of particular notes was first effected by calculations depending on the mechanical theory of strings. Subsequently the method of beats was employed, and the first reliable determinations appear to have been made by this method, which was developed by Scheibler. The usual process consists of providing a series of notes each of which makes four beats with its next neighbour, whence every such pair has vibration numbers differing by four. The series extends over an octave, whence the total difference of frequency between the extreme notes which form the octave is known. And this number is equal to the frequency of the lower note of the octave. This method, however, is difficult of execution, and depends on a number of observations, each of which is liable to error.

The method described in most of the books depends on the employment of the "siren." This consists essentially of a circular plate, revolving on an axis through its centre at right angles to its plane. Series of holes are arranged in circles, and puffs of air are sent through the holes as they move over fixed holes. In this way a known number of impulses is produced at each revolution. The revolutions are counted by a wheel work. With the more perfect forms of this instrument fair determinations of frequency could be effected by bringing the note of the instrument into coincidence with that to be determined, and counting the impulses delivered during a certain time. But until quite recently there was great uncertainty as to the actual frequency of the notes in use. In particular, the forks sold some time ago as 512 for treble C were for the most part several vibrations higher. And the various forks sold as philharmonic have at different times represented a great variety of pitches. The pitch of treble C has in recent times varied between the limits 512 and 540, being almost exactly a semitone. A few of the principal pitches may be summarized as follows:—



=512—old theoretical pitch.
518—equal temperament equivalent of French diapason normale. A = 435.
528—Society of Arts. Helmholtz's theoretical pitch.
540—Modern concert pitch.

There is a tendency in practice to keep the pitch rising. This appears to arise from the habit among musicians of considering flatness in the orchestra or in singing a more heinous offence than sharpness. Everybody tries, at all events, not to be flat. Wind instruments made to concert pitch force the pitch up at all public performances. A rise is easily made, but a fall only with great difficulty. It will be seen that the pitch of the French diapason normale is the best part of a semitone below modern concert pitch, and the difficulty of getting it adopted is well known.

Forks stamped with the numbers of vibrations are now issued privately by some of the principal musical firms, and they appear to be fairly accurate. Probably they are copied from certain series of forks beating four per second which have been constructed according to Scheibler's process, so as to furnish the vibration numbers.

The most easy and convenient way of settling the frequency of tuning-forks, or rather of adjusting any vibrating body to a standard note, appears to be by means of a uniform rotation machine controlled by a clock so as to revolve exactly once per second. A disk is mounted on the machine, having say 135 radial slits spokewise. A light behind the disk then throws 135 flashes per second. If a tuning-fork or other vibrating body be placed in front of the disk and looked at against the illuminated background, it presents a pattern which will be stationary if the fork be 135 or 270 or 405 or 540, or any other multiple of 135. If the fork is sharp the pattern moves one way, if flat the other. In this way the vibration number of a vibrating body is referred directly to the clock, and the adjustment to the standard note is one easily made, and not requiring great delicacy of observation.

3. The loudness or intensity of notes undoubtedly increases with the magnitude of the displacements of which the vibrations consist, or rather perhaps with the magnitude of the changes of pressure which occur in the neighbourhood of the ear. It has been customary to speak of the energy of the vibration as affording a measure of intensity, and this is true from a mechanical point of view. But the subjective intensity or loudness is certainly not correctly measured by any of these quantities. Further, the same changes of pressure or the same mechanical intensity cause sounds which vary in loudness according to the pitch. Taking this last point first, it is easy to show that a given mechanical intensity produces a very much louder sound in the higher parts of the scale than in the lower. The simplest way of looking at this is to consider the work employed in exciting the pipes of an organ-stop. The upper pipes take only a small fraction of the wind, and consequently of the power, used by the lower ones, and yet the upper pipes appear quite as loud. It has been shown that with a particular stop the work consumed was proportional to the length of the pipe, and so inversely as the vibration number.

It has been maintained lately that the loudness of sound is measured by the amplitude of the motion, or by the changes of pressure, rather than by the mechanical intensity. The experiments on which this view is based consist of dropping weights from different heights. A weight m from a height h gives a certain loudness. Now let the weight be doubled, the question is whether the loudness remains the same when the height is halved, or when it is divided by $\sqrt{2}$. The experiments appear to prove that the latter is the case. The estimation of the loudness is difficult on account of the apparent change of timbre, but the experiments are carefully arranged and discussed, and appear to establish a *prima facie* case.[1] The experiments are based upon Fechner's law, and appear to afford proof of its applicability. Fechner's law may be stated thus:—equal differences of sensation are produced by changes which are equal fractions of the whole excitation. Thus we may take the change in the mechanical excitation to consist in doubling it; then every time that it is doubled a change will be made in the sensation which is in all cases equally recognizable. The general probability of the truth of this will be seen by enumerating ten different magnitudes under which sounds may be classified; these represent fairly equal differences of sensation:—

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[1] *Nörr. Zeitschrift für Biologie*, 1879, p. 297.

Loud. Not loud.

1 . 2 . 3 . 4 . 5 . 6 . 7 . 8 . 9 . 10

fff ff f mf mp p pp ppp

Magnitude 1 serves for sounds louder than those used in music, 10 for sounds softer than those used in music,—microscopic sounds, so to speak. It seems reasonable, without going into detail, to assume that the mechanical ratio of any two consecutive magnitudes is the same. The general expression of this law is, The measure of sensation is the logarithm of the mechanical excitation. It appears probable that the ratio of energy corresponding to one of the above differences of magnitude is somewhere about 2 or 3. The corresponding ratio depending on amplitude or compression would be from 1·4 to 1·7, but these quantities are not known with any accuracy.

4. The pitch depending on the period or frequency and the loudness on the amplitude or magnitude of the changes, there remains on the one hand the quality of tone, and on the other the form of the vibration or the manner in which the motion takes place between the prescribed limits. These may be expected to correspond with each other, and in fact they do so. The peculiarities of form of vibration are most easily discussed in the case of a musical string whose vibrations are started or maintained in a given manner. The smoothest and purest quality of tone that can be produced is known as a simple tone. When a string produces a simple tone its motion is such that its shape at any moment is that of a curve of sines, and that every point of the string executes oscillations according to the pendulum law.

Simple tones are also produced by any vibrating surface which moves according to the pendulum law. The method for producing simple tones given by Helmholtz, and commonly employed, is to use tuning-forks as the sources of sound, and present their extreme faces to the opening of a resonator or air-chamber arranged so as to vibrate to the same note as the fork. Resonators may be conveniently made from wide-mouthed bottles with flat corks having holes bored in them. The dimensions are usually found by trial, though data exist for their calculation. Simple tones have also been produced by fitting a sort of organ-pipe mouthpiece into the corks of such bottles. The mouths require to be cut up much higher than usual; the notes produced are of an exceedingly full and pure character. Such bottle-notes can be blown from an organ-bellows, and being easily manipulated are very suitable for experiments on the properties of simple tones.

The law of Ohm states that the simple tone or pendulum vibration is that to which the sensation of pitch is attached in its simplest form. If the motion which constitutes the vibration of a note be of any other type, it is capable of being analysed by the ear into a series of simple tones according to what is called Fourier's Theorem. This is most simply described in connexion with stretched strings, assuming that the notes which are exhibited in the form of the string pass over into the air through the sound-board without essential alteration of quality, which appears to be true in a general way. Fourier's Theorem, as applied to a string, states that the motion of the string is equivalent to the sum of the motions which would result if there were a curve of sines of the whole length, two curves of sines each of half the length, three each of one-third the length, and so on,—the amplitudes being determined when the total motion to be represented is given. This equivalence is true mechanically; the law of Ohm says that it is also true for the ear. Hence a great presumption that the ear acts by a receptive mechanism obeying the laws of mechanics.

The notes formed by the division of a string into two, three, or more parts are commonly called *harmonics*. They are also called *overtones*; but this word includes such cases as those of bars, &c., where the notes produced by those divisions are not harmonious with the fundamental. Harmonics play an important part in the theory of consonant combinations, but the theory of consonance cannot be rested entirely upon the properties of harmonics.

CONSONANCE AND DISSONANCE.

It was already known in ancient times that lengths of the same stretched string having the ratio of any two small whole numbers form consonant intervals, or perhaps we may more correctly say smooth combinations, since the interval of a fourth (3 : 4) is regarded as a dissonance in technical music, though it is a smooth combination. The question why smooth combinations are associated with small whole numbers is known as the Pythagorean question. The modern knowledge that the length of a given string is inversely as the vibration number refers the question more generally to vibration numbers rather than to lengths of string. This question has been answered by Helmholtz; we proceed to give a short account of his answer, with some slight modifications.

It has been long known that when two notes form an imperfect unison, or nearly form almost any smooth combination, flutterings or beats are heard. These have been already described in the case of imperfect unisons where two notes differ but little from each other in pitch. They exist also, in most cases, where two notes nearly, but not quite, form a smooth combination. According to Helmholtz, beats are the cause of the sensation of dissonance, and to seek further for this cause we must seek the cause of beats. We may note that this must be taken with some limitation, since the fourth is regarded as a dissonance, though it presents no beats. In the case of imperfect unisons there is no difficulty. Such beats have been long explained as arising out of the alternate coincidences and oppositions of the motions or pressures arising from the two sets of vibrations.

In other cases, however, this explanation is not applicable. Explanations similar in principle have been given by Smith, an English writer of the last century; but these only amount to reckoning the recurrence of certain configurations arising from the superposition of the two sets of motions. No hypothesis is made as to the actual nature of the receptive mechanism of the ear, and no attempt is made to determine of what sounds the beats consist, nor how such sounds arise. We have already seen that the ear receives separately notes which are more than one or two semitones apart. They appear to be received on different parts of the aural mechanism. The production of the beats in the case of imperfect fifths, octaves, &c., where the impulses fall on different parts of the receptive mechanism, appears therefore to be due to secondary causes rather than to the direct superposition of the impulses.

Beats of Harmonics.—This class of beats arises from the fact that in compound notes containing harmonics a pair of notes representing two small whole numbers gives rise to the coincidence of a pair of harmonics forming a unison, and, if the interval be mistuned, the harmonics form an imperfect unison. Beats of this description are easily identified by the pitch of the harmonics. The imperfect unison gives rise to alternations of sound and silence, or to variations of intensity, of a note having the pitch in question. With practice these variations can be heard with the unaided ear. But the employment of resonators, tuned to the pitch in question and connected with the ear, causes the beat to be heard with great intensity

Beats of Combination Tones.—When two notes are sounded loudly at the same time they give rise to the appearance of certain other notes within the ear, which are called combination tones. Call the vibration numbers of the two notes p and q. Then the first combination tone (Tartini tone, difference tone) has the frequency $p-q$. Other combination tones are also formed, whose frequencies are of the forms $p-2q$, $p-3q$, and so on. Each of these has its region of greatest intensity when its frequency is smallest consistently with its forming an audible sound. Thus the first difference tone $(p-q)$ is most powerful when p and q differ only by one or more semitones, though the note is still recognizable by the beats it produces when p and q are a fifth or an octave apart. The beats of mistuned consonant intervals other than the beats of harmonics are produced by the formation of imperfect unisons between combination tones and primaries, or among the combination tones themselves.

Intervals of the form $h:1$.—These comprise the intervals formed between fundamental and harmonics. The beats of mistuned consonances of the form $h:1$, other than the beats of harmonics, consist of variations of intensity of the lower note of the pair. This rule has been established experimentally by the employment of the pure notes furnished by bottles blown from an organ-bellows.

Octave. Let the notes be 100 : 201. $p-q=101$, which with 100 gives one beat per second.

Twelfth. Let the notes be 100 : 301. $p-2q=101$, which with 100 gives one beat per second.

Double octave. Let the notes be 100 : 401. $p-3q=101$. One beat per second as before, and so on.

These explanations satisfy the observation that the beats are on the lower notes of the combinations.

Other Consonant Intervals.—The chief remaining consonance which furnishes beats is the fifth. There is no doubt that the beats of the fifth, other than the beats of harmonics, are chiefly on the octave below the lower note. Hence the following explanation:—

Fifth. Let the notes be 200 : 301,

$$p-q=101$$
$$2q-p=\underline{99}$$

2 beats per second, an octave below the lower note of the pair.

Triad with Mistuned Third.—If a fifth be tuned perfect and a third inserted, the note two octaves below the lowest note of the triad can generally be heard distinctly. If the third be mistuned, beats are heard on that note.

Let the notes be 400, 501, 600,

$$501-400=101$$
$$600-501=\underline{99}$$

2 beats per second, two octaves below the lowest note of the triad.

There can be little doubt that the definition of consonances as intervals which can be tuned free from beats lies at the basis of almost all music. There can also be little doubt that the power of the perception or memory of absolute pitch, though sparely distributed, must ensure to those musicians who have it influence on the progress of the art. With these persons the influence of consonance or smoothness is generally subordinate to the recognition of the pitch of the notes used. Between these two elements scales of different kinds have been evolved in different parts of the world. These scales have almost invariably a basis of consonances, generally fifths. But when once developed the melodic effects almost invariably supersede the reference to the consonances in the ears of expert persons. The scales of different countries and systems, embodied in melodies, sound atrocious to those accustomed to other scales, quite independently of the consonant relations on which they are all founded in common.

The subject of Temperament deals with the general theory of the construction of scales from slightly mistuned consonances. (R. H. M. B.)

MUSICAL-BOX, an instrument for producing by mechanical means tunes or pieces of music. The modern musical-box is an elaboration of the elegant toy musical snuff-box in vogue during the 18th century. The notes or musical sounds are produced by the vibration of steel teeth, or springs cut in a comb or flat plate of steel. The teeth are graduated in length from end to end of the comb or plate, the longer teeth giving the deeper notes; and, where necessary, by filing or loading with lead the individual teeth are accurately attuned. Each tone and semitone in the scale is represented by three or four separate teeth in the comb, to permit of successive repetitions of the same note when required by the music. The teeth are acted upon and musical vibrations produced by the revolution of a brass cylinder studded with projecting pins, which, as they move round, raise and release the proper teeth at due intervals according to the nature of the music. An entire revolution of the cylinder completes the performance of the special pieces of music for which the apparatus is set, but upon the same cylinder there may be inserted pins for performing as many as thirty-six separate airs. This is accomplished by making both the points of the teeth or springs and the projecting pins which touch them very fine, so that a very small change in the position of the cylinder is sufficient to bring an entirely distinct set of pins in contact with the note teeth. In the more elaborate musical-boxes the cylinders are removable, and may be replaced by others containing distinct sets of music. In these also there are combinations of bell, drum, cymbal, and triangle effects, &c. The revolving motion of the cylinder is effected by a spring and clock-work, and the rate of revolution is regulated by a fly regulator. The head-quarters of the musical-box trade is Geneva, where the manufacture gives employment to upwards of a thousand persons.

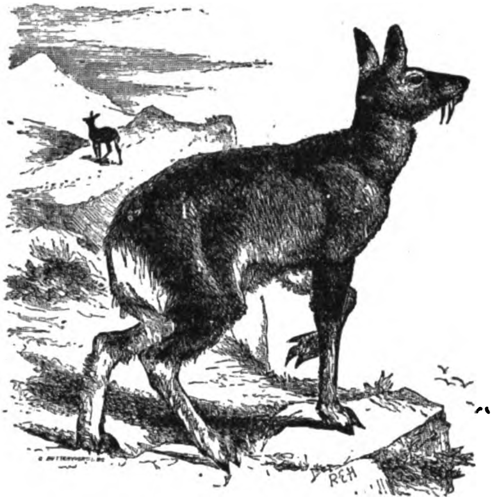
The musical-box is a type of numerous instruments for producing musical effects by mechanical means, in all of which a revolving cylinder or barrel studded with pins is the governing feature. The principle of the barrel operating by percussion or by wind on reeds, pipes, or strings governs carillons or music bells, barrel organs, mechanical flutes, celestial voices, harmoniphones, and the sometimes huge and complex orchestrions in which a combination of all orchestral effects is attempted. A principle of more recent introduction than the studded cylinder consists of sheets of perforated paper or card, somewhat similar to the Jacquard apparatus for weaving. The perforations correspond in position and length to the pitch and duration of the note they represent, and as the web or long sheet of paper passes over the instrument, the perforated holes are brought in proper position and sequence under the influence of the suction or pressure of air from a bellows, and thereby the notes are either directly acted on, as in the case of reed instruments, or the opening and closing of valves set in motion levers or liberate springs which govern special notes. The United States are the original home of the instruments controlled by perforated paper known as orguinettes, organinas, melodeons, &c.

MUSK, a substance of powerful and most enduring odour, is a secretion of the male Musk Deer (*q.v.*). Three kinds of musk are distinguished in commerce, the most important and valuable being the Chinese or Tong-king musk, imported principally from Shanghai. It is put up in small tin-lined silk-covered caddies, each containing from two to three dozen pods. These are generally adulterated to an enormous extent with dried blood, fragments of leather, leaden pellets, peas, &c., so that often little more than the smell of the original tenant of the pod remains. The Chinese pods may vary in value according to quality and genuineness from 14s. to 40s. per oz. Musk collected from the western Himalayas is exported from India to the extent of from 3000 to 5000 oz. annually. It is much less prized than genuine Tong-king musk. The third variety, known as Kabardine or Siberian musk, is imported from Central Asia by way of Russia. It is in large pods, said to be yielded by a distinct species of deer, and is very inferior in point of odour.

Good musk is of a dark purplish colour, dry, smooth, and unctuous to the touch and bitter in taste. It dissolves in boiling water to the extent of about one-half, alcohol takes up one-third of the substance, and ether and chloroform dissolve still less. A grain of musk will distinctly scent millions of cubic feet of air without any appreciable loss of weight, and its scent is not only more penetrating but more persistent than that of any other known substance. Its chemical constitution has not been specially investigated; but in addition to its odoriferous principle it contains ammonia, cholestrin, fatty matter, a bitter resinous substance and other animal principles. As a material in perfumery it is of the first importance, its powerful and enduring odour giving strength and permanency to the vegetable essences, so that it is a principal ingredient in nearly all compounded perfumes. Musk, or some substance possessed of the musk odour, is also contained in glands in the jaw of alligators and crocodiles, whence it has been extracted for use in perfumery in India and Egypt. The musk-ox and the musk-rat (Indian and European) are, as their names indicate, remarkable for a musk odour (see below). In the vegetable kingdom also a musky smell pervades the seeds of *Abelmoschus moschatus*, the entire plant *Mimulus moschatus*, and the sumbul root (*Euryangium Sumbul*).

MUSK-DEER, an animal belonging to the genus *Moschus*, of the section *Pecora*, a division of the *Artiodactyle Ungulates* (see MAMMALIA, vol. xv. p. 430), and allied to the Deer (*Cervidæ*). In many respects it differs from the typical members of that group and stands by itself as an isolated zoological form, retaining characters belonging to the older and more generalized types of ruminants before they were distinctly separated into the horned and the antlered sections now dominant upon the earth. One of these characters is that both sexes are entirely devoid of any sort of frontal appendage. In this, however, it agrees with one genus of true deer (*Hydropotes*); and, as in that animal, the upper canine teeth of the males are remarkably developed, long, slender, sharp-pointed, and gently curved, projecting downwards out of the mouth with the ends turned somewhat backwards. Among the anatomical peculiarities in which it differs from all true deer is the presence of a gall-bladder.

Although, owing to variations of colour presented by different individuals in different localities and seasons, several nominal species have been described, zoologists are now generally agreed that there is but one, the *Moschus moschiferus* of Linnæus. In size it is rather less than the European roe-deer, being about 20 inches high at the shoulder. Its limbs, especially the hinder ones, are long. The feet are remarkable for the great development of the lateral pair of hoofs, and for the freedom of motion they all present, so that they appear to have the power of grasping projecting rocky points,—a power which must be of great assistance to the animal in steadying it in its agile bounds among the crags of its native haunts. The ears are large, and the tail quite rudimentary. The hair covering the body is long, coarse, and of a peculiarly brittle and pith-like character, breaking with the application of an extremely slight force; it is generally of a greyish-brown colour, sometimes inclined to yellowish red, and often variegated with lighter patches. The Musk-deer has a wide distribution over the highlands of central and eastern Asia, including the greater part of southern Siberia, and extends to Kashmir on the south-west and Cochin-China on the south-east, always, however, at great elevations,—being rarely found in summer below 8000 feet above the sea-level, and ranging as high as the limits of the thickets of birch, rhododendron, and juniper, among which it mostly conceals itself in the day-time. It is a hardy, solitary, and retiring animal, chiefly nocturnal in its habits, and almost always found alone, rarely in pairs and never in herds. It is exceedingly active and surefooted, having perhaps no equal in traversing rocks and precipitous ground; and it feeds on moss, grass, and leaves of the plants which grow on the mountains among which it makes its home.



Musk-deer.

Most of the animals of the group to which the Musk-deer belongs, in fact the large majority of mammals, have some portion of the cutaneous surface peculiarly modified and provided with glands secreting some odorous and oleaginous substance specially characteristic of the species. This, correlated with the extraordinary development of the olfactory organs, appears to offer the principal means by which animals in a state of nature become aware of the presence of other individuals of their own species, or of those inimical to them, even at very great distances, and hence it is of extreme importance both to the wellbeing of the individual and to the continuance of the race. The situation of this specially modified portion of skin is extremely various, sometimes between the toes, as in sheep, sometimes on the face in front of the eyes, as in many deer and antelopes. Sometimes it is in the form of a simple depression or shallow recess, often very deeply involuted, and in its most complete state of development it forms a distinct pouch or sac with a narrow tubular orifice. In this sac a considerable quantity of the secretion can accumulate until discharged by the action of a compressor muscle which surrounds it. This is the form taken by the special gland of the Musk-deer, which has made the animal so well known, and which has proved the cause of an unremitting persecution to its possessor. It is found in the male only, and is a sac about the size of a small orange, situated beneath the skin of the abdomen, the orifice being immediately in front of the preputial aperture. The secretion with which the sac is filled is of dark-brown or chocolate colour, and when fresh described as being of the consistence of "moist gingerbread," but becoming dry and granular after keeping. It has a peculiar and very powerful scent, which when properly diluted and treated forms the basis of many of our most admired perfumes. When the animal is killed the whole gland or "pod" is cut out and dried, and in this form reaches the market of the Western world, chiefly through China.

For further details on the anatomy and zoology of *Moschus* see Pallas, *Spicilegia Zoologica*, xiii. (1779); A. Milne-Edwards, "Recherches Anatomiques, Zoologiques, et Palæontologiques sur la Famille des Chevrotains," in *Annales des Sciences Naturelles*, 5th ser., zool.; ii. (1865); Brandt and Ratzeburg, *Medicinische Zoologie*, i. pp. 41-51 (1839); W. H. Flower, *Proc. Zool. Soc. London*, 1875, pp. 159-190; A. H. Garrod, *ibid.*, 1877, pp. 287-292.

MUSKEGON, a city of the United States, the county seat of Muskegon county, Michigan, at the upper end of Muskegon Lake, a fine sheet of water formed by the Muskegon river before it falls into Lake Michigan. The staple trade is in lumber, which is floated down the river, worked up by its saw-mills and planing-mills, and exported by boat and rail. The cut of lumber in the season of 1882 was 650,000,000 feet. There are also car, engine, and boiler works, and various manufactories of wooden ware. The population increased from 6002 in 1870 to 11,262 in 1880. Settled in 1836, and laid out in 1853, Muskegon was incorporated as a village in 1861 and as a city in 1870.

MUSKELUNGE. See Pike.

MUSK-OX. The animal commonly known by this name, though approaching in size the smaller varieties of oxen, is in structure and habits closely allied to the sheep, its affinities being well expressed by the generic name *Ovibos* bestowed upon it by De Blainville. The specific name *Moschatus*, as also the common English appellatives "musk-ox," "musk-buffalo," or "musk-sheep" applied to it by various authors, refer to the musky odour which the animal exhales. This does not appear to be due to the secretion of a special gland, as in the case of the Musk-deer; but it must be observed that, except as regards the osteology, very little is known of the anatomy of this species.

Musk-ox.

The *Ovibos moschatus* about equals in size the small Welsh and Scotch cattle. The head is large and broad. The horns in the old males have extremely broad bases, meeting in the median line, and covering the brow and whole crown of the head. They are directed at first downwards by the side of the face and then turn upwards and forwards, ending in the same plane as the eye. Their basal halves are of a dull white colour, oval in section and coarsely fibrous; their middle part smooth, shining, and round; their tips black. In the females and young males the horns are smaller, and their bases are separated from each other by a space in the middle of the forehead. The ears are small, erect, and pointed, and nearly concealed in the hair. The space between the nostrils and the upper lip is covered with short close hair, as in sheep and goats, without any trace of the bare "muffle" of oxen. The greater part of the animal is covered with long brown hair, thick, matted, and curly on the shoulders, so as to give the appearance of a hump, but elsewhere straight and hanging down,—that of the sides, back, and haunches reaching as far as the middle of the legs and entirely concealing the very short tail. There is also a thick woolly under-fur, shed in the summer. The hair on the lower jaw, throat, and chest is long and straight, and hangs down like a beard or dewlap, though there is no loose fold of skin in this situation as in oxen. The limbs are stout and short, terminating in unsymmetrical hoofs, the external being rounded, the internal pointed, and the sole partially covered with hair.

The Musk-ox is at the present day confined to the most northern parts of North America, where it ranges over the rocky barren grounds between the 60th parallel and the shores of the Arctic Sea. Its southern range is gradually contracting, and it appears that it is no longer met with west of the Mackenzie river, though formerly abundant as far as Eschscholtz Bay. Northwards and eastwards it extends through the Parry Islands and Grinnell Land to north Greenland, reaching on the west coast as far south as Melville Bay; and it was also met with in abundance by the German polar expedition of 1869-1870 at Sabine Island on the east coast. No trace of it has been found in Spitzbergen or Franz Joseph Land. As proved by the discovery of fossil remains, it ranged during the Pleistocene period over northern Siberia and the plains of Germany and France, its bones occurring very generally in river deposits along with those of the reindeer, mammoth, and woolly rhinoceros. It has also been found in ordinary Pleistocene gravels in several parts of England, as Maidenhead, Bromley, Freshfield near Bath, Barnwood near Gloucester, and also in the lower brick earth of the Thames valley at Crayford, Kent.

It is gregarious in habit, assembling in herds of twenty or thirty head, or, according to Hearne, sometimes eighty or a hundred, in which there are seldom more than two or three full-grown males. They run with considerable speed, notwithstanding the shortness of their legs. Major H. W. Feilden, naturalist to the Arctic Expedition of 1875, says: "No person watching this animal in a state of nature could fail to see how essentially ovine are its actions. When alarmed they gather together like a flock of sheep herded by a collie dog, and the way in which they pack closely together and follow blindly the vacillating leadership of the old ram is unquestionably sheep-like. When thoroughly frightened they take to the hills, ascending precipitous slopes and scaling rocks with great agility." They feed chiefly on grass, but also on moss, lichens, and tender shoots of the willow and pine. The female brings forth one young one in the end of May or beginning of June after a gestation of nine months. According to Sir J. Richardson, "when this animal is fat its flesh is well tasted, and resembles that of the caribou, but has a coarser grain. The flesh of the bulls is highly flavoured, and both bulls and cows when lean smell strongly of musk, their flesh at the same time being very dark and tough, and certainly far inferior to that of any other ruminating animal existing in North America." The carcase of a Musk-ox weighs, exclusive of fat, above 8 cwt. On this subject Major Feilden says: "The cause of the disagreeable odour which frequently taints the flesh of these animals has received no elucidation from my observations. It does not appear to be confined to either sex, or to any particular season of the year; for a young unweaned animal, killed at its mother's side and transferred within an hour to the stew-pans, was as rank and objectionable as any. The flesh of some of these animals of which I have partaken was dark, tender, and as well flavoured as that of four-year old Southdown mutton" (*Zoologist*, September 1877).

See Richardson, *Fauna Boreali-Americana* (1829), and *Zoology of H.M.S. Herald* (1852); W. Boyd Dawkins, "*Ovibos moschatus*," in *British Pleistocene Mammalia*, part v.; *Memoirs of the Palæontographical Society* (1872).

MUSK-RAT. A name commonly applied to an animal also called Musquash (*Fiber zibethicus*), of the sub-family *Arvicolinæ*, family *Muridæ*.[1] It is related in structure and habits to the English water-vole, but is of larger size, the head and body being about 12 inches in length and the tail but little less. It is rather a heavily-built animal, with a broad head, no distinct neck, and short limbs; the eyes are small, and the ears project very little beyond the fur. The fore-limbs have four toes and a rudimentary thumb, all with claws; the hind limbs are larger, with five distinct toes, united by short webs at their bases. The tail is laterally compressed, nearly naked, and scaly. The hair much resembles that of a beaver, but is shorter; it consists of a thick soft under-fur, interspersed with longer stiff, glistening hairs, which overlie and conceal the former, on the upper surface and sides of the body. The general colour is dark umber-brown, almost black on the back and grey below. The tail and naked parts of the feet are black. The musky odour from which it derives its name is due to the secretion of a large gland situated in the inguinal region, and present in both sexes.

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[1] See Mammalia, vol. xv. p. 419, where also an illustration (fig. 94, p. 418) of its skull and dentition is given.

The Musk-rat is the only species of its genus and is peculiar to America, being extensively distributed in suitable localities in the northern part of the continent, extending from the Atlantic to the Pacific, and from the Rio Grande to the barren grounds bordering the Arctic Seas. It is aquatic in its habits, living on the shores of lakes and rivers, swimming and diving with great facility, feeding on the roots, stems, and leaves of water-plants, or on fruits and vegetables which grow near the margin of the streams it inhabits. Musk-rats are most active at night, spending the greater part of the day concealed in their burrows dug out of the bank, consisting of a chamber with numerous passages, all of which open under the surface of the water. For winter quarters they build more elaborate houses of conical or dome-like form, composed of sedges, grasses, and similar materials plastered together with mud. As their fur is an important article of commerce, large numbers are annually killed, being either trapped or speared at the mouths of their holes.

Musk-rat.

The name Musk-rat is applied in India to a large species of Shrew (*Sorex cærulescens* or *indicus*) which frequents houses at night, hunting round rooms for cockroaches and other insects, occasionally uttering a sharp shrill cry. The strong musky odour of the animal arises from large glands beneath the skin of the side of the body, a short distance behind the fore-limbs. This odour is so powerful and penetrating that it is popularly believed in India that if the animal runs over a corked bottle of wine or beer it will infect the fluid within. Jerdon says that certainly many bottles are met with quite undrinkable from the peculiar musky odour of their contents, but, rejecting the possibility of its passing through the glass, he attributes it to the corks having been infected previously to bottling, stating in corroboration of this view that he has never found the odour in liquors bottled in England.

MUSLIN, a term embracing the thin delicate woven cotton fabrics, the lightest and most airy of all textures. The word is derived from Mosul; the original home of muslin-weaving is the East Indies, where even yet wonderful fabrics for airy lightness and delicacy continue to be woven with the aid of only the most rude and primitive appliances. The most delicate muslins are made at Dacca, where webs have been woven of yarn calculated to be equal to 380° (that is, 380 hanks, each 840 yards in length, weigh 1 lb). Such a web measuring 10 yards 1 foot in length by 3 feet in breadth, and having 104 threads of warp and 100 of weft per inch, was found to weigh not more than 1565 grains. Figured, embroidered, colour-woven, and printed muslins are made at various places, principally in Madras province, and gold and silver printed muslins are made at Jeypore and Hyderabad in India. The making of muslin in Europe was first attempted at Glasgow by Robert Monteith about the year 1780, but he had to procure Indian bird-nest yarn for his web. The improvements in machinery effected about that time, however, soon enabled spinners to produce yarn of high counts, and thereafter the muslin trade took firm hold in the west of Scotland. In recent times the perfection of combing machinery, &c., has enabled spinners to supply yarn of much greater tenuity than has ever been spun in India, and indeed vastly finer than is of any use for weaving purposes. A few yards of muslin have been woven with 700° cotton, but it is of use only to indicate the limit up to which it is possible to weave yarn. Fine muslin or tarlatan has been woven of 440° yarn by M. Thivel Michon of Tarare in France, but to the eye and touch it is less fine and delicate than Dacca "mulmul khas," owing possibly to dressing with starch, and to the less degree of condensation in machine-spinning as compared with hand-spinning. The varieties of European muslins and their applications are numerous. Among plain muslins are included books, mulls (from "mulmul"), jaconets, tarlatans, Bishop and Victoria lawns, nainsooks, &c., chiefly distinguished by variety of finish, dressing, folding, &c. For window-curtains, hangings, &c., there are manufactured harness and book muslins, lenos, sprigs, spots, and lappets; and for ladies' dresses plain, striped, and figured grenadines, and saccarillas, besides which dyed and printed muslins are largely used. Sewed muslin, which was formerly an important Scottish industry, also continues to be a branch of the trade.

MUSSCHENBROEK, PIETER VAN (1692-1761), natural philosopher, was born at Leyden in March 1692, and studied at the university of his native city. The teacher from whom he derived the most profit was the eminent mathematician Gravesande. A scientific partnership was formed in 1717 between the master and the pupil for the prosecution of natural philosophy according to the principles of Newton, and in opposition to those of Descartes; Gravesande concentrating his attention on the theoretical part of the study, while Musschenbroek conducted the experiments. The consequence was that the downfall of Cartesianism and the establishment of Newtonianism were very much accelerated in Holland. Graduating in 1715 with a dissertation, *De aeris præsentia in humoribus animalium*, Musschenbroek was appointed professor at Duisburg in 1719. In 1723 he was promoted to the chair of natural philosophy and mathematics at Utrecht. In 1731 he declined an invitation to Copenhagen, and was promoted in consequence to the chair of astronomy at Utrecht in 1732. The attempt of George II. of England in 1737 to attract him to the newly-established university of Göttingen was also unsuccessful. At length, however, the claims of his native city overcame his resolution to remain at Utrecht, and he took possession of the mathematical chair at Leyden in 1739, where, declining all offers from abroad, he continued till his death in September 1761.

His first important production was *Epitome elementorum physico-mathematicorum*, 12mo, Leyden, 1726,—a work which was afterwards gradually altered as it passed through several editions, and which appeared at length (posthumously, edited by Ludolf) in 1762, under the title of *Introductio ad philosophiam naturalem*. The *Physicæ experimentales et geometricæ dissertationes* (1729) threw new light on magnetism, capillary attraction, and the cohesion of bodies. A Latin edition with notes (1731) of the Italian work *Saggi di naturali esperienze fatte nell' Accademia del Cimento* contained amid many other curious investigations a description of new instrument, the pyrometer, which Musschenbroek had invented, and of several experiments which he had made on the expansion of bodies by heat. Musschenbroek is also the author of *Elementa physica*, 8vo, 1734 (English translation 1744 by Colson), and of papers in the *Mémoires* of the Paris and St Petersburg Academies, and in the London *Philosophical Transactions*.

MUSSEL, a term applied in England to two families of Lamellibranch Molluscs,—the marine *Mytilacea*, of which the Edible Mussel, *Mytilus edulis*, is the representative, and the fresh-water *Unionacea*, of which the River Mussel, *Unio pictorum*, and the Swan Mussel, *Anodon cygneus*, are the common British examples. It is not obvious why these fresh-water forms have been associated popularly with the *Mytilacea* under the name Mussel, unless it be on account of the frequently very dark colour of their shells. They are somewhat remote from the sea mussels in structure, and have not even a common economic importance.

The Sea Mussel (*Mytilus edulis*) belongs to the second order of the class *Lamellibranchia* (see vol. xvi. pp. 685 *sq.*), namely, the *Heteromya*, in which the anterior or pallial adductor is much smaller than the pedal or posterior adductor. It and the other *Mytilacea* are remarkable for the comparatively free condition of the gill-filaments, which, whilst adhering to one another to form gill-plates (vol. xvi. p. 689, fig. 133), are yet not fused to one another by concrescence. It is also remarkable for the small size of its foot and the large development of two glands in the foot—the byssus-forming and the byssus-cementing glands.

The byssus is a collection of horny threads by which the Sea Mussel (like many other Lamellibranch or Bivalve Molluscs) fixes itself to stones, rocks, or submerged wood, but is not a permanent means of attachment, since it can be discarded by the animal, which, after a certain amount of locomotion, again fixes itself by new secretion of byssus from the foot. Such movement is, however, very rare. *Mytilus* possesses no siphonal tube-like productions of the margin of the mantle-skirt, nor any notching of the same, representative of the siphons which are found in its fresh-water ally, the *Dreissena polymorpha*.

Mytilus edulis is an exceedingly abundant and widely distributed form. It occurs on both sides of the northern Atlantic and in the Mediterranean basin. It presents varieties of form and colour according to the depth of water and other circumstances of its habitat. Usually it is found on the British coast encrusting rocks exposed at low tides, or on the flat surfaces formed by sandbanks overlying clay, the latter kind of colonies being known locally as "scalps." Under these conditions it forms continuous masses of individuals closely packed together, sometimes extending over many acres of surface and numbering millions. The readiness with which the young *Mytilus* attaches itself to wicker-work is made the means of artificially cultivating and securing these molluscs for the market both in the bay of Kiel in North Germany and at the mouth of the Somme and other spots on the coast of France.

Natural scalps are subject to extreme vicissitudes: an area of many acres may be destroyed by a local change of current producing a deposit of sand or shingle over the scalp, or by exposure to frost at low tide in winter, or by accumulation of decomposing vegetable matter. The chief localities of natural scalps on the British coast are Morecambe Bay in Lancashire and the flat eastern shores, especially that of the Wash of Lincoln, and similar shallow bays. These scalps are in some cases in the hands of private owners, but the English Government has not granted sufficiently definite rights to such individuals to enable them to protect their property from marauders, and to justify them in undertaking artificial cultivation.

The Sea Mussel is scarcely inferior in commercial value to the oyster. In 1873 the value of mussels exported from Antwerp alone to Paris to be used as human food was £280,000. In Britain their chief consumption is in the deep-sea line fishery, where they are held to be the most killing of all baits. Twenty-eight boats engaged in haddock-fishing at Eyemouth used between October 1882 and May 1883 920 tons of mussels (about 47 million individuals), costing nearly £1800 to the fishermen, about one-half of which sum was expended on the carriage of the mussels. It is quite impossible to calculate the number of tons of mussels annually used in this way by British fishermen, but it amounts to some hundreds of thousands, and the supplying of the market would offer a lucrative investment for capital did the Government grant definite proprietary rights over the fore-shore and sea-bottom to those ready to enter upon such enterprise. Many thousand tons of mussels are wastefully employed as manure by the farmers on lands adjoining scalp-producing coast, as in Lancashire and Norfolk, three half-pence a bushel being the price quoted in such cases. It is a curious fact, illustrative of the ignorant procedure and arbitrary fashions of fisher-folk, that on the Atlantic seaboard of the United States the Sea Mussel, *Mytilus edulis*, though common, is not used as bait nor as food. Instead, the Soft Clam, *Mya arenaria*, a Lamellibranch not used by English or Norwegian fishermen, though abundant on their shores, is employed as bait by the fishermen to the extent of 1½ million bushels per annum, valued at £120,000. At the mouth of the river Conway in North Wales the Sea Mussel is crushed in large quantities in order to extract pearls of an inferior quality which are occasionally found in these as in other Lamellibranch Molluscs (Gwyn Jeffreys).

Mytilus edulis is considered of fair size for eating when it is 2 inches in length, which size is attained in three years after the spat or young mussel has fixed itself. Under favourable circumstances it will grow much larger than this, specimens being recorded of 9 inches in length. It is very tolerant of fresh water, fattening best, as does the oyster, in water of density 1014 (the density of the water of the North Sea being 1026). Experiments made by removing mussels from salt water to brackish, and finally to quite fresh water show that it is even more tolerant of fresh water than the oyster; of thirty mussels so transferred all were alive after fifteen days. *Mytilus edulis* is occasionally poisonous, owing to conditions not satisfactorily determined.

The fresh-water Mussels, *Anodon cygneus*, *Unio pictorum*, and *Unio margaritiferus* belong to the order Isomya of Lamellibranch Mollusca, in which the anterior and posterior adductor muscles are equally developed. An account of the anatomy of *Anodon* is given in the article MOLLUSCA. *Unio* differs in no important point from *Anodon* in internal structure. The family *Unionacea*, to which these genera belong, is of world-wide distribution, and its species occur only in ponds and rivers. A vast number of species arranged in several genera and sub-genera have been distinguished, but in the British Islands the three species above named are the only claimants to the title of "fresh-water mussel."

Anodon cygneus, the Pond Mussel or Swan Mussel, appears to be entirely without economic importance. *Unio pictorum*, the common River Mussel (Thames), appears to owe its name to the fact that the shells were used at one time for holding water-colour paints as now shells of this species and of the Sea Mussel are used for holding gold and silver paint sold by artists' colourmen, but it has no other economic value. *Unio margaritiferus*, the Pearl Mussel, was at one time of considerable importance as a source of pearls, and the pearl mussel fishery is to this day carried on under peculiar state regulations in Sweden and Saxony, and other parts of the Continent. In Scotland and Ireland the pearl mussel fishery was also of importance, but has altogether dwindled into insignificance since the opening up of commercial intercourse with the East and with the islands of the Pacific Ocean, whence finer and more abundant pearls than those of *Unio margaritiferus* are derived.

In the last forty years of the last century pearls were exported from the Scotch fisheries to Paris to the value of £100,000; round pearls, the size of a pea, perfect in every respect, were worth £3 or £4. The Pearl Mussel is still used as bait in the Aberdeen cod fishery.

For an account of the anatomy of *Mytilus edulis* the reader is referred to the treatise by Sabatier on that subject (Paris, 1875). Its development from the egg has not been fully studied, but some very important facts as to the structure of the free-swimming young or spat are to be found in the memoir by Lacaze Duthiers, *Annales des Sciences Naturelles*, 1856. The essay by Mr Charles Harding on *Molluscs used for Food or Bait*, published by the committee of the London International Fisheries Exhibition, 1883, may be consulted as to the economic questions connected with the Sea Mussel. (E. R. L.)

MUSSELBURGH, a Scottish burgh of barony and regality, a municipal and parliamentary burgh in the parish of Inveresk and county of Midlothian, 5½ miles east of Edinburgh. The burgh, which stretches about a mile along the south shore of the Firth of Forth, is intersected by the river Esk and embraces the village of Fisherrow. In the town is Pinkie House, an ancient baronial residence, formerly a seat of the abbot of Dunfermline, whose monastery held the lands and regality before the Reformation. About a mile to the south-east the battle of Pinkie, so disastrous to the Scottish arms, was fought in 1547. Musselburgh is a place of great antiquity; one of the two stone bridges over the Esk is said to represent an ancient Roman structure, and remains of Roman work have been found at Inveresk in the immediate vicinity. The town has an important factory for fishing-nets, a paper mill, breweries, and other manufactories, and there is a harbour, chiefly for fishermen, at Fisherrow. Loretto School here has its name from the old chapel of Loretto, founded in 1534 by Thomas Duthy, a hermit from Mount Sinai. The Musselburgh Links, east of the river, are much frequented by golfers, and upon the Links there is a good racecourse. The population of the burgh in 1881 was 7866.

MUSSET, Alfred de (1810-1857), poet, play-writer, and novelist, was born on the 11th December 1810 in a house in the middle of old Paris, near the Hôtel Cluny. His father, Victor de Musset, who in the course of his life held several ministerial posts of importance, traced his descent back as far as 1140. In Alfred's childhood there were various things which fostered his imaginative power. He and his brother Paul, who afterwards wrote a biography of Alfred, delighted in reading old romances together, and in assuming the characters of the heroes of these romances. But it was not until about 1826 that Musset gave any definite sign of the mental force which afterwards distinguished him. In the summer of 1827 he all but won a prix d'honneur by an essay on "The origin of our feelings," and in 1828, when Scribe, Mélesville, and the elder Brazier were in the habit of coming to Madame de Musset's house at Auteuil, where drawing-room plays and charades were constantly given, Musset, excited by this companionship, wrote his first poem, which, to judge from the extracts preserved, was neither better nor worse than much other work of clever boys who may or may not afterwards turn out to be possessed of genius. Shortly after his first attempt in verse he was taken by Paul Foucher to Victor Hugo's house, where he met such men as Alfred de Vigny, Mérimée, and Sainte-Beuve. It was under Hugo's influence, no doubt, that he composed a play. The scene was laid in Spain, and some lines, showing a marked advance upon his first effort, are preserved. In 1828, when the war between the classical and the romantic school of literature was growing daily more serious and exciting, Musset, who had published some verses in a country newspaper, boldly recited some of his work to Sainte-Beuve, who wrote of it to a friend, "There is amongst us a boy full of genius." At eighteen years old Musset produced a translation, with a few insertions of his own, of De Quincey's *Opium-Eater*. This was published by Mame, attracted no attention, and has been long out of print. His first original volume was published in 1829 under the name of *Contes d'Espagne et d'Italie*, had an immediate and striking success, provoked bitter opposition, and produced many unworthy imitations. In December 1830 he was just twenty years old, and was already conscious of that curious double existence within him so frequently symbolized in his plays,—in Octave and Célio for instance (in *Les Caprices de Marianne*), who also stand for the two camps, the men of matter and the men of feeling,—which he has elsewhere described as characteristic of his generation. At this date his piece the *Nuit Vénitienne* was produced by Harel, manager of the Odéon. The exact causes of its failure might now be far to seek; unlucky stage accidents had something to do with it, but there seems reason to believe that there was a strongly-organized opposition. However this may be, the result was disastrous to the French stage; for it put a complete damper on the one poet who, as he afterwards showed both in theoretical and in practical writings, had the fine insight which took in at a glance the merits and defects both of the classical and the romantic schools. Thus he was strong and keen to weld together the merits of both schools in a new method which, but for the fact that there has been no successor to grasp the wand which its originator wielded, might well be called the school of Musset. The serious effect produced upon Musset by the failure of his *Nuit Vénitienne* is curiously illustrative of his character. A man of greater strength and with equal belief in his own genius might have gone on appealing to the public until he compelled them to hear him. Musset gave up the attempt in disgust, and waited until the public were eager to hear him without any invitation on his part. In the case of his finest plays this did not happen until after his death; but long before that he was fully recognized as a poet of the first rank, and as an extraordinary master of character and language in prose-writing. In his complete disgust with the stage after the failure above referred to there was no doubt something of a not ignoble pride, but there was something also of weakness—of a kind of weakness out of which it must be said sprang some of his most exquisite work, some of the poems which could only have been written by a man who was face to face with difficulties which were old enough in the experience of mankind, though for the moment new and strange to him, and by which he felt himself to be overwhelmed.

In 1833 Musset published the volume called *Un Spectacle dans un Fauteuil*. One of the most striking pieces in this—*Namouna*—was written at the publisher's request to fill up some empty space; and this fact is noteworthy when taken in conjunction with the horror which Musset afterwards so often expressed of doing anything like writing "to order,"—of writing, indeed, in any way or at any moment except when the inspiration or the fancy happened to seize him. The success of the volume seemed to be small in comparison with that of his *Contes d'Espagne*, but it led indirectly to Musset's being engaged as a contributor to the *Revue des Deux Mondes*. In this he published, in April 1833, *André del Sarto*, and he followed this six weeks later with *Les Caprices de Marianne*. This play, which now ranks as one of the classical pieces in the repertory of the Théâtre Français, is a fine illustration of the method above referred to, a method of which Musset gave something like a definite explication five years later. This explication was also published in the *Revue des Deux Mondes*, and it set forth that the war between the classical and the romantic schools could never end in a definite victory for either school, nor was it desirable that it should so end. "It was time," Musset said, "for a third school which should unite the merits of each." And in *Les Caprices de Marianne* these merits are most curiously and happily combined. It so happens that, as the piece is generally given on the stage, with the omission of one change of scene, the classical unities are almost exactly preserved, while the whole play is impregnated with romanticism in the best sense of the word. It has perhaps more of the Shakespearean quality—the quality of artfully mingling the terrible, the grotesque, and the high comedy tones—which exists more or less in all Musset's longer and more serious plays than is found in any other of these. In Claudio, the husband, the terrible and the grotesque are strangely and powerfully allied; Tibia, his serving-man, is grotesque with a touch of grimness caught from his master; Octave and Célio represent the two elements which were always warring in Musset's own heart—one is the careless half-cynical man of the world and the other the wholly tender romantic lover; Marianne is that type of the highest comedy to which events lend a touch of tragedy, while in Hermia, Célio's mother, is the very poetry of maternal love. The piece is called a comedy, and it owes this title to its extraordinary brilliance of dialogue, truth of characterization, and swiftness in action, under which there is ever latent a sense of impending fate. Many of the qualities indicated are found in others of Musset's dramatic works, and notably in *On ne badine pas avec l'Amour*, where the skill in insensibly preparing his hearers or readers through a succession of dazzling comedy scenes for the swift destruction of the end is very marked. But *Les Caprices de Marianne* is perhaps for this particular purpose of illustration the most compact and most typical of all. One other point in Musset's method may be noted in connexion with this play. Paul de Musset asked him where he had ever met a Marianne. He answered, "Everywhere and nowhere; she is not a woman, she is woman." The appearance of *Les Caprices de Marianne* in the *Revue* was followed by that of *Rolla*, a marked symptom of the "maladie du siècle." Then came the unfortunate journey which Musset made to Italy with George Sand. It is well known that the rupture of what was for a time a most passionate attachment had a disastrous effect upon Musset, and brought out the weakest side of his moral character. He was at first absolutely and completely struck down by the blow. But it was not so well known until Paul de Musset pointed it out that the passion expressed in the *Nuit de Décembre*, written about twelve months after the journey to Italy, referred not to George Sand but to another and quite a different woman. The story of the Italian journey and its results are told under the guise of fiction from two points of view in the two volumes called respectively *Elle et Lui* and *Lui et Elle*. During Musset's absence in Italy *Fantasio* was published in the *Revue*, and not long after his return *On ne badine pas avec l'Amour* appeared in the same way. In 1835 he produced *Lucie*, *La Nuit de Mai*, *La Quenouille de Barberine*, *Le Chandelier*, *La Loi sur la Presse*, *La Nuit de Décembre*, and *La Confession d'un Enfant du Siècle*. The last-named work, a prose work, is exceptionally interesting as exhibiting the poet's frame of mind at the time, and the approach to a revulsion from the Bonapartist ideas amid which he had been brought up in his childhood. To the supreme power of Napoleon he in this work attributed that moral sickness of the time which he described. "One man," he wrote, "absorbed the whole life of Europe; the rest of the human race struggled to fill their lungs with the air that he had breathed." When the emperor fell, "a ruined world was a resting-place for a generation weighted with care." The *Confession* is further important, apart from its high literary merit, as exhibiting in many passages the poet's tendency to shun or wildly protest against all that is disagreeable or difficult in human life—a tendency to which, however, much of his finest work was due. In 1836 appeared, amongst other things, *Il ne faut jurer de Rien*, a comedy which holds, and is likely long to hold, the stage of the Théâtre Français, and the beginning of the brilliant letters of Dupuis and Cotonet on romanticism. *Il ne faut jurer de Rien* is as typical of his comedy work as is *Les Caprices de Marianne* of the work in which a terrible fatality underlies the brilliant dialogue and light keen characterization. In 1839 were published the *Caprice* (which afterwards found its way to the Paris stage through, in the first instance, the accident of Madame Allan the actress hearing of it in a Russian translation) and some of the *Nouvelles*. In 1839 he began a romance called *Le Poète Déchu*, of which the existing fragments are full of passion and insight. In 1840 he passed through a period of feeling that the public did not recognize his genius—as, indeed, they did not—and wrote a very short but very striking series of reflexions headed with the words "A trente Ans," which Paul de Musset published in his *Life*. In 1841 there came out in the *Revue de Paris* Musset's *Le Rhin Allemand*, an answer to Becker's poem which appeared in the *Revue des Deux Mondes*. This fine war-song made a great deal of noise, and brought to the poet quantities of challenges from German officers. Between this date and 1845 he wrote comparatively little. In the last-named year the charming "proverbe" *Il faut qu'une Porte soit ouverte ou fermée* appeared. In 1847 *Un Caprice* was produced at the Théâtre Français, and the employment in it of such a word as "rebonsoir" shocked some of the old guard of the old school. In 1848 *Il ne faut jurer de Rien* was played at the Théâtre Français, and the *Chandelier* at the Théâtre Historique. Between this date and 1851 *Bettine* was produced on the stage and *Carmosine* written; and between this time and the date of his death, from an affection of the heart, in May 1857, the poet produced no large work of importance.

Alfred de Musset now holds the rank which Sainte-Beuve first accorded, then denied, and then again accorded to him as a poet of the first rank. He had genius, though not genius of that strongest kind which its possessor can always keep in check. His own character worked both for and against his success as a writer. His very weakness and his own consciousness of it produced such beautiful work as, to take one instance, the *Nuit d'Octobre*, but it too often prevented him, from one cause or another, from producing any work at all. His *Nouvelles* are extraordinarily brilliant; his poems are charged with passion, fancy, and fine satiric power; in his plays he hit upon a method of his own, in which no one has dared or availed to follow him with any closeness. He was one of the first, most original, and in the end most successful of the first-rate writers included in the phrase "the 1830 period." The wildness of his life, though it cannot be denied, has probably been exaggerated; and it has lately been suggested by M. Arsène Houssaye that the symptoms of the heart disease which caused his death may sometimes have been mistaken for the symptoms of intoxication. His brother Paul de Musset has given in his *Biographie* a striking testimony to the finer side of his character. In the later years of his life Musset was elected, not without some difficulty, a member of the French Academy. Besides the works above referred to, the *Nouvelles et Contes* and the *Œuvres Posthumes*, in which there is much of interest concerning the great tragic actress Rachel, should be specially mentioned. Musset has had no successor in France either as a poet or as a dramatist. (W. H. P.)

MUSTARD. The varieties of mustard-seed of commerce are produced from several species of the Cruciferous genus *Brassica*. Of these the principal are the Black or Brown Mustard, *Brassica nigra* (*Sinapis nigra*, L.), the White Mustard, *Brassica alba*, and the Sarepta Mustard, *B. juncea*. The finest qualities of Black and White Mustard are cultivated in the eastern counties of England. The former is a plant requiring a rich soil and much care in its treatment, but its seeds, which are very minute, weighing not more than one-fiftieth of a grain, are the most valuable for commercial purposes. The peculiar pungency and odour to which mustard owes much of its value are due to an essential oil developed by the action of water on two peculiar chemical substances contained in the black seed. These bodies are a compound termed by its discoverers myronate of potassium, but since called sinigrin, $C_{10}H_{18}KNS_2O_{10}$, and an albuminoid body, myrosin. The latter substance in presence of water acts as a ferment on sinigrin, splitting it up into the essential oil of mustard, a potassium salt, and sugar. It is worthy of remark that this reaction does not take place in presence of boiling water, and therefore it is not proper to use very hot water in the preparation of mustard. Essential oil of mustard is in chemical constitution an iso-sulphocyanate of allyl C_4H_5NS. It is prepared artificially by a process, discovered by Zinzin, which consists in treating bromide of allyl with sulphocyanate of ammonium and distilling the resultant sulphocyanate of allyl. The seed of White Mustard contains in place of sinigrin a peculiar principle called sinalbin,

$C_{30}H_{44}N_2S_2O_{16}$, in several aspects analogous to sinigrin. In presence of water it is acted upon by myrosin, present also in White Mustard, splitting it up into sulphocyanate of acrinyl, sulphate of sinapine, and sugar. Sulphocyanate of acrinyl is a powerful rubefacient principle, whence White Mustard, although yielding no volatile oil, forms a valuable material for cataplasms. The seeds of *Brassica juncea* have the same constitution and properties as Black Mustard, as a substitute for which they are extensively cultivated in Russia. The mustard-seed imported from the East Indies is also largely composed of *B. juncea*.

Both as a table condiment and as a medicinal substance, mustard has been known from a very remote period. Under the name of *νᾶπυ* it was used by Hippocrates in medicine. The form in which table mustard is now sold in the United Kingdom dates from 1720, about which time Mrs Clements of Durham hit on the idea of grinding the seed in a mill and sifting the flour from the husk. The bright yellow farina thereby produced under the name of "Durham mustard" pleased the taste of George I., and rapidly attained wide popularity. As it is now prepared mustard consists essentially of a mixture of black and white farina in certain proportions. Several grades of pure mustard are made containing nothing but the farina of mustard-seed, the lower qualities having larger amounts of the white cheaper mustard; and corresponding grades of a mixed preparation of equal price, but containing certain proportions of wheaten or starch flour, are also prepared and sold as "mustard condiment." The mixture is free from the unmitigated bitterness and sharpness of flavour of pure mustard, and it keeps much better.

All varieties of mustard-seed contain from 25 to 35 per cent. of a bland inodorous yellow-coloured fixed oil, free from pungency and with little tendency to become rancid. It is extensively used in India for cooking and all ordinary purposes, and is one of the ordinary commercial oils of Western countries. The mustard papers commonly used as rubefacients and vesicants are made from mustard flour entirely deprived of its fixed oil.

MUTINY. This word, which primarily means a commotion and then an insurrection or sedition, is in English military law applied to a sedition in any forces belonging to Her Majesty's regular, reserve, or auxiliary forces, or navy. Such offences are dealt with by courts-martial, which up to the year 1879 derived their authority from the annual Mutiny Act (Act for punishing Mutiny and Desertion and for the better payment of the Army and their Quarters), the maintenance of a standing army in time of peace being illegal without the consent of parliament. For further details see MILITARY LAW and COURT MARTIAL.

MUTTRA, a district in the lieutenant-governorship of the North-Western Provinces, India, lying between 27° 14′ and 27° 58′ N. lat. and 77° 19′ and 78° 33′ E. long., is bounded on the N. by Alígarh and Gurgáon, on the E. by Alígarh, Máinpuri, and Etah, on the S. by Agra, and on the W. by Bhartpur state, with an area of 1453 square miles. The district consists of an irregular strip of territory lying on both sides of the Jumna. The general level is only broken at the south-western angle by low ranges of limestone hills. The eastern half consists for the most part of a rich upland plain, abundantly irrigated by wells, rivers, and canals, while the western portion, though rich in mythological association and antiquarian remains, is comparatively unfavoured by nature. The crops are scanty, and the larger forest trees are not found. For eight months of the year the Jumna shrinks to the dimensions of a mere rivulet, meandering through a waste of sand. During the rains, however, it swells to a mighty stream, a mile or more in breadth. Till recently nearly the whole of Muttra consisted of pasture and woodland, but new roads constructed as relief works in 1837-38 have thrown open many large tracts of country, and the task of reclamation has since proceeded rapidly.

The census of 1881 returned the population of Muttra at 671,690 (males 360,967, females 310,723), Hindus numbering 611,669 and Mohammedans 58,088. There were only 65 native Christians. The population of the three municipal towns in 1881 was as follows:—Muttra, 55,016; Brindaban, 21,467; and Kosi, 11,231. In 1881-82, 1048 square miles were returned as cultivated, 172 as cultivable, and 108 as uncultivable. *Joár* and cotton form the principal staples for the autumn (*kharíf*) harvest, while gram and barley are the chief grains grown for the spring (*rabi*) harvest. Sugar-cane, tobacco, indigo, and vegetables are all but unknown. The mass of the population is fairly well off, and the peasantry are described as being in better circumstances than those of neighbouring districts. Great extremes of temperature occur, the cold of winter being comparatively excessive, while hot winds blow from the west with great violence during April, May, and June. The average rainfall for the ten years ending 1869 was 23·6 inches.

The central portion of Muttra district forms one of the most sacred spots in Hindu mythology. A circuit of 84 *kos* around Gokul and Brindaban bears the name of the Braj-Mandal, and carries with it many associations of the earliest Aryan times. Here Krishna and his brother Balaráma fed their cattle upon the plain; and numerous relics of antiquity in the towns of Muttra, Gobardhán, Gokul, Mahában, and Brindaban still attest the sanctity with which this holy tract was invested. During the Buddhist period Muttra became a centre of the new faith. After the invasion of Mahmúd of Ghazni the city fell into insignificance till the reign of Akbar; and thenceforward its history merges in that of the Játs of Bhartpur, until it again acquired separate individuality under Suráj Mall in the middle of the last century. The Bhartpur chiefs took an active part in the disturbances consequent on the declining power of the Mughal emperors, sometimes on the imperial side, and at others with the Mahrattas. The whole of Muttra passed under British rule in 1804.

MUTTRA, chief town and administrative headquarters of the above district, is situated on the right bank of the Jumna, about 30 miles above Agra, in 27° 30′ N. lat. and 77° 43′ E. long., with a population (1881) of 55,016, viz., males 28,769, and females 26,247.

It is an ancient town, mentioned by Fa Hian as a centre of Buddhism about 400 A.D.; his successor Hiouen Thsang, about 650, states that it then contained twenty Buddhist monasteries and five Brahmanical temples. Muttra has suffered more from Mohammedan sack and plunder than most of the towns of northern India. It was sacked by Mahmúd of Ghazni in 1017-18; about 1500 Sultán Sikandar Lodi utterly destroyed all the Hindu shrines, temples, and images; and in 1636 Sháh Jahán appointed a governor expressly to "stamp out idolatry." In 1669-70 Aurangzeb visited the city and continued the work of destruction. Muttra was again captured and plundered by Ahmad Sháh with 25,000 Afghán cavalry in 1756. The town still forms a great centre of Hindu devotion, and large numbers of pilgrims flock annually to the festivals.

MUZAFFARGARH, a district in the lieutenant-governorship of the Punjab, India, lying between 29° 1′ and 30° 46′ N. lat. and 70° 33′ and 71° 49′ E. long., is bounded on the N. by Derá Ismáil Khán and Jhang districts, on the E. and S.E. by the Chenáb river, and on the W. by the Indus, with an area of 3136 square miles. It occupies the extreme southern apex of the Sind Ságar Doáb, the wedge-shaped tract between the Indus and the Five Rivers or Panjnad. The district stretches northward from their confluence in a narrow ridge of land, gradually widening for about 120 miles, until at its northern border it is 55 miles broad. In the northern half of the district is the wild *thal* or central desert of the Sind Ságar Doáb, an arid elevated tract with a width of 40 miles in the extreme north, which gradually contracts until it disappears about 10 miles south of Muzaffargarh town. Although apparently a tableland, it is really composed of separate sandhills, with intermediate valleys lying at a lower level than that of the Indus, and at times flooded. Scattered amid this waste of sand-heaps are a few good plots of land, which the industry of the Ját cultivators has appropriated. The border strips fringing the *thal* towards the rivers are also for the most part under cultivation. South of the *thal*, the country consists of rich and productive lands, out of the reach of excessive flooding and at the same time within reach of easy irrigation. But in the extreme south the floods from the two rivers spread at times over the whole intervening tract. On abating they leave luxuriant pasturage; and, if the subsidence takes place sufficiently early, magnificent crops of wheat, pease, and other grain are raised in the cultivated portion. The towns stand on high sites or are protected by embankments; but the villages scattered over the lowlands are exposed to annual inundations, during which the people abandon their grass-built huts and take refuge on wooden platforms attached to each house. Throughout the cold weather large herds of camels, belonging chiefly to the Povindah merchants of Afghánistán, graze upon the sandy waste.

The census of 1881 returned the population at 338,605 (males, 184,510, females 154,095), viz., 292,476 Mohammedans, 43,297 Hindus, 2788 Sikhs, 33 Christians, and 44 "others." The district contains only one town with a population exceeding 5000—namely, Kot Adu or Parhar (5552). Muzaffargarh, the headquarters station, has only 3136 inhabitants. The area under cultivation in 1881 was returned at 397,529 acres, of which 279,103 were irrigated by government works, and 118,376 by private individuals. The areas under the different crops in 1881-82 were rice 38,589 acres, wheat 193,749, great millet 15,915, spiked millet 15,431, barley 11,450, pease 32,388, gram 7959, *masúr* 6382, and tobacco 655. Most of the land is cultivated by the proprietors themselves; and the rents, where they exist, are almost universally paid in kind. Trade is mainly in the hands of Povindah merchants. The district is unusually hot and dry, the average rainfall for the seven years ending 1872-73 being only 5·9 inches.

Muzaffargarh possesses hardly any distinct annals of its own, having always formed part of Múltán (*q.v.*).

MUZAFFARNAGAR or Mozuffernugger, a district in the lieutenant-governorship of the North-Western Provinces, India, lying between 29° 11′ and 29° 45′ N. lat. and 77° 3′ and 78° 10′ E. long., is bounded on the N. by Sahâranpur, on the E. by the Ganges, on the S. by Meerut, and on the W. by the Jumna, with an area of 1656 square miles. It lies near the northern extremity of the Doáb or great alluvial plain between the Ganges and the Jumna, and shares to a large extent in the general monotony of that level region. A great portion of the area is sandy and unfertile, but under irrigation the soil is rapidly improving, and in many places the villages have succeeded in introducing a high state of cultivation.

The census of 1881 returned the population at 758,444 (males 409,436, females 349,008). The excessive proportion of males is doubtless due to the practice of female infanticide, which Government has done all in its power to suppress. In 1874 no less than ninety-four villages were still on the "proclaimed" list under the Infanticide Act. Hindus numbered 535,218, Mohammedans 213,842, Christians 54, and Buddhists 9330. The population of the four municipal towns in 1881 was as follows—Muzaffarnagar (the chief town and administrative headquarters), 15,080; Kairana, 18,374; Kándhla, 11,109; Shamlí, 7359. Out of a total area of 1,059,910 acres in 1881-82, 707,394 were returned as under cultivation. In the *rabi* harvest the chief crops are wheat, barley, millet, and pulse. The *kharíf* or autumn crops include the above grains, together with sugar-cane, cotton, and indigo. Irrigation was afforded in 1881-82 by one or other of the great canals to 219,121 acres. The condition of the peasantry is comfortable, and the village communities are prosperous and intelligent. Most of the land is cultivated by husbandmen with rights of occupancy; the number of tenants-at-will is rapidly declining. Rents are more frequently paid in kind than in cash. Before the opening of the canals Muzaffarnagar was liable to famines caused by drought; but the danger from this has been minimised by the spread of irrigation. Its trade is confined to the raw materials it produces. The climate of the district is comparatively cool owing to its proximity to the hills; and the average rainfall is about 29 inches.

Hindu tradition represents Muzaffarnagar as having formed a portion of the Pandáva kingdom of the *Mahábhárata*; authentic history, however, dates from the time of the Moslem conquests in the 13th century, from which time it remained a dependency of the various Mohammedan dynasties which ruled at Delhi until the practical downfall of the Mughal empire in the middle of the last century. In 1788 the district fell into the hands of the Mahrattas. After the fall of Alígarh, the whole Doáb as far north as the Siwálik hills passed into the hands of the British without a blow, and Muzaffarnagar became part of Sahâranpur. It was created a separate jurisdiction in 1824.

Muzaffarnagar, chief town and administrative headquarters of the above district, is situated on the military road from Meerut to Landaur in 29° 28′ N. lat. and 77° 44′ E. long. The population in 1881 was 15,080, of whom 8814 were males and 6266 females. It is a closely-built town, crowded with small lanes, and was founded in 1633. It is now a station on the Sind, Punjáb, and Delhi Railway, and has a considerable trade in agricultural produce.

MUZAFFARPUR or Mozufferpore, a district in the lieutenant-governorship of Bengal, India, lying between 25° 30′ and 26° 51′ N. lat. and 84° 55′ and 85° 58′ E. long., is bounded on the N. by Nepál, E. by Darbhangah, on the S. by Patná, and W. by Saran and Champáran districts, with an area of 3004 square miles. It was formed in January 1875 out of the great district of Tirhut, which up to that time was the largest and most populous district of lower Bengal. Of its six subdivisions, the three eastern were in January 1875 formed into the new district of Darbhangah, and the three western—Muzaffarpur, Hájipur, and Tájpur—into the district of Muzâffarpur.

The census of 1881 returned the inhabitants at 2,582,060 (males 1,265,731, females 1,316,329), viz., Hindus 2,265,380, Mohammedans 316,308, Europeans 140, mixed races 48, native Christians 179. The cultivated area amounts to 1,435,859 acres, of which 762,830 are under rice. Muzaffarpur suffered severely from the famines of 1866 and 1874.

Muzaffarpur, chief town and administrative headquarters of the above district, is situated on the right or south bank of the Little Gandak river in 26° 7′ N. lat. and 85° 26′ E. long., with a population (1881) of 42,460. The town is clean, with many broad and well-kept streets; it has a good collectorate and court-houses, jail, dispensary, and several good schools. A large trade is carried on both by road and river. The town, however, is liable to inundation, and suffered severely from this cause in 1871.

MUZIANO, Girolamo (1528-1590?), an eminent Italian painter, was born at Acquafredda near Brescia in 1528. Under Romanino, an imitator of Titian, he studied his art, designing and colouring according to the principles of the Venetian school. But it was not until he had left his native place still in early youth, and had repaired to Rome about 1550, that he came into notice. There his pictures soon gained for him the surname of *Il Giovane de' Paesi* ("the young man of the landscapes"); chestnut-trees are predominant in these works. He next tried the more elevated style of historical painting. He imitated Michelangelo in giving great prominence to the anatomy of his figures, and became fond of painting persons emaciated by abstinence or even disease. His great picture of the Resurrection of Lazarus at once established his fame. Michelangelo praised it, and pronounced its author one of the first artists of that age. It was placed in the church of Santa Maria Maggiore, but was afterwards transferred to the Quirinal palace. Muziano, with dogged perseverance (at one time he shaved his head, so as not to be tempted to go out of doors), continued to proceed in the path on which he had entered. He grew excellent in depicting foreign and military costumes, and in introducing landscapes into his historical pieces after the manner of Titian. Mosaic working also occupied his attention while he was employed as superintendent at the Vatican; and it became under his hands a perfect imitation of painting. His ability and industry soon gained for him a handsome fortune. Part of this he expended in assisting to found the Academy of St Luke in Rome. He died in 1590, or, according to another authority, in 1592, and was buried in the church of Santa Maria Maggiore.

Many of Muziano's works are in the churches and palaces of Rome; he also worked in Orvieto and Loreto. In Santa Maria degli Angeli, Rome, is one of his chief works, St Jerome preaching to Monks in the Desert; his Circumcision is in the church of the

Gesù, his Ascension in the Aracoeli, and his St Francis receiving the Stigmata in the church of the Conception. A picture by him, representing Christ washing the feet of his disciples, is in the cathedral of Rheims.

MYCENÆ, one of the most ancient cities of Greece, was situated in the north-eastern extremity of the fertile Argive plain—μύχῳ Ἄργεος ἱπποβότοιο. Its situation is exceedingly strong, and it commands all the roads leading from Corinth and Achaia into the Argive plain; this fact, combined with its distance from the sea, shows that the city was founded by a race which came from the direction of Corinth and not by immigrants landing on the coast. The walls of Mycenæ are the greatest monument that remains of the Heroic age in Greece; part of them is similar in style and doubtless contemporary in date with the walls of the neighbouring town Tiryns, but other parts seem to be the work of a rather later time. There can therefore be little doubt that the two towns were the strongholds of a single race, Tiryns commanding the sea-coast and Mycenæ the inner country. The city of Argos, on the other hand, has no remains to connect it with this early Mycenæan race; and legend tells of the rivalry between the dynasties of the Pelopidæ at Mycenæ and of the Prœtidæ at Argos. The long warfare between the two cities lasted till 468 B.C., when Mycenæ was dismantled and its inhabitants dispersed. The city never revived; Strabo asserts that no trace of it remained in his time, but Pausanias describes the ruins.

Subjoined are the most important monuments. 1. The "Treasuries" of Atreus and his sons, as Pausanias calls them. They were subterranean buildings of beehive shape, in the side of the hill south-west of the city; one of them is still almost perfect. A sloping passage, δρόμος, led to the doorway, with its ornamented columns, at the base of the building. The great circular chamber inside was probably covered with plates of bronze; a door in one side admitted to a second smaller chamber. Such buildings, which are found in other parts of Greece—*e.g.*, Orchomenus, Sparta, Attica, Iolcus, &c.—were undoubtedly the sepulchres of noble families.

2. The graves discovered by Dr Schliemann in 1876 within the city wall. They are enclosed within a circular *περίβολος* with a single entrance, and the place was therefore a holy place in the ancient Mycenæan time; on the other hand the part of the city wall which encloses them is a later addition to the original wall. At some period before 468 B.C. this addition was built; before that time the *περίβολος* was outside the wall. Some heroes of the race were worshipped here by the ancient inhabitants, but their names are not recorded by any trustworthy authority. In the time of Pausanias, six centuries after Mycenæ was destroyed, local legend maintained that these were the graves of Atreus, Agamemnon, Cassandra and her children, and Eurymedon; but it is uncertain whether this was the original legend, or a later tale that grew under the influence of Greek literature.

3. The Lion-Gate. The principal entrance to the city is approached by a *δρόμος*, flanked on each side by the city wall and leading up to a gateway. Over the entrance is placed a triangular slab of stone on which are carved two lions in relief; they are rampant, facing one another, but separated by an upright column. The art of this relief shows no resemblance to archaic Greek art; it is foreign in character, the work of an immigrant race, which brought with it a well-developed civilization.

Greek legend always maintains that the Pelopidæ of Mycenæ came from Phrygia, and this is corroborated by the evidence of archæology. The objects found in excavations, and the sculptured ornament on the doorways of the "Treasuries" and over the Lion-Gate, all point to foreign influence and particularly to Asia Minor. The same type of the two lions and the column has been recently found over the entrance to a colossal sepulchre in the rocks near the south-western corner of the Sangarius valley in Phrygia. Legend and remains alike show that a rich and powerful dynasty of foreign origin ruled at Mycenæ; the only early remains in the Greek world that equal them in interest are the ruins of ancient Troy. It is precisely these two cities which are described in the Homeric poems as the two great cities of the Greek world.

MYDDLETON, SIR HUGH (*c.* 1555-1631), the projector of the New River scheme for supplying London with water, was the sixth son of Richard Myddleton, governor of Denbigh Castle in the reigns of Edward VI., Mary, and Elizabeth. Hugh Myddleton became a goldsmith in London, occupying a shop in Bassihaw (now Basinghall) Street, and he is also mentioned in the records of Denbigh, for which he was chosen M.P. in 1603, as a merchant adventurer. In the state papers there is an entry of £250 paid to him for a jewel supplied to the queen. In connexion with his business as goldsmith Myddleton worked silver and lead mines in Cardiganshire, and in this way obtained the practical knowledge of engineering which enabled him to put in operation his scheme for supplying London with water (see LONDON, vol. xiv. p. 825). In recognition of his services he was created a baronet by James I. in 1622; but pecuniarily the enterprise was a complete failure. Myddleton died 10th December 1631, and was buried in the churchyard of St Matthew, Friday Street, London. See Pinks, *History of Clerkenwell.*

MYELITIS (μυελός, marrow) is a disease which by inflammation induces destructive changes in the tissues composing the spinal cord. In the *acute* variety the nerve elements in the affected part become disintegrated and softened, but repair may take place; in the *chronic* form the change is slower, and the diseased area tends to become denser (sclerosed), the nerve-substance being replaced by connective tissue. Myelitis may affect any portion of the spinal cord, and its symptoms and progress will vary accordingly. Its most frequent site is in the lower part, and its existence there is marked by the sudden or gradual occurrence of weakness of motor power in the legs (which tends to pass into complete paralysis), impairment or loss of sensibility in the parts implicated, nutritive changes affecting the skin and giving rise to bed-sores, together with bladder and bowel derangements. In the acute form, in which there is at first pain in the region of the spine and much constitutional disturbance, death may take place rapidly from extension of the disease to those portions of the cord connected with the muscles of respiration and the heart, from an acute bed-sore which is very apt to form, or from some intercurrent disease. Recovery to a certain extent may, however, take place; or, again, the disease may pass into the chronic form. In the latter the progress is usually slow, the general health remaining tolerably good for a time, but gradually the strength fails, the patient becomes more helpless, and ultimately sinks exhausted, or is cut off by some complication. The chief causes of myelitis are injuries or diseases affecting the spinal column, extension of inflammation from the membranes of the cord to its substance (see MENINGITIS), exposure to cold and damp, and occasionally some pre-existing constitutional morbid condition, such as a fever. Any debilitating cause or excess in mode of life will act powerfully in predisposing to this malady. The disease is most common in adults. The treatment for myelitis in its acute stage is similar to that for spinal meningitis. When the disease is chronic the most that can be hoped for is the relief of symptoms by careful nursing and attention to the condition of the body and its functions. Good is sometimes derived from the employment of electricity, and the use of baths and douches to the spine.

MYNPOOREE. See MAINPURI.

MYRIAPODA. The Myriapoda or Centipedes are usually treated of in text-books as one of the classes of the group Arthropoda, being associated in that group with the Crustacea, Arachnida, and Insecta as equivalent divisions of the animal kingdom. In consequence, however, of recent evidence which points to a community of origin of all the Tracheate forms apart from that of the Crustacea, it is probably more natural to divide the Arthropoda (with the exception of certain minor groups of obscure affinities) into two classes, one consisting of the Crustacea, the other of the Tracheata. If this plan of classification be adopted, the Myriapoda form a sub-class of the Tracheata. It is necessary that the peculiar contrast in structure between the remarkable genus *Peripatus* and all other Tracheata should be clearly indicated in any systematic arrangement. *Peripatus*, an account of which, in consequence of its important relations to the Myriapoda, is given in the present article, has been variously placed by systematists as constituting a separate class of the Arthropoda, the "Protracheata," or as worthy of higher or lower rank than indicated by such position. It will be regarded here as representing a special sub-group of the Tracheata—the Protracheata as opposed to the remaining Tracheates or Eutracheata—thus:—

- Arthropoda.
  - Class—CRUSTACEA.
  - Class—TRACHEATA.
    - Group—*Protracheata.* Sub-class—Peripatidea.
    - Group—*Eutracheata.* Sub-class—Myriapoda. Insecta. Arachnida.

Linnæus included the Myriapoda in his Insecta Aptera, together with the Crustacea and Arachnida. In 1779 Fabricius first separated the Myriapoda as a distinct order under the name Mitosata, but still retained several separate orders of Crustacea as equivalent. In 1796 Latreille divided the Aptera of Linnæus into seven orders, one of which was constituted by the Myriapoda (so first named by him), but he included with them the Isopoda. In 1800 Cuvier and Lamarck first separated Linnæus's Insecta into three primary natural classes, creating the Crustacea and retaining as the two others the Arachnida and Insecta. In 1825 Latreille, finally following Leach (1815), set up the Myriapoda as a fourth class, separating them from the Insecta connected with them. Subsequently the class Myriapoda was a constant source of controversy amongst naturalists, and many attempts were made to overthrow it altogether. Thus the Myriapoda were connected by Macleay with the Insecta, and also by Kirby in 1826, further by Burmeister in 1837, and by Von Siebold with Crustacea in 1848

The PROTRACHEATA may be defined as—

Tracheata with imperfectly-jointed appendages, and numerous stigmata indefinite in number, scattered in various regions of the body; the first pair of post-oral appendages only modified to act as jaws; the second pair rudimentary, bearing the opening of the duct of a slime-gland; remaining pairs numerous, all alike; ambulatory legs, each provided with a pair of claws; no definite infra-œsophageal nerve-ganglion; ventral nerve-cords imperfectly ganglionated, widely divaricated, united posteriorly dorsad of the rectum; complicated segmental organs present, opening at the bases of the legs; arch-enteron in the embryo formed by invagination; a wide slit-like blastopore formed in the embryo, which gives rise to the mouth anteriorly and anus posteriorly.

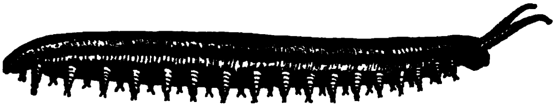

FIG. 1.—Large adult example of *Peripatus capensis* of natural size. (From Moseley.)

The sole representatives of this group of the Tracheata are the seven or eight known species of the genus *Peripatus* (fig. 1). These are soft-bodied animals very like lepidopterous caterpillars in form, of a brown or blackish colour, with a series of pairs of short conical legs placed laterally at equal intervals along the entire length of the ventral surface behind the mouth. The legs in advanced embryos show a distinct division into five joints by transverse constrictions, but in the adults this jointing is much obscured. The skin not being protected by chitinous plates, but only by fine papillæ armed with chitine, no definite hinge-joints are formed comparable to those so usually present in other Tracheata. The terminal joint of each leg or foot is provided with a pair of curved claws. The number of legs present varies in the different species. The head bears a pair of simple eyes and a pair of antennæ composed of very numerous joints. The first pair of legs, which in the embryo closely resembles those developed behind it (fig. 2), becomes in the process of development turned in in front of the mouth, and its claws become modified into a pair of sickle-shaped toothed jaws which work against one another in front of the mouth, and are completely enclosed in the adult in a wide buccal cavity. This cavity opens to the exterior ventrally on the under side of the head by the buccal aperture, which is oval in form and is surrounded by tumid lips, and has often been described as the mouth, although the true mouth lies within the buccal cavity underneath the jaws (figs. 3, 4).

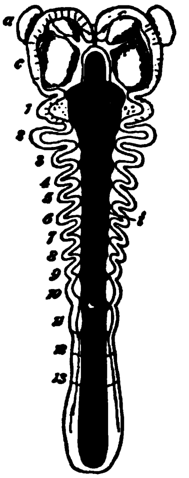

FIG. 2.—Early embryo of *Peripatus capensis* uncoiled (from Balfour, after Moseley). a, antennæ; c, procephalic lobe; i, intestine; o, mouth; 1, 2, 3, &c., post-oral appendages.

The second pair of appendages of the embryo becomes converted in the adult into a pair of short papillæ,—the oral papillæ, which bear at their tips the openings of a pair of large glands secreting a viscid substance. Respiration is effected in *Peripatus* by means of an immense number of small tracheal tufts. Each of these tufts consists of a short tubular chamber or sac, opening at one end, which is narrowed, to the exterior by a minute simple aperture (*stigma*) in the cuticle, and provided at its opposite enlarged extremity with a tuft of very fine air-tubes. In these fine tracheal tubes only a very faint indication of an imperfect spiral thickening of the chitinous lining membrane can be detected. The tubes are, with very rare exceptions, unbranched; they are freely distributed to the various muscles, viscera, &c. These tracheal tufts closely resemble in structure those of the Diplopod Myriapoda, but their disposition differs from that occurring in all other Tracheata. Instead of a definite small number of stigmata only being present, placed in definite positions on the successive somites, an indefinite number is present in *Peripatus*. Certain of these are scattered irregularly over the whole body-surface, whilst others are concentrated more or less thickly in a double row on each side of the dorsal median line, in a corresponding double ventral row, and further on the anterior and posterior aspects of the legs and round the bases of the legs. A series of segmental organs is present, a pair for each pair of legs. They are coiled tubes opening at one end into the body cavity and at the other to the exterior at the bases of the legs on their inner or ventral aspects.

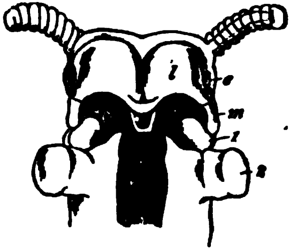

FIG. 3.—Ventral view of the head of a more advanced embryo of *Peripatus capensis* (from Balfour, after Moseley). e, eye; l, thickening of epiblast of procephalic lobe to form supra-œsophageal ganglion; m, process from procephalic lobe growing over the first post-oral appendage; o, mouth; 1 and 2, first and second pairs of post-oral appendages, becoming later the jaws and oral papillæ respectively.

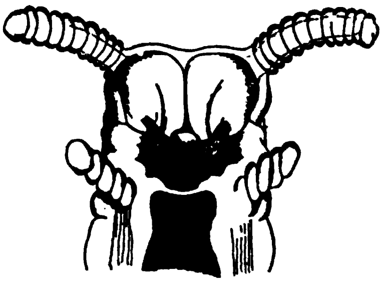

FIG. 4.—Ventral view of a head of an embryo *Peripatus* at an advanced stage of development (from Moseley). The figure shows the jaws (the modified pair of claws of the first pair of appendages) turned in towards the mouth, the dark spot between them, which together with them is enclosed by the wall of the buccal cavity. The second post-oral appendages or oral papillæ are seen to be distinctly five-jointed.

The nervous system consists of a pair of supra-œsophageal ganglia fused together in the middle line, from which arise the ventral cords, which remain widely divaricated throughout the length of the body to its hinder extremity, where they unite above the dorsal surface of the rectum. The ventral cords appear at first without ganglionic enlargements, but in reality rudimentary ganglionic swellings are present on them corresponding with the origins of the nerves for the jaws, oral papillæ, and all the legs. They are connected by fine transverse commissures forming a so-called rope-ladder nerve-system. Visceral nerves are present, with an arrangement similar to that in Chætopods rather than that found in Arthropoda. A dorsal and a ventral blood-vessel are present. The dorsal vessel is, according to Gaffron, a true muscular heart provided with a pair of dorsally-placed valvular openings on each segment of the body, but without any trace of vessels in connexion with these. It lies as in other Tracheata in a pericardial sinus formed by a horizontally-stretched septum, and especially approaches in its general structure the corresponding organ of Diplopoda.

The ovary in the female is closely similar to that of *Lithobius* in structure. The animal is viviparous, and the pair of long oviducts function as uterus. In the male the spermatozoa are long and filiform, exactly like those of *Lithobius*. They are actively mobile, and perform exactly the same movements as those of *Lithobius*, and, as in that genus, are formed into rod-like spermatophores.

In its embryological development, which cannot here be followed, conclusions as to the affinities of *Peripatus* with the Tracheates receive strong confirmation. Early embryos of *Peripatus* bear a remarkable resemblance to those of scorpions, spiders, and Myriapoda, and the mode of formation of the procephalic lobes, nerve-system, and limbs is closely similar. The five-jointing of the limbs of the embryo of *Peripatus* is remarkably similar to that occurring in embryo spiders, such as *Agelena*. In one important respect the embryonic history of *Peripatus* differs most remarkably from that of all other Tracheata, as far as is known. A large, open, slit-like blastopore is, as discovered by Balfour, formed in the very early embryo of *P. capensis*. This slit closes in its centre, and its anterior extremity apparently remains permanently open as the mouth, whilst its posterior region persists as the anus. In the embryos of other Tracheates the only representative of this no doubt ancestral mode of development surviving is the so-called mesoblastic groove.

The species of *Peripatus* live in moist places, in hollows in decayed wood, and under stones and logs. The animals walk with a gait similar to that of caterpillars, with their bodies completely supported from the ground by their legs. When irritated they eject from their oral papillæ fine jets of the viscid slime secreted by their slime-glands. These fine jets form networks of fine threads, looking like a spider's web, which cling to the fingers with the tenacity of bird-lime. The New Zealand species is said to catch insects for food by means of these slime-jets. The animals roll themselves up like *Julus* when quiescent. They appear to be nocturnal in habits.

The group *EUTRACHEATA* may be thus defined—

Tracheata of various form, usually with completely jointed appendages; never bearing diffuse stigmata indefinite in number, but with not more than two pairs on each somite; ventral nerve-cords closely approximated, with well-marked infra-œsophageal ganglion, never united posteriorly dorsad of the anus; no segmental organs present; no blastopore formed in the embryo; mouth and anus formed as a stomodæum and a proctodæum respectively.

The sub-class MYRIAPODA may be defined as follows—

Eutracheata with a head distinctly separate from the numerous closely similar posterior somites, with a pair of antennæ and two pairs of jaws; with numerous similar jointed walking legs; Malpighian tubes present.

The Myriapoda, like *Peripatus*, approach the Annelids in having elongate bodies, either cylindrical or more or less flattened, composed of numerous similar joints or somites. They bear numerous pairs of walking legs on the somites posterior to the head, and in this particular differ most markedly from all insects except some of the most primitive forms, such as the *Campodeidæ*, which approach them by the possession of rudimentary abdominal legs, and with which, as will be described, they are possibly connected to some extent by such a form as *Scolopendrella*. Some forms (*Glomeridæ*) most remarkably resemble woodlice in shape, and hence Latreille's connexion, already referred to, of the Myriapoda with the Isopodous Crustacea. The head of Myriapoda is very like that of Insecta, and bears a single pair of antennæ, the eyes when present, and two pairs of jaws. The first pair of jaws, the stout toothed mandibles, are, as in insects, always devoid of palps, but in nearly all cases they are jointed, a primitive condition not occurring in insects. The second pair, the maxillæ, are fused together to form a sort of under-lip. In one aberrant family (*Polyzonidæ*) the mouth parts are formed into a tubular pricking and sucking apparatus. The body behind the head is composed of distinctly separated similar segments, usually numerous (in *Pauropus* nine only). There is no division of the body into thoracic and abdominal regions. The ventral nerve-cord stretches the entire length of the body, and is provided with a ganglion more or less distinct for each somite. The first three of its ganglia are fused together. Eyes are wanting in some forms, in others they are present on the sides of the head as simple ocelli or groups of ocelli. In one form only (*Scutigera*) are they compound and faceted. The structure of the ocelli differs remarkably from that of the simple eyes of spiders, in that the crystalline rods in each ocellus are so placed that their axes lie parallel to the plane of the equator of the simple lens, at right angles to the optic axis of the eye instead of in its direction. They are also not isolated by pigment. Grenacher hence concludes that it is impossible that any definite image can be formed on the rods, so as to convey any impression of it to the retinal cells with which they are in connexion. Hence these eyes must discriminate only variations in intensity of light. In *Scutigera* the internal structure of the eyes, though closely simulating that of the compound eyes of insects in many details, is in reality very peculiar and different from that in all other Arthropoda. The digestive canal is simple and straight, except in *Glomeridæ*, and ends in a terminal anus. At the commencement of that portion which acts as a rectum, and which in the embryo is formed from the proctodæum, two or four long coiled urinary tubes (*Malpighian tubes*), homologous with those of insects, open into it. There is a dorsal tubular heart, divided into a series of chambers corresponding with the somites, and, as in insects, contained within a blood sinus (pericardium), formed by a horizontal septum stretched across the body-cavity, and provided with a series of pairs of wing-like muscles (*alæ cordis*), by which the sinus-cavity is dilated. Respiration is effected by means of air-tubes or tracheæ as in insects. In the Diplopoda, excepting the *Glomeridæ*, in which they are ramified as in the Chilopoda, these are of essentially the same structure as in *Peripatus*, viz., tufts of unbranched tubes with feebly-developed spiral filaments springing from a common short sac-like chamber (fig. 5). Four of these sac-like chambers open on the ventral surface of the body by means of two pairs of stigmata on each somite. In the Chilopods wide tracheal tubes with well-developed spiral thickening of their lining membrane, springing directly from the stigmata, freely branching, and often anastomosing like those in insects, are always present. In all cases single pairs of laterally-

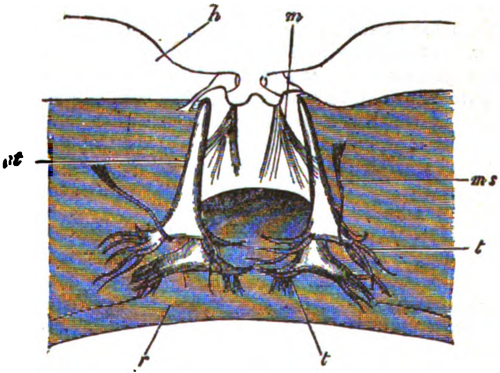

FIG. 5.—Inner view of the sterna of a single segment of *Julus londinensis*, much enlarged to show the structure and arrangement of the tracheal organs (after Voges). The two pairs of tracheæ are seen in situ, the posterior pair overlapping the anterior. *h*, posterior margin of the body-ring (tergum); *r*, anterior border; between the two lie the two terga; *st*, tubular chamber of tracheæ; *t*, fine tracheæ given off from it; *ms*, respiratory muscle attached to tracheal sac; *m*, ventral body muscle.

placed stigmata only are present on each somite. In the aberrant *Scolopendrella* possibly a single pair of stigmata only are present on the sides of the head, and in *Scutigera* there are only seven unpaired stigmata present in the middle dorsal line. In this latter form the tracheæ proceeding from the stigmata are very short; they branch a few times dichotomously, and then terminate in blind enlargements. From these the air is conveyed throughout the body in connexion with the fat bodies and peculiar folds of membrane as far as into the tarsi, the arrangement thus approaching somewhat that of the tracheal lungs of Arachnida. Remarkable glandular structures provided with ducts opening to the exterior occur in various Myriapoda. In all the Diplopoda there are rows of apertures placed laterally one on each somite on either side of the body, known as *foramina repugnatoria*, because each acts as the opening of the duct of a gland producing an acrid offensive fluid, which is discharged by the animal on irritation. In a species of *Fontaria*, one of the *Polydesmidæ*, as has been recently discovered, this secretion contains a chemical body, probably benzol and petroleum ether, which readily breaks up into prussic acid, and another substance, probably benzaldehyde. The animal thus, when irritated, smells strongly of prussic acid. Similar glands are wanting in most Chilopods, but in *Geophilus Gabrielis* there are a series of glands opening to the exterior by means of a series of perforated chitinous plates placed ventrally in the median line, which discharge a red fluid, probably of a similar defensive nature.

The foramina repugnatoria of the Diplopods were by early observers mistaken for stigmata, as they correspond in position with the stigmata of the Chilopods. It is worthy of note that, if Moseley's hypothesis that tracheal organs have arisen in evolution as modifications of universally scattered cutaneous glands is correct, the lateral foramina repugnatoria and glands of the *Julidæ* may be after all to some extent homologous with the lateral stigmata and tracheæ of the *Scolopendridæ*, the ventral tracheæ of the *Julidæ* with the ventral glands of *Geophilus Gabrielis*, whilst the dorsal stigmata of *Scutigera* represent the survival of part of the dorsal tracheæ of an ancestral form, with scattered tracheæ like *Peripatus*. In some derived forms the glands have survived as tracheæ in one region of the body, in others in another region, in some certain of them have remained as glands or reverted to that condition, in others they have developed into enlarged tracheæ.

The generative organs of the Myriapoda are usually elongate, unpaired, tubular organs, often with paired ducts, always provided with accessory glands, and in the female often with a receptaculum seminis. In the Chilopods the ducts open at the hinder extremity of the body; in the Diplopods on the ventral surface of the third somite posterior to the head.

The Myriapoda are usually divided into two orders—the Diplopoda and the Chilopoda. Of these the former appears to be the most ancient and primitive, as proved by its general structure, and especially by that of its tracheæ, and by geological evidence so far as knowledge extends. They may be thus characterized.

Order Diplopoda (=Chilognatha).

Myriapoda with bodies circular or semicircular in section; antennæ short, of no more than seven joints; no appendages acting as poison-claws; each somite in the middle and hinder region of the body bearing two pairs of legs; a variable small number of anterior somites always bearing single pairs only; stigmata ventral, two pairs to each somite; tracheal organs tuft-shaped with sac-like main tube, not branching or anastomosing; laterally-placed repugnatorial glands present; a single pair of Malpighian tubes present; generative organs opening on the third post-cephalic somite; larvæ at birth provided with only three pairs of functionally active legs.

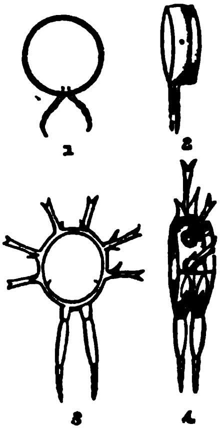

FIG. 6.—Diagrams of the structure of recent and certain Palæozoic Diplopoda (after Scudder). 1, cross section of a recent; 3, of a Palæozoic Diplopod; 2, side view of a somite of a recent; 4, of a Palæozoic Diplopod. In 1 and 3 the space occupied by the sterna is indicated by fine lines projecting within the rings; it is very narrow in 1, broad in 3. In 2 and 4 the posterior bevelled border of the somites lies to the right. In 1 and 2 the foramina repugnatoria are shown.

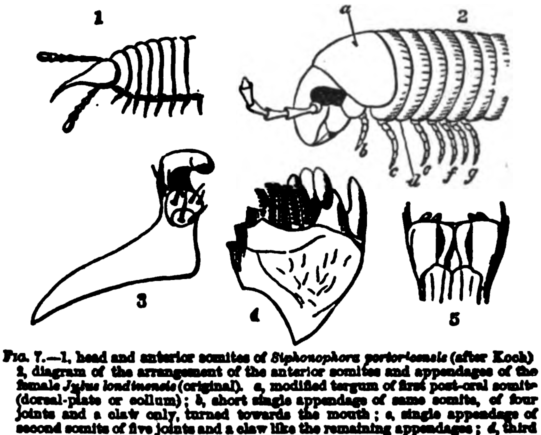

FIG. 7.—1, head and anterior somites of *Siphonophora portoricensis* (after Koch). 2, diagram of the arrangement of the anterior somites and appendages of the female *Julus londinensis* (original). *a*, modified tergum of first post-oral somite (dorsal-plate or collum); *b*, short single appendage of same somite, of four joints and a claw only, turned towards the mouth; *c*, single appendage of second somite of five joints and a claw like the remaining appendages; *d*, third or generative somite devoid of appendages and sterna, but bearing the generative apertures; *e*, single appendage of fourth somite; *f*, *g*, dual appendages of succeeding somites. 3, hook-like first post-cephalic appendage of male of same attached to its plate of support (= one-half of modified sternum?). 4, mandible of same. 5, the four-lobed plate formed by the fused single pair of maxillæ.

In the genus *Julus*, the well-known Millepedes, which may be taken as types of this order, the body is nearly cylindrical, slightly flattened beneath, and composed of a series of chitinous rings, one to each somite, which are bevelled off at their posterior borders for a certain part of their breadth so as to fit each within the next succeeding ring (fig. 6). The rings ("terga") are not complete, but interrupted by a narrow interval corresponding with the ventral median line, which is closed in each ring by a pair of ventral plates ("sterna") placed one in front of the other. Each of these ventral plates, except in the first four post-oral somites, bears a pair of short jointed legs composed each of five joints and a single terminal claw, the bases of the legs of opposite sides being so closely approximated in the middle line as to be in contact. Just in front of the base of each leg is a simple stigma communicating with a tuft-shaped tracheal organ (fig. 5). There are thus two pairs of legs to all except the most anterior somites, and two pairs of tracheæ. The mandibles mostly have broad chewing surfaces suited to mastication of vegetable matter. The maxillæ of the two sides are fused together to form a four-lobed plate acting as an under-lip. There are no poison-claws as in the Chilopoda, but the leg-shaped appendages of the first post-cephalic somite, the tergum of which is in most forms enlarged and shield-like, are turned towards the mouth, and probably assist in the process of feeding. In the males of some forms these appendages are shaped into peculiar short blunt grasping hooks, bearing spines on their bases (fig. 7). Of the succeeding three somites one (the third post-cephalic) is devoid of legs, and also of sternal plates; the other two bear a single pair of legs each only. The remainder of the somites bear each two pairs of legs (hence the term Diplopoda), except the seventh post-oral in the male, on which a complicated paired copulatory organ, formed out of modifications of the sterna and other components of the normal somite, is present. The form of these copulatory organs varies very much in species and genera of Diplopoda, and is of great systematic value. In both male and female *Julus* the generative ducts open by a pair of apertures on the ventral surface of the third segment, just behind the bases of the second pair of legs, the copulatory organs in the male being without internal connexion with the ducts of the testis.

The *Julidæ* coil themselves up spirally when at rest or when attacked, like *Peripatus*. The whole of the Diplopods are vegetable feeders. In the tropics very large representatives of the *Julidæ* occur, especially species of the genus *Spirobolus*, which do considerable damage in gardens by devouring leaves. In the *Polyzonidæ* (fig. 7) the mouth parts are formed into a pricking and sucking beak or tube. In the *Polydesmidæ* the body is semi-cylindrical in section, with the lateral regions of each tergum broadened out into a pair of horizontal projecting plates. In the Palæozoic Diplopoda, *Euphorberia* and its allies, the terga bore each six stout projecting spines, forming rows of spines along the body (fig. 6); the sterna enclosed one-third of the circuit of the body instead of only an insignificant ventral streak as in the *Julidæ*. In addition to the stigmata there are found on the ventral aspect of these fossil forms certain paired organs supposed by Scudder, who conjectures that these ancient Diplopoda may have been amphibious in habits, to have given support to gills. In the *Glomeridæ* the body is shortened, of twelve or thirteen somites only, and closely simulates that of the woodlouse in appearance. The males of *Sphærotherium*, a genus of this family, possess a stridulating apparatus at the hinder end of the body

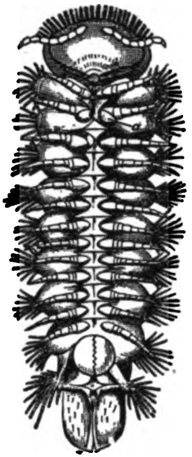

Fig. 8.—Ventral view of *Polyxenus lagurus* (after Bode) much enlarged, actual length a little over $\frac{1}{12}$th of an inch. *a*, position of generative openings.

Very important from a zoological point of view are the genera *Polyxenus* and *Pauropus*, the species of both of which are extremely small. *Polyxenus* (fig. 8) is about one-twelfth of an inch in length, and has fourteen pairs of legs, only the first four pairs of which are borne on the first four post-cephalic somites. The body is covered with bundles of hairy scales. In *Pauropus* (fig. 9) only nine pairs of legs are present. The antennæ are branched at their tips; the first post-cephalic somite bears a single pair of legs, the second post-cephalic a single pair of legs, and the remaining somites, except the posterior which bears a single pair, two pairs each. Sir John Lubbock, the discoverer of this form, which has many aberrant features besides those described above, referred it to a separate order of Myriapoda, *Pauropoda*.

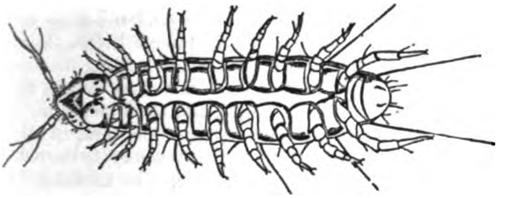

Fig. 9.—Enlarged view of *Pauropus Huxleyi*. (After Lubbock.)

Order Chilopoda.

Myriapoda mostly of dorso-ventrally compressed form, with long multi-articulate antennæ; with the second pair of post-cephalic appendages applied to the mouth as poison-claws; only one sternum and one pair of legs to each somite; stigmata lateral (in *Scutigera* dorsal); tracheal organs ramified, not tuft-shaped, often anastomosing; generative openings posterior; larvæ born with more than three pairs of functionally active legs.

In *Scolopendra* (fig. 10) the body is band-like and flattened dorso-ventrally. The terga and sterna are nearly flat broad plates of chitinous material, connected laterally by more flexible softer skin, in which in each somite lies on either side a single stigma. The corresponding large ramified tracheal trunks, which are provided internally with well-developed spiral filaments, are connected on each side by lateral longitudinal anastomosing tubes. The antennæ are many-jointed, long, and tapering; the head is followed by a second compound somite formed of four embryonic somites fused, termed the "basilar somite," which is covered by a single enlarged shield-like tergum. The legs are borne at the lateral margin of the ventral surface, their bases being wide apart; one pair is present to every post-basilar somite. The mandibles are provided with sharp cutting teeth; the maxillæ are fused together in the middle line as in Diplopoda. They do not form a plate, but in the centre a small bilobed process only, and bear a pair of soft palps laterally (fig. 11). The basilar somite bears as the first pair of post-cephalic appendages a pair of palp-like legs turned forwards in front of the mouth, and as the second a pair of large powerful limbs, the poison-claws, provided with a pair of curved claws perforated at their extremities by the ducts of poison-glands embedded in the claws and their penultimate joints. The basilar somite may bear posteriorly in addition a pair of walking legs, but this pair is frequently aborted in the adult animal. The last pair of legs at the hinder extremity of the body is elongated and directed backwards in the line of the body posteriorly. The generative ducts open posteriorly beneath the anus.

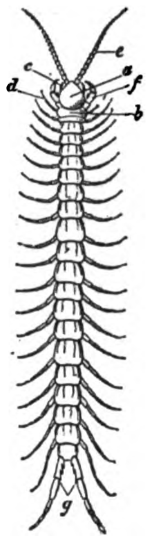

Fig. 10.

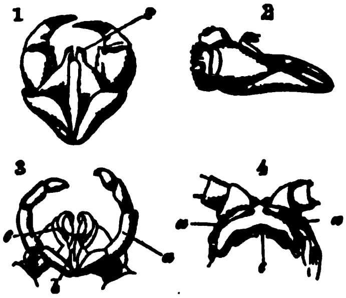

Fig. 11.

Fig. 10.—*Scolopendra morsitans* (after Buffon). *a*, cephalic tergite; *b*, basilar tergite; *c*, first post-cephalic appendage (=third post-oral); *d*, third post-cephalic; *e*, antenna; *f*, second post-cephalic (=poison-claws); *g*, last pair of appendages enlarged and directed backwards.

Fig. 11.—Mouth pairs of *Scolopendra morsitans* (after Buffon). 1, the poison-claws or fourth post-oral appendages; *a*, median cutting processes formed by the anterior edge of the basilar sterna; 2, one of the mandibles with its cutting edge to the left; 3, the maxillæ and third post-oral appendages *a*; *c*, palp-like maxillæ; *b*, small process formed by their fused bases; 4, ventral view of head with jaws removed; *a*, eyes; *c*, labrum.

The Chilopoda are all carnivorous, catching their prey and killing it by means of the poison-claws. *Eucorybas crotalus* of S. Africa makes with its hind legs a rattling noise like that of the rattlesnake. *Arthronomalus longicornis* of Europe is phosphorescent in the dark. The *Geophilidæ*, which are without eyes, have very long worm-like bodies, composed of very numerous segments. They live gregariously in moist earth. In *Lithobius*, the commonest British Centipede, the somites are unequal in size, there being nine larger and six smaller terga and fifteen legs composed each of six joints and a claw. The genus *Scutigera* and its allies form a remarkable family, *Scutigeridæ* (fig. 12), in which the antennæ are bristle-like and as long as the body, and the legs are extremely long, increasing in length towards the hinder end of the body. The peculiarities of their eyes and respiratory organs have already been referred to above. Most important is the aberrant genus *Scolopendrella*, which has lately been shown to have certain marked features indicating alliance to the primitive insects, *Thysanura*. The species of *Scolopendrella* are minute forms five or six mm. in length, appearing (fig. 12), as indicated by the name, at first sight like small *Scolopendras* (fig. 13). The head and antennæ nearly resemble those of *Campodea*. The body bears, according to Wood Mason, dorsally fifteen tergites behind the head, the first of these being quite rudimentary. Ventrally thirteen corresponding indications of somites only can be detected; and these bear twelve pairs of functional appendages. Two of the tergites appear to be devoid of sternites and appendages. The first post-cephalic appendages (=third post-orals) are small and turned towards the mouth; the eleven following ventrally-indicated somites bear each, besides a pair of functional

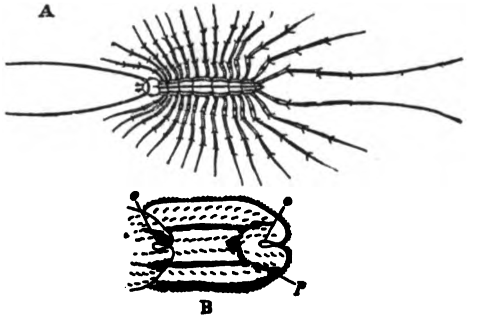

Fig. 12.—A. *Scutigera rubrolineata* (after Buffon). B. Tergum and part of a second of the same enlarged to show the position of the stigmata *s*, *s*; *p*, hinder margin of tergum.

ambulatory legs, a second pair of rudimentary appendages lying internally to these latter. The legs are five-jointed and bear each a pair of claws as in *Campodea* and *Peripatus* instead of a single claw as in other Myriapoda (*Lithobius* sometimes bears a pair on the anal legs only). There is a pair of caudal stylets on the last somite perforated by the ducts of silk glands. The arrangement of the stigmata is uncertain. Hasse finds only a single pair on the head, Wood Mason and others many pairs on the body somites. Peculiar paired segmental organs are present on the ventral surface which may be excretory. It appears not impossible that *Scolopendrella* may have originally possessed two pairs of appendages to each somite, and may thus represent to some extent a transition form between the ancient Diplopoda and the more recent Chilopodous type; but as the anatomy of *Scolopendrella* is as yet imperfectly known, and nothing is known as to its embryonic development, its place in classification must remain for the present an open question. By Ryder a separate order (*Symphyla*) has been formed for it, whilst Packard has placed it amongst the *Thysanura* notwithstanding its numerous jointed legs, which constitute the most essential distinction of Myriapoda from Insecta.

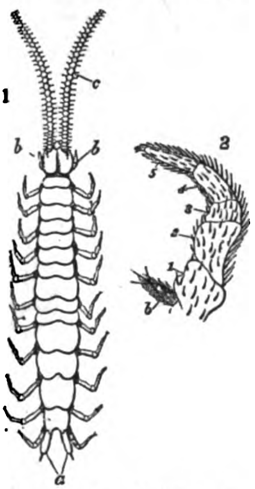

FIG. 13.—1, *Scolopendrella immaculata* highly magnified (slightly modified from Packard); *a*, caudal stylets; *b*, *b*, first post-cephalic appendages; *c*, antennæ; 2, one of the functional legs further enlarged (from Wood Mason), showing the five joints and terminal pair of claws; *b*, inner rudimentary leg of same somite.

Remains of representatives of the Chilopoda have not been found in Palæozoic strata. The earliest known are Secondary from the Solenhofen slate.

Development of the Myriapoda.—*Scolopendra* is viviparous like *Peripatus*. *Lithobius* lays its eggs loosely amongst earth, they are very hard to find there, and nothing is thus known of its development. The female *Geophilus* lays her eggs in heaps and watches over them; in the case of *Julus* the process is similar. Information as to the development of the Myriapoda generally is at present very imperfect. In no case as far as yet known is a blastopore formed as in *Peripatus*. The first structure to appear in *Strongylosoma* (*Polydesmidæ*) is a ventral thickened plate. The appendages are formed in succession from before backwards, and the mouth and anus as stomodæum and proctodæum. The embryo when hatched (fig. 14) has nine post-cephalic somites, the second of which is without appendages, whilst the first, third, and fourth each bear a functional pair of limbs, the fifth bears two pairs of rudimentary limbs beneath the larval skin, and the sixth a single pair, which very soon becomes double. The young *Strongylosoma* is thus provided with three pairs of functionally active legs. The young *Julus* has a similar number, the third post-cephalic somite being apodous, and it was formerly considered that this fact established a connexion between the Myriapoda and the Insecta, the three pairs of larval legs of the Myriapod being supposed to correspond with the three pairs of legs of insects. Such, however, is not the case; there being no second maxillæ in Myriapoda, the first pair of legs in the larva must correspond with the second maxillæ of insects; and even if this could be shown to be incorrect, the three pairs of legs would still not correspond with those of insects, because in the young *Strongylosoma* the second and in *Julus* the third post-cephalic somites are devoid of legs. Moreover, the larvæ are only apparently hexapodous, not in reality so. In *Pauropus* there is a hexapodous larval stage. In the Chilopoda no functional or real hexapodous larval stage occurs, as far as is known.

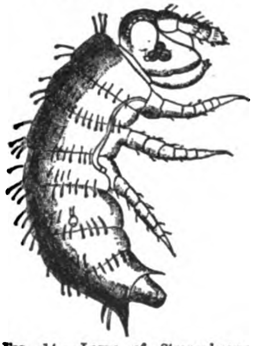
FIG. 14.—Larva of *Strongylosoma Guerinii* just hatched. (From Balfour, after Metschnikoff.)

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MYRISTICA. See NUTMEG.

MYROBALANS. See LEATHER, vol. xiv. p. 382.

MYRON, one of the chief sculptors of the older Attic school, was born at Eleutheræ on the borders of Bœotia and Attica, and flourished in the middle of the 5th century B.C. He was, like Phidias, a pupil of Ageladas of Argos. He worked almost exclusively in bronze; the only known exception is his wooden statue of Hecate at Ægina. He made some statues of gods and heroes, but these were not the works on which his fame rested. The ancient critics, as quoted by Pliny, censured his inability to represent the feelings of the mind; hence the lofty ideals of Phidias and the Attic school in general were beyond the scope of his art. His works seemed to live and move before the spectator; but he could make an athlete hurling the discus, not a Zeus hurling the thunder. His most famous works were the Cow, the runner Ladas, and the Discobolus. Of the first, which was esteemed his greatest work, no copy is known, and, though thirty-six epigrams celebrate the realism and the life of this animal, which might be mistaken for a living cow, none of them give any information as to the attitude in which it was represented. The statue of Ladas is also unrepresented in modern museums; no imitation has yet been found. Ladas, an Argive runner, died from over-exerting himself in the long race at the Olympic games. To judge from two epigrams, Myron represented him in the moment of his supreme effort, with flanks contracted as if the last breath had gone out from them and was still hovering on the open lips. The copies that have been preserved of two other works of Myron make it easier to realise the qualities that the ancient critics praise in him. The Discobolus is known from several copies, the best being a life-size statue in the Massimi palace at Rome. The athlete is represented at the moment when, after swinging the discus (five pounds in weight) back to the full stretch of his arm, he is quickening every sinew to begin the forward motion, and to employ in delivering the discus the full strength of every muscle and the whole weight of the body and the impetus acquired by the longest possible swing of the arm.

A similar moment, the critical point when one motion is suddenly transformed into its opposite, was seized in another work, of which several copies remain. Its discovery is due to the penetration of Brunn, and, though his ingenious combination has not yet found universal acceptance, it will probably be confirmed by future discovery. He compared a relief on the Acropolis of Athens, described by Pausanias without the artist's name with the words of Pliny, (*Myron fecit*) *Satyrum admirantem tibias et Minervam*, and recognized imitations of this scene on an Attic coin, a vase-painting, and an Attic relief, in which Marsyas is represented starting back with outstretched arms before the goddess Athena. He also recognized the figure of Marsyas alone in a marble statue of the Lateran museum, which has been restored as a dancing satyr; and a bronze statue in the British Museum has since been recognized as a slight variation of the same subject. None of these works agree completely with the words of Pausanias or with one another, but the general resemblance is so striking that they must be free imitations of a single work. Marsyas is surprised either by the sight of the flute which Athena has thrown away or by the threatening action of the goddess; his forward motion is suddenly checked, but he has not begun a retrograde motion. His hands, the parts which the mind commands most quickly, are thrown wide apart without any definite object in their motion, and the body is poised between the preceding action and the new action that will begin immediately. Pliny mentions a competition between Myron and Pythagoras of Rhegium, in which the Pancratiast of the latter was adjudged superior.

MYRRH is a gum-resin highly esteemed by the ancients as an unguent and perfume, used for incense in temples and also in embalming. The word is Semitic; it appears in the Old Testament as מֹר (Exod. xxx. 23; Ps. xlv. 8; Cant. *passim*), in Arabic as "morr." In Exod. (*l.c.*) "pure myrrh" should rather be "flowing myrrh," that is, the "myrrha stacte" of classical writers,—the finest myrrh, according to Pliny (xii. 35), exuding without incisions in the bark. So Johnson[1] says that it exudes from cracks in the trunk near the root and flows freely on stones underneath, the exudation being sometimes aided by bruising the bark with a stone. Myrrh was one of the gifts offered by the Magi, and a royal oblation of gold, frankincense, and myrrh is still annually presented by the queen on the feast of Epiphany in the Chapel Royal in London, this custom having been in existence certainly as early as the reign of Edward I.[2] Until the present century the botanical source of myrrh was enveloped in great obscurity. In 1826 Ehrenberg brought home specimens of the myrrh trees found at Jízán on the east side of the Red Sea, in lat. 16° 40′ N., and also on the neighbouring mountains of Jara. The more recent investigations of Hildebrandt (1878) show that one of the plants brought home by Ehrenberg and named *Balsamodendron Myrrha* yields the true myrrh. It was found by Hildebrandt growing on sunny slopes of the Sarát mountains at an elevation of 1600 to 3200 feet. It forms a low tree, attaining a height of not more than 10 to 12 feet, with thorny branches and a light grey bark, bearing some resemblance to those of the hawthorn. The leaves are ternate, the two lateral leaflets being minute in comparison with the central one; they are smooth, obovate, and denticulate. The fruit is about the size of a pea, oval and somewhat compressed. The tree grows interspersed among *Acaciæ* and *Euphorbiæ* in dwarfish thickets. The myrrh, according to Ehrenberg, when it first exudes is of an oily and then of a buttery consistence, and of a yellowish white colour, gradually assuming a golden and ultimately a reddish tinge as it hardens. Myrrh is chiefly collected, according to Vaughan,[3] in the Somali country and in the neighbourhood of Harar (9° 20′ N., 42° 17′ E.) south-west of Zeila, in the months of July and August (Johnson, *loc. cit.*), and is brought to the great fair of Berbera held in November, December, and January. Thence it is transported to Aden and shipped to Bombay, where it is sorted, the inferior kinds being sent chiefly to China and the finer sorts to Europe. The Banians of India, who trade in myrrh, have their business houses at Bombay, but employ partners or agents, who reside at Makallah and Aden to attend the fair at Berbera, and exchange Indian or English piece goods for myrrh, bdellium, and frankincense. Myrrh of the best quality is known as Turkey myrrh, and the inferior quality as East Indian myrrh, from being exported from Bombay. At the present time, however, all myrrh is imported either direct from Aden or from Bombay. The Somalis also cross over to the Arabian shore and collect this gum-resin on the hills about Shugra and Sureea to the east of Aden, where myrrh trees abound. The myrrh of this district differs slightly in appearance, and is less resinous than that of Somali Land, and in the opinion of Hanbury (*Pharm.*, p. 143) is probably the produce of a distinct species of *Balsamodendron*. The difference between African and Arabian myrrh was known to the ancients, who considered the Troglodyte or African myrrh the best. At Bombay this difference is still recognized. Specimens of the Arabian myrrh tree collected by Wykeham Perry in 1878 were less spinous than those of the Somali plant, but were too imperfect to determine if they belonged to a distinct species. *Balsamodendron Kua*, R. Br., a small spiny Abyssinian species allied to *B. Myrrha*, as yet undescribed, was found by Salt to yield myrrh.

Myrrh is usually imported in chests containing from one to two cwt., and is mixed with other gum-resins obtained from different species of *Balsamodendron*. The principal of these are subjoined.

(1) *Baisa Bol*, *Bhesa Bol*, or *Bissa Bol*, probably the produce of *Balsamodendron Kataf*, Kunth, a tree which is known to the Somalis as *hebbakhade*, and which has much larger leaves than the myrrh tree. This gum-resin resembles myrrh in appearance, but has a disagreeable taste and is scarcely bitter. At Aden bissa bol is worth only 2½ rupees per maund (28 ℔), while myrrh sells for 9½ rupees per maund. It is used in China, mixed with food, to give to milch cows to improve the quality and increase the quantity of milk, and when mixed with lime as a size to impart a gloss to walls. (2) Opaque bdellium, probably identical with the gum hotai described by Vaughan (*loc. cit.*), and produced by *B. Playfairii*. When shaken with water it forms a slight but permanent lather, and on this account is used by the Somali women for cleansing their hair and by the men to whiten their shields. It is known as *meena hârma* in Bombay, and is there used for the extraction of the guinea-worm. (3) African bdellium is the produce of *B. africanum*, and is probably the tree described by Adanson as *Nioutt*. The last two gum-resins are without the white streaks which are characteristic of myrrh and bissa bol; the former presents an opaque and the latter a resinous appearance, both being acrid, but having scarcely any bitterness or aroma. (4) Indian bdellium, probably identical with the Indian drug googul obtained in Scinde and Baluchistán from *Balsamodendron Mukul* and *B. pubescens*, Hook, has an acrid taste, an odour resembling cedar-wood, and softens in the hand. It is probably the produce of *B. Mukul* which has recently been found by Balfour in Socotra.

As met with in commerce true myrrh occurs in pieces of irregular size and shape, from half an inch to 2 or 3 inches in diameter, and of a reddish-brown colour. The transverse fracture has a resinous appearance with white streaks; the flavour is bitter and aromatic and the odour characteristic. It consists of a mixture of resin, gum, and essential oil in varying proportions from 23 to 44 per cent., the resin being present in good specimens to the extent of 27 per cent., and the oil from ¾ to 3 per cent. The resin appears to be a complex body, partly soluble in ether and partly in bisulphide of carbon. The gum is soluble in water and forms an adhesive mucilage. The odour of myrrh is due to the volatile oil, which is heavier than water. The bitterness is believed to be due to a glucoside, the chemical constitution of which has not been ascertained. It is obtained by treating with warm water the resin extracted by means of alcohol.

Myrrh is used in medicine at present chiefly as an auxiliary to other drugs, such as iron and aloes, in order to strengthen and modify their action. It appears to have a special action on the mucous membrane, improving the quality of its secretions and diminishing them in quantity when excessive. When taken internally it produces a sensation of warmth extending over the whole abdomen. The appetite is increased and the digestive process much facilitated, especially in cases in which there is weakness and torpidity of the intestinal canal. As an emmenagogue it is found especially useful where pulmonary complications exist. The tincture diluted with water is used as an application to spongy gums and the aphthous sore mouth of children.

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[1] *Travels in Abyssinia*, i. 249.

[2] *Liber quotidianus Contra-rotulatoris Garderobæ Edw. I.*, Lond., 1787, pp. xxxii. and 27.

[3] *Pharm. Journ.*, (1), xii. p. 227.

The Hebrew *lôt*, erroneously translated myrrh in Genesis xxxvii. 25; xliii. 11 (Sept. *σταχτή*; Vulg. *stacte*), is generally identified with *ladanum* (vol. xii. p. 718), which has been used as a medicine and perfume from the earliest times,[1] and is still an article of commerce in Turkey. An excellent account of the mode of collecting it is given by Tournefort (*Voyage*, i. 79).

Bibliography.—Forskål, *Fl. Ægypt. Arab.*, p. 80; Nees, *Beschreib. Officin. Pflanzen*, p. 357, 1829; Marchand, *Adansonia*, vii. p. 258; *Pharmacographia*, 2d ed., pp. 140-146; Bentley and Trimen, *Medicinal Plants*, p. 60; *Pharmaceutical Journal*, (1), xii. pp. 226, 227; (3), vi. p. 661; (3), ix. p. 893; (3), x. pp. 80-84; xi. pp. 41, 42; Cooke, *Report on Gum-Resins in the India Museum*, 1874, p. 72; Hildebrandt in *Sitzungsbericht d. Gesellsch. naturforsch. Freunde*, Berlin, November 1878, p. 196. (E. M. H.)

MYRTLE. The *μύρτος* of the Greeks, the *myrtus* of the Romans, and the Myrtle, *Myrtus communis*, of botanists, as now found growing wild in many parts of the Mediterranean region, doubtless all belong to one and the same species. It is a low-growing evergreen shrub, with opposite leaves, varying in dimensions, but always small, simple, dark-green, thick in texture, and studded with numerous receptacles for oil. When the leaf is held up to the light it appears as if perforated with pin-holes owing to the translucency of these oil-cysts. The fragrance of the plant depends upon the presence of this oil. Another peculiarity of the myrtle is the existence of a prominent vein running round the leaf within the margin. The flowers are borne on short stalks in the axils of the leaves. The flower-stalk is dilated at its upper end into a globose or ovoid receptacle enclosing the 2- to 4-partitioned ovary. From its margin proceed the five sepals, and within them the five rounded, spoon-shaped, spreading, white petals. The stamens spring from the receptacle within the petals and are extremely numerous, each consisting of a slender white filament and a small yellow two-lobed anther. The style surmounting the ovary is slender, terminating in a small button-like stigma. The fruit is a purplish berry, consisting of the receptacle and the ovary blended into one succulent investment enclosing very numerous minute seeds destitute of perisperm. The embryo-plant within the seed is usually curved.

In cultivation many varieties are known, dependent on variations in the size and shape of the leaves, the presence of so-called double flowers, &c. The common myrtle is the sole representative in Europe of a large genus which has its headquarters in extra-tropical South America, whilst other members are found in Australia and New Zealand. The genus *Myrtus* also gives its name to a very large natural order, the general floral structure of which is like that of the myrtle above described, but there are great differences in the nature of the fruit or seed-vessel according as it is dry or capsular, dehiscent, indehiscent, or pulpy. Minor differences exist according to the way in which the stamens are arranged. The aromatic oil to which the myrtle owes its fragrance, and its use in medicine and the arts, is a very general attribute of the order, as may be inferred from the fact that the order includes, amongst other genera, the *Eucalyptus*, the *Pimenta*, and the *Eugenia* (cloves). Brazil nuts, sapucaya nuts, and souari nuts are all produced by trees belonging to this order.

MYSIA, in ancient geography, was the name given to a province in the north-west of Asia Minor, which was bounded by Lydia and Phrygia on the S., by Bithynia on the N.E., and by the Propontis and Ægean Sea on the N. and W. But its precise limits are very difficult to assign,—the frontier on the side of Phrygia being, as observed by Strabo himself, very vague and fluctuating, while the north-western corner of the province, adjoining the Hellespont, was usually separated from Mysia under the name of the Troad, a district which was sometimes included in the name of Mysia, sometimes not. The river Æsepus, according to Strabo, constituted the boundary between the two, but on this subject also there was much discrepancy among ancient geographers.

The physical geography of Mysia (considered apart from that of the Troad) is characterized by two mountain-chains: that of Olympus in the north, which may be regarded as constituting the boundary between Mysia and Bithynia, and rises to a height of more than 6000 feet; and that of Temnus in the south, which for some distance separates Mysia from Lydia, and is afterwards prolonged through the former province to the neighbourhood of the Gulf of Adramyttium. The only considerable rivers are the Rhyndacus and its tributary the Macestus in the northern part of the province, both of which have their sources in the high tableland of Phrygia, and, after diverging widely in their course through Mysia, ultimately unite their waters below the Lake of Apollonia at a distance of only about 15 miles from the Propontis. The Caicus in the south takes its rise in Mount Temnus, and from thence flows westward to the Ægean Sea, passing within a few miles of the city of Pergamum, and discharging its waters into the Elaitic Gulf. In the northern portion of the province are two considerable lakes: that of Apollonia, formed by the expansion of the waters of the Rhyndacus, and nearly 50 miles in circumference; and that of Miletopolis, about 30 miles round, the waters of which are discharged into the Macestus.

The most important cities of Mysia were Pergamum in the valley of the Caicus, about 20 miles from the sea, which under the successors of Alexander became the seat of a flourishing Greek monarchy (see PERGAMUM), and Cyzicus on the shores of the Propontis, a Milesian colony, which attained to a high degree of wealth and prosperity. But the whole of the sea-coast from thence round to the Gulf of Adramyttium was studded with a series of Greek towns, extending along the south shore of the Propontis, as well as the Hellespont and the Troad, several of which were places of considerable importance, including Parium, Lampsacus, and Abydos. In like manner the whole sea-coast from the Gulf of Adramyttium to the mouth of the Caicus, and from thence to the Elaitic Gulf, was occupied by Greek colonies, many of them dating from a very early period, and for the most part of Æolian origin, from which circumstance the whole of this coast district was known by the name of Æolis, as the corresponding district between Lydia and the sea was called Ionia (ÆOLIS). The most considerable of these Greek towns were Assos and Adramyttium, on the gulf that derived its name from the latter city, and farther south, on the Elaitic Gulf, Elæa, Myrina, and Cyme.

Ancient writers all agree in describing the Mysians as a distinct people, like their neighbours the Lydians and Phrygians, though they never appear in history as an independent nation. Their ethnological relations, like those of the other tribes of western Asia, are rather obscure; but it appears from Herodotus and Strabo that they were a kindred race with the Lydians and Carians, a fact attested by their common participation in the sacred rites at the great temple of Zeus at Labranda, as well as by the statement of the historian Xanthus of Lydia (a competent authority upon such a point) that their language was a mixture of Lydian and Phrygian. Strabo was of opinion that they came originally from Thrace, and were a branch of the same people as the Mysians or Mœsians who dwelt on the banks of the Danube,—a view not inconsistent with the preceding, as he considered the Phrygians and Lydians also as having migrated from Europe into Asia. According to a Carian tradition reported by Herodotus (i. 171) Lydus and Mysus were brothers of Car,—an idea which also points to the belief in a common origin of the three nations. The Mysians appear in the list of the Trojan allies in

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[1] Celsius, *Hierobot.* i. 280-286; Herod., iii. 112; Dioscorides, p. 128.

Homer; but nothing else is known of their early history. The story told by Herodotus (vii. 20) of their having invaded Europe in conjunction with the Teucrians before the Trojan War is probably a mere fiction; and the first historical fact we learn concerning them is their subjugation, together with all the surrounding nations, by the Lydian king Crœsus. After the fall of the Lydian monarchy they naturally passed under the Persian empire, and so continued until its overthrow by Alexander. After the death of the conqueror they were annexed to the Syrian monarchy, of which they continued to form a part until the defeat of Antiochus the Great (190 B.C.), after which they were transferred by the Romans to the dominion of Eumenes, king of Pergamum, as a reward for his services during the war. After the extinction of the Pergamenian dynasty (130 B.C.) Mysia became a part of the Roman province of Asia, and from this time disappears from history. The inhabitants probably became gradually Hellenised, but none of the towns of the interior, except Pergamum, ever attained to any importance.

The only relic of the Mysian language is a very short inscription found by Mr Frank Calvert in the acropolis of Thymbria, and supposed by Professor Sayce to be in the Mysian dialect, but its evidence is very inconclusive.

MYSORE or Maisúr (*i.e.*, Mahesh-asura, "Buffalo-demon") is a native state in southern India, lying between 11° 40′ and 15° N. lat. and 74° 40′ and 78° 30′ E. long., and surrounded entirely by British territory, with an area of 24,723 square miles. The Mysore country above the Gháts, though frequently called "the tableland," is by no means flat or a plain, but is in some parts mountainous and everywhere undulating. Deep ravines are situated in the angle where the Eastern and Western Gháts converge into the group of the Nílgiri hills. An interesting feature of the country is the large number of isolated rocks (*drúg*, "difficult of access") which often rear their heads as stupendous monoliths to the height of 4000 or 5000 feet above sea-level. Some of these rocks—in particular Nandidrúg (4810 feet) and Savandrúg (4024 feet)—have been the scene of many a hard-fought contest, while Kabaldrúg obtained an evil fame as a state prison. The eight highest peaks in Mysore are Mulláina-giri (6317 feet), Kuduri-mukha (6215), Bábá Búdan-giri (6214), Kalhatti (6155), Rudra-giri (5692), Pushpa-giri (5626), Merti-gudda (5451), and Wodin-gudda (5006 feet). Five of these are comprised in the Bábá Búdan or Chandradrona range, a magnificent horse-shoe-shaped cluster of mountains. Mysore is naturally divided into two regions of distinct character—the hill country called the Malnád, on the west, and the more open country known as the Maidán, comprising the greater part of the state, where the wide-spreading valleys and plains are covered with villages and populous towns. The drainage of the country, with a slight exception, finds its way into the Bay of Bengál, and is divisible into three great river systems—that of the Krishna on the north, the Cauvery on the south, and the Pennair, Penar, and Palar on the east. A few minor streams flow west into the Arabian Sea. Owing to either rocky or shallow beds none of the Mysore rivers are navigable, but some are utilized for floating down timber at certain seasons. The main streams, especially the Cauvery and its tributaries, support an extensive system of irrigation by means of channels drawn from immense dams (*anicuts*), which retain the water at a high level and permit only the overflow to pass down stream. The streams which gather from the hill-sides and fertilize the valleys are embanked at every favourable point in such a manner as to form a series of reservoirs or tanks, the outflow from one at a higher level supplying the next lower, and so on, all down the course of the stream at short intervals. These tanks, varying in size from small ponds to extensive lakes, are dispersed throughout the country to the number of 20,000; the largest is the Sulukere Lake, 40 miles in circumference.

The census of 1881 returned the population of Mysore at 4,186,188 (males 2,085,842, females 2,100,346), viz., Hindus 3,956,336, Mohammedans 200,484, Christians 29,249, "others" 119. The population of the chief towns in the executive districts was as follows:—Bangalore, 155,857; Mysore, 60,292; Shimoga, 12,040; Kolar, 11,172; Tumkúr, 9909; Chikmagalur, 7088; Hassan, 5950; and Chitalchoog, 4271. In 1880-81 out of a total of 4,280,674 acres of cultivable land 3,139,560 were occupied by *rági* and other dry crops, 554,752 by rice, 21,058 by wheat, 147,464 by oil-seeds, 24,076 by sugar cane, 20,893 by cotton, 159,165 by coffee, 135,542 by cocoa-nut and areca-nut, and the remainder by fibres, tobacco, vegetables, mulberry, pepper, and lac. Two cinchona plantations have been recently established, and promise good results. In the Lál Bágh or Government garden at Bangalore, attempts have been made with some success to grow vanilla, cocoa, rhea, ipecacuanha, and various other exotic plants, while the culture of apples, peaches, strawberries, and other fruits has been greatly improved.

The drought which affected all southern India in 1876-78 fell with especial severity upon Mysore. From October 1875 to October 1877 four successive monsoons failed to bring their full supply of rain. The harvest of 1875 was generally below the average, and remissions of revenue were found necessary; but it was not till the close of 1876 that actual famine occurred. During the whole of 1877 famine was at work; but in October of that year the monsoon broke with a fair rainfall, and cultivation at last became possible. It will, however, take many years before Mysore recovers its normal condition of prosperity; and it is estimated by competent authorities that one-fourth of the entire population of the state was swept away by starvation or disease, while the mortality among cattle was yet more heavy. In 1880-81 also 200,000 head of cattle perished. In September 1877, when affairs were at their worst, no less than 280,000 persons were in receipt of relief. The total amount expended on state relief, apart from loss of land revenue, was upwards of a million sterling.

The chief manufacture of Mysore is iron-smelting at Bangalore. Gold-mining is pursued in Kolar and Bangalore (since 1881) districts. Jewellery is a speciality of Bangalore. Carpets, rugs, cotton textures, silk cloths, cumblies, &c., are also manufactured, the total estimated value being 6,281,651 rupees. Sandal-wood, which forms a state monopoly, yields an average annual income of about £15,000. The Madras railway runs through the state. An excellent net-work of provincial and district roads intersects the state, and great attention has been paid to the numerous passes through the Western Gháts to the low country beyond.

The total revenue for 1880-81 was 10,270,383 rupees. Local funds to the extent of 700,697 rupees were also levied for the maintenance of district roads and tanks, and for the support of village schools. Municipalities have been established at all district head-quarters, and also in sixty-seven other towns. The system of judicial procedure, both civil and criminal, has been assimilated to that in force in British territory. Mysore pays a yearly subsidy to the British Government of 2,450,000 rupees for the maintenance of a force for the defence of its territory. There is also a local force. In 1880-81 the total number of schools of all classes in the state was 899 Government schools and 1881 aided schools, the total number of scholars being 42,657. There are in all 20 hospitals or dispensaries; the average daily attendance in 1880-81 was 1500.

In the earliest historical times the northern part of Mysore was held by the Kadamba dynasty, whose capital, Banawási, is mentioned by Ptolemy; they reigned with more or less splendour during fourteen centuries, though latterly they became feudatories of the Chalukyas. The Cheras were contemporaries with the Kadambas, and governed the southern part of Mysore till they were subverted by the Cholas in the 8th century. Another ancient race, the Pallavas, held a small portion of the eastern side of Mysore, but were overcome by the Chalukyas in the 7th century A.D. These were overthrown in the 12th century by the Ballálas, an enterprising and warlike race professing the Jain faith. They ruled over the greater part of Mysore, and portions of the modern districts of Coimbatore, Salem, and Dhárwár, with their capital at Dwárásamudra (the modern Halebid); but in 1310 the Allála king was captured by Málik Káfur, the general of Alá-ud-dín; and seventeen years later the town was entirely destroyed by another force sent by Muhammad Tughlak. After the subversion of the Ballála dynasty, a new and powerful Hindu sovereignty arose at Vijáyanagar on the Tungabhadra (see India, vol. xii. p. 794). In 1565 a confederation of the Mohammedan kingdoms defeated the Vijáyanagar sovereign, Rájá Rám, at the battle of Talikot; and his descendants ultimately became extinct as a ruling house. During the feeble reign of the last king, the petty local chiefs (páligárs) asserted their independence. The most important of these was the wodeyar ("lord") of Mysore, who in 1610 seized the fort of Seringapatam, and so laid the foundation of the present state. His fourth successor, Chikka Deva Ráj, during a reign of thirty-four years, made his kingdom one of the most powerful in southern India. In the 18th century the famous Haidar Alí usurped the throne, and by his military prowess made himself one of the most powerful princes of India. His dynasty, however, was as brief as it was brilliant, and ended with the defeat and death of his son Tipu at Seringapatam in 1799. A representative of the ancient Hindu line was then replaced on the throne. Owing to his career of misgovernment, the British administration assumed the authority in his name in 1831. He died in 1868, leaving an adopted son, Chikka Krishna Arasu, a minor, during whose pupilage and training the state management was conducted by British officers. The full sovereignty of the state was handed over to him in March 1881.

Mysore, the ancient capital of the above state, is situated 10 miles south-west of Seringapatam, in 12° 18′ N. lat. and 76° 41′ E. long., with a population of 60,292 in 1881. The town, which is spread over an area of about 3 square miles, lies at the foot of the Chámundi hill, in a valley formed by two parallel ridges running north and south. The streets generally are broad and regular, except in the fort. The majority of the houses are tiled, and some of them are substantial buildings two or three stories high. Altogether, the town has a clean and prosperous look, and its sanitary condition has been greatly improved of late years. The fort stands in the south of the town, forming a quarter by itself; the ground-plan is quadrangular, each of the sides being about 450 yards long. In the interior is the palace of the mahárájá, built in an extravagant style of Hindu architecture, and adorned inside with a few paintings by a European artist, the principal object of interest being the throne, which is said to have been presented to Chikka Deva Ráj by the emperor Aurangzeb. A new palace has been erected at Bangalore for the young mahárájá. Opposite the western gate of the fort is a lofty and handsome building known as the Mohan Mahál, erected by the late mahárájá for the entertainment of the European officers. The houses of the European residents are, for the most part, to the east of the town. The residency was built by Colonel Wilks in the beginning of this century. It has a handsome portico; and a room at the back, added by Sir John Malcolm, is said to be the largest in India. The building now used for the district offices was originally built by Colonel Wellesley (duke of Wellington) for his own occupation. Mysore was the capital of the state up till 1831, when on the British occupation the seat of administration was removed to Bangalore. (W. W. H.)

MYSTERIES. This name was applied to certain ceremonies in Greek religion which were esteemed peculiarly sacred and might not be freely spoken about. The subject is one of great difficulty on account of the absolute silence maintained with regard to it by many writers, and the guarded terms in which the few references to it are couched. The obligation to silence was not felt by the Christian writers, and it is to them that we owe most of our knowledge. Their testimony is of doubtful value, and it has been keenly debated whether any trust can be placed in it; but it is in such perfect accord with the few references in pagan authors that this scepticism is unjustifiable. The Christian writers on whom we have to depend were arguing against pagan opponents, and their arguments would have lost all force if it had been possible to retort that the descriptions and facts were inaccurate. The Mysteries were the chief stronghold of those pagan controversialists who maintained that all the truths and the morality advocated by the Christian writers were contained in the Greek religion, and therefore the Christians directed their arguments chiefly against this strongest part of their opponents' case. It results from a study of the evidence that, on the whole, they stated the case in favour of the Mysteries with much clearness and fairness, admitting the good points, but directing their polemic against the weak side.

Of the many Mysteries which existed in different parts of Greece, the Eleusinian were the most famous, the most widely popular, the most representative in every way. In several parts of Greece—*e.g.*, at Phlius—there were Mysteries directly adopted from Eleusis; in other places, such as Lerna, Andania, &c., a genuine old mystic cultus was greatly modified by the same example.[1] The Christian writers therefore direct their polemic mainly against the Eleusinian Mysteries, and the material for study is far less scanty in their case than in any other. The following remarks, accordingly, will be almost entirely confined to them. Any discussion of the subject must be founded on Lobeck's great work *Aglaophamus* (1829), in which, with equal learning and acuteness, he destroyed once for all the *a priori* theories current before his time, that the Mysteries enshrined a primitive revelation of divine truth made to mankind, or contained a philosophic doctrine borrowed by the Greeks from the wisdom of the East and handed down unmodified from generation to generation.[2] As a constructive work, Lobeck's treatise is not so perfect. What we are in search of is not so much the objective facts of the Mysteries as the place which they held in the Greek mind. The effect of a religious institution like the Mysteries depends chiefly on subjective considerations; actions and rites in themselves quite commonplace may bear to the eye of faith the most sacred and impressive character. This point of view is not taken into account by Lobeck. Again, the polemical character detracts from the value of his work as a final statement of the question; he is sometimes satisfied with proving that ancient evidence does not bear out the theories which he combats, but he does not estimate duly its actual worth. Finally, additional evidence has been accumulated since his time; inscriptions and works of art have afforded important corroborative evidence, and it is certain that statements which Lobeck set aside as not referring to the Eleusinian religion do really relate to it.[3]

There is no ancient authority to show that the ritual of the Mysteries differed essentially from that of the general religion of Greece. All ancient testimony tends to prove that the ritual was based on religious myths, similar to those which were common in Greece, and that the difference between mystic and exoteric rites lay chiefly in the accompaniments. Athenæus[4] says that the Mysteries were distinguished from the ordinary festivals by their peculiar magnificence and expense, and by the "mystic paradosis" which took place at them, *i.e.*, certain sacred things were exposed in a peculiarly impressive manner to the worship of the participants. Their magnificence must have been very great. Painting, sculpture, architecture, music, dancing, &c., were combined with lavish skill to form one grand and impressive spectacle. Other great festivals were displays of Attic splendour, but the Mysteries were intended, in the Periclean scheme, to be the great religious ceremony of all Greece; the allies were required, and the other Greeks requested, to pay homage and first-fruits to the two goddesses of Eleusis.[1]

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[1] The contrast between the account given by Pausanias of the Mysteries of Andania in the 2d century after Christ and the account given in the great inscription 91 B.C. shows how the example of Eleusis had worked in the interval.

[2] The chief older theories of the Mysteries were those of Warburton, St Croix, and Creuzer.

[3] The principal special authorities on the Mysteries since Lobeck are:—Sauppe, *Mysterieninschr. von Andania*; Foucart's commentary on this inscription in Le Bas, *Voyage Archéol.* (1847-77), *Inscr. de la Pelopon n.*; Foucart, "Inscr. d'Eleus." in *Bull. Corr. Hell.*, 1880; id., *Associations Relig. chez les Grecs*; C. Lenormant in *Mém. de l'Acad. d'Inscr. et de Belles Lettres*, xxiv. 343; Guignaut, "Myst. de Cer. et de Pros.," *ibid.*, xxi. 68; K. O. Müller in Ersch and Gruber's *Allg. Encyk.*, art. "Eleusinia;" id. in *Orchomenos*, p. 453; Preller in Pauli's *Realencyklop.*, arts. "Eleusinia," "Mysteria," "Orpheus,"—the best statement of the subject; id., *Demet. und Perseph.*; Gerhard, *Griech. Mysterienbilder*; id., *Ueber d. Bilderkreis von El.* (1863-65); Stephani in *Compte Rendu*, St Petersb., 1859; Millingen in *Annali Inst. Arch.*, vol. xv.; A. Mommsen, *Heortologie* (1864); F. Lenormant, *Rech. Archéol. à El.*; id., *La Voie Sacrée Eleus.*; id., "Eleus. Myst." in *Nineteenth Century*, 1881, May, July, September.

[4] Athen., ii. p. 40 D.

The strictest secrecy was enjoined and observed in regard to the Mysteries and everything connected with them; but this secrecy was not that of a narrow cult, confined to a small number of participants. The Eleusinian Mysteries were open as early as the time of Herodotus to any of the Greeks who wished to be initiated.[2] There was, therefore, no secret to keep inviolate from the uninitiated. Just as in the actual representation of the Mysteries a silence so strict as to be proverbial[3] was maintained, so it was a condition of their good effect that they should not hereafter be lightly spoken of.[4] Those who believed in the Mysteries kept in their heart, as a saving and sacred possession, the knowledge of what they had seen and heard and kissed and handled; the thought was too holy to be rashly spoken of, even to the initiated.[5] Numerous references prove that this mystic silence was generally very carefully observed. In the poets we sometimes find an affectation of observing silence about myths which are quite common property; and writers of religious or superstitious character frequently make a mystic secret of matters that less scrupulous writers speak freely about.[6] The degree to which silence was observed depended entirely on the individual conscience, and the fact that it was in general so strictly maintained is the best proof of the vitality and power of the Mysteries over the popular mind.

The saving and healthy effect of the Eleusinian Mysteries was believed in not only by the mass of the people but by many of the most thoughtful and educated intellects, Pindar, Sophocles, Isocrates, Plutarch, &c.[7] Plato, who finds no language too strong to stigmatize the demoralizing effect of the Orphic Mysteries, speaks of the Eleusinia with great respect; he compares the contemplation of the "ideas" by the disembodied souls to the contemplation of the "phasmata"[8] revealed in the Mysteries. This saving power is expressly connected with the future life; he that has been initiated has learned what will ensure his happiness hereafter. This point, which is ridiculed by Lobeck (pp. 70-1), must be examined carefully. The words of Pindar, Sophocles, Isocrates agree with the words of the Homeric *Hymn* (l. 480) that the initiated have peculiar advantages in the future world, and many other passages are equally clear and distinct. Lobeck maintains that they have no special meaning, inasmuch as Isocrates says the same about all men who live an upright life.[9] This argument misses the most important religious question with regard to the subject,—Is the salvation in the future life, which is assured by initiation, attained by mere ritualistic observances, or does it depend on the effect produced by initiation on the life and character of the initiated person? Plato condemns in the strongest terms the Orphic Mysteries, which promise salvation in return for mere ritualistic acts of purification and initiation; if he respects the Eleusinian Mysteries, which also promise salvation as the reward of initiation, this can be only because he believes that they promise it on different grounds. The reason is explained by Isocrates, who expressly says that this salvation in the future life, the reward of the initiated, is gained by all who live a pious and just life. In like manner, Diodorus says that the initiated are said to grow better; and Andocides makes a similar remark about the object of the Mysteries. According to Sopater, initiation establishes a kinship of the soul with the divine nature; and Theon Smyrnæus says that the final stage of initiation is the state of bliss and divine favour which results from it.[10]

These quotations prove the general belief that the aim of the Eleusinian Mysteries was high, and that a lasting effect was produced by them on the initiated. This implies a high stage of religious thought, such as no other ancient faith, except that of the Hebrews, attained; but a passage in a Rhodian inscription of the 5th century B.C. shows that this idea was not wholly unfamiliar in Greek religion. The first and most important condition required of those who would enter the temple at Lindus is that they be pure in heart, and not conscious of any crime; conditions of ceremonial purity are enumerated as secondary matters.[11] Now, with regard to the profanation of the Mysteries by those persons who ridiculed them, it is easy to understand that the very simple character of the rites, the commonplace nature of the sacred things which were exposed as the crowning ceremony of the Mysteries to the adoration of the people, lent themselves readily to ridicule when contrasted with the solemn preparations that led up to the crowning act, and the great effects that were expected from the initiation. The people who had been initiated, who believed in the salutary effect of the admission to handle and kiss the sacred objects, were naturally both shocked and indignant at the ridicule thus cast on their holy sacrament by the pitiless analysis of a cold disbelieving intellect. They felt that more than met the eye existed in these sacred things. The Mysteries occupied a place among the ancients analogous to that of the Holy Sacrament in the Christian church. The intention was to admit all that were not notoriously wicked; the disqualifying crime was unexpiated murder. The belief was entertained that the solemnity and impressiveness of the ceremony tended to produce a strong effect on the character of the initiated.

There is overwhelming proof in ancient writers that the effect of the Mysteries was not dependent on any dogmatic instruction. Even the doctrine of a future life, which is always associated in the old writers with the Mysteries, was not expressly inculcated in them, but left to the spectators to gather for themselves from the spectacle presented to them.[12] On the other hand, ancient testimony shows a striking unanimity in describing the manner in which the Mysteries were believed to educate the people. One of the most important passages is that where Galen maintains that the study of nature, if prosecuted with the concentrated attention given to the Mysteries, is even more fitted than they are to reveal the power and wisdom of God, inasmuch as these truths are more obscurely expressed in the Mysteries than in nature. Plato compares the contemplation of the "ideas" with that of the Mysteries; Chrysippus calls the discussion on the nature of the gods, which forms the last section of the Stoic physic, τελετή.[13] From these passages we may infer the belief of the writers that important truths were enigmatically[1] expressed in the Mysteries, and that the intellect which could penetrate beneath the surface was able to apprehend them. Plutarch says that it required a philosophic training and a reverent religious frame of mind to comprehend the Mysteries. Similarly Aristotle expressly says that no instruction was given to the *μύσται*, but that, while in a suitable state of receptivity, their emotions and character were acted upon. The testimony of the Christian writers is entirely to the same effect; while stigmatizing the impure character of some of the rites, they always admit that the Mysteries were intended to lead the people up to a knowledge of religious truth.[2] It is obvious that the essential point on which the effect of the ceremony depended was that the mind of the initiated should be wrought up to a pitch of eager, rapt expectancy and breathless attention. The attentive silence of the spectators at the Mysteries was proverbial. Many means contributed to produce this state. A certain amount of previous training and instruction was imparted by the *μυσταγωγοί* to the candidates. It is true that all who had been initiated had the right to act as *μυσταγωγοί*, that they were left legally free to introduce any one whom they thought fit, that the amount of instruction they could impart varied according to their character and education. Lobeck has emphasized all these elements which tended to impair the character and lessen the effect of the Mysteries. But though this point is incapable of proof, the general character of the Mysteries suggests that custom may have modified to some degree the freedom allowed by law, and that the Eleusinian officials tried to regulate the instruction given. Moreover, the lesser Mysteries were a kind of preparation for the greater, and Clement mentions that in them, and in them alone, a certain amount of instruction was given to the *μύσται*.[3] These circumstances combined with the general belief of the people in the holiness and power of the Mysteries to produce in the mind of the *μύσται* an expectant feeling and a disposition to look for some meaning in the spectacle.

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[1] Inscription published by Foucart in *Bull. Corr. Hell.*, 1880.

[2] Herod., viii. 65. It was an accusation against Socrates that he alone of all the Athenians had not been initiated, Lucian, *Dem.*, ix. 237; Lobeck, p. 21.

[3] Philostr., *Vit. Apoll.*, i. 15, 17, *ὥσπερ ἐν μυστηρίοις ἐσιώπων*, &c.; see Lobeck, p. 67.

[4] Strab., p. 357, *ἡ κρύψις ἡ μυστικὴ σεμνοποιεῖ τὸ θεῖον.*

[5] Macrob., *Sat.*, i. 18, 236; Lobeck, p. 185.

[6] Theocr., iii. 50, and many passages in Herod. and Paus.

[7] Pind., *fr.* 102; Soph., *fr.* 719, Ddf.; Isocr., *Pan.*, vi. p. 59, § 28; Crinagoras in Jac., *Anthol.*, ii. 332; Cic., *Legg.*, ii. 14; Lobeck, § 11.

[8] Plat., *Phædr.*, p. 250, *Epin.*, p. 986.

[9] Isocr., *Symmach.*, xii. 266.

[10] Diod. Sic., *Hist.*, v. 48; Andoc., *De Myst.*, § 31; Sopat., *Diær. Zetem.*, p. 120, in Walz, *Rhet. Græc.*; Theon Smyrn., *Mathem.*, i. p. 18, ed. Bull; see Lobeck, pp. 39, 189.

[11] Inscription quoted by Foucart in *Inscr. de la Peloponn.*, p. 171, in Le Bas, *Voy. Archéol.*

[12] Lobeck, §§ 216-19.

[13] Lobeck, §§ 19-20.

The grades of admission to the Mysteries tended to produce the same impression. The process of initiation was not a momentary one, completed in one act; it extended over an elaborate series of stages, and the ancients certainly associated these successive steps with a gradual increase of knowledge and insight. The candidate was initiated in the lesser Mysteries in Anthesterion (February) at Athens; he was admitted as a *μύστης* at Eleusis in the following Boedromion (September), but he could not attain the higher initiation as *ἐπόπτης* till at least one year more had elapsed. It was also believed that a higher order of initiation was reserved for those who were qualified for the offices of *ἱεροφάντης* and *δᾳδοῦχος*, in which the last knowledge of the cultus was imparted to them.[4]

Finally, the physical circumstances of the initiation were such as to produce an excited and high-strung nervous condition. The nine days' fast, very strictly observed,[5] the long march from Athens to Eleusis and the frequent religious ceremonies with which it was marked, the wandering by night around the shores and plain of Eleusis with torches in search of the lost Cora,—all tended to produce a strained enthusiastic state. And the season of the year and of the month—for the nights were dark—co-operated; Boedromion fell about the end of the hot season, when the bodily strength is usually low. Then came the actual Mysteries: the *μύσται* were admitted to the holy building; the splendid illumination seemed dazzlingly bright after the darkness outside; the strange apparitions, the impressive voices, the gorgeous dresses of the actors, the magnificence of the sacred drama, to which the highly suggestive and symbolic art of Greece no doubt contributed largely,—all these they saw and heard in awestruck silence. Then came the crowning act of the ceremony: they had perhaps before this drunk the sacred draught with which the goddess had refreshed herself after her long fast, but now the holy things which the goddess had herself shown to the daughters of Celeus were revealed to them. They were admitted one by one to touch, to kiss the holy things, to lift them from the cist, to put them into the basket, to taste them, to replace them in the cist, and to pronounce the sacred formula. The scene that takes place in every modern Greek church on the eve of Easter Sunday gives some faint idea of the character of this *παράδοσις*.

This state of enthusiasm was common to all Mysteries, especially to the Phrygian. It was susceptible of great abuses, *e.g.*, the self-mutilation and the immorality of the Phrygian rites. But the spirit of Hellenism toned down the excesses, while it tried to preserve the fervour and self-forgetfulness of the Phrygian and Bacchic orgies. The relation of the state to the Mysteries contributed to regulate the excited fervour of the celebrants. While it never interfered with the established ritual, the state was the last judge in cases of misdemeanour; it appointed officials to control the expenditure and conduct the public part of the ceremony. Inscriptions[6] have thrown much light on this point, but it is not possible here to dwell on it. The Mysteries of Eleusis were the one great attempt made by the Hellenic genius to construct for itself a religion that should keep pace with the growth of thought and civilization in Greece. The strained enthusiasm attendant upon them seems at first strange and unhellenic to a mind accustomed to the moderated chastened tone of Greek art and literature, and to the spectacular character of Greek exoteric religion with its utter want of vitality and religious fervour. The public religion either became, like the Panathenaia, a purely political display of the power and splendour of Athens, or else, like much of the old ceremonial of the acropolis, was performed perfunctorily.. It had no hold on the mind of the people; its simple antique ceremonies told nothing of the subjects which troubled men's minds, the thoughts of sin, of a future life, and of punishment for guilt. But the Mysteries concerned themselves precisely with these subjects: they provided a series of preliminary purifications for their votaries; they turned men's minds to the deeper problems of life and death, and gave them new views; they made some attempt to reach and touch the individual mind. Thus, while the public Hellenic religion sank into disrepute, the Mysteries became more and more important as time elapsed.

It is impossible to reconstruct the mystic ceremonial, but sufficient indications are given for us to understand its general character. It consisted of acts and words, *δρώμενα* and *λεγόμενα*, which supplemented one another, and were both required to make an intelligible whole.[7]

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[1] The word "enigma" is used by Sopater, *Diær. Zetem.*, p. 120; Clem. Alex., *Strom.*, p. 658, and Christian writers frequently; Lobeck, pp. 148, 189.

[2] Plut., *Isid.*, lxviii.; Aristot. ap. Synes., *Or.*, p. 48 (ed. Petav.); Cic. *N. D.*, i. 42, is important, *rerum magis natura cognoscitur quam deorum.*

[3] Cl. Alex., *Strom.*, v. 689; Lobeck, p. 140.

[4] Theon Smyrn., *Mathem.*, i. p. 18, quoted by Lobeck, p. 39.

[5] It is nowhere mentioned that the *μύσται* fasted nine days, but the analogy of the nine days' fast of Demeter makes it quite safe to assume that this was the rule for her worshippers; see *Hymn*, l. 47-9. The fast was perhaps, like the Mohammedan Ramadan, observed only while the sun was up; but, in addition to this, various kinds of food were wholly prohibited, see Lobeck, pp. 189-91.

[6] See the inscription of Andania, and the important inscription of Eleusis published in *Bull. Corr. Hell.*, 1880.

[7] The case of the young man in Sopater's imaginary trial proves this very clearly.

The *λεγόμενα* were obscurely-worded phrases and traditional songs, whose sanctity was due to their antiquity. They had no didactic character, and were hardly intelligible without preparatory instruction. They were chanted by the hierophant, and that a fine voice was one of the requisites for this office several epigrams and inscriptions bear witness. The mythic ancestor of the family, in whom are embodied the requirements for the office, was called Eumolpus. The *δρώμενα* appear to have been a dramatic representation of the life of the deities by whom the Mysteries had been instituted. These deities were presented on the stage in appropriate dresses, the parts being played by the ministers of the cultus. At Andania this is known to have been the case,[1] and Porphyry enumerates the parts played by the chief officials of Eleusis at one point in the mystic drama.[2] It is also certain that figures, probably of great size, were introduced by machinery. The terms *φάσματα ἅγια*, *εὐδαίμονα*, *θεῖα*, *ἄρρητα*, are applied to the mystic sights.[3]

The Homeric *Hymn* to Demeter is a religious, not an historical myth. It does not relate the origin of agriculture, for the gift with which the goddess rewards her Eleusinian hosts is not the art of agriculture but the knowledge of the Mysteries (l. 273, 474). It springs directly from the cultus of Eleusis, and contains the *ἱερὸς λόγος*, the fortunes of the two goddesses, mother and daughter, the periodical representation of which formed the basis of the ritual. It is, of course, not a complete description of the ritual; it is an exoteric and poetic statement, in which the most holy of the rites and the most mysterious of the personages are alluded to only in an indirect way. The express statement of Clement,[4] that the whole myth of Cora was represented at Eleusis, confirms the inference drawn from the *Hymn*. Many writers[5] refer to the appearance presented by the shores and bay of Eleusis on the *dies lampadum*, when the worshippers wandered in the darkness with torches searching for the lost Cora. This ceremony took place in the open country, and was therefore not a part of the mystic ritual revealed to the *μύσται* in the *τελεστήριον*. It probably took place on Boedromion 21, on the night before the mystic rites proper began. The *μύσται* waited outside the sacred enclosure in perfect darkness on the moonless eve of Boedromion 22. Suddenly the *προπύλαια* were thrown open, and the light was seen streaming through the *ὀπαῖον* in the roof of the *τελεστήριον* and through the open door in which stood the *δᾳδοῦχος* holding up the sacred torches. This scene is frequently alluded to.[6] The scenes inside the *τελεστήριον* are mentioned less frequently,[7] but the few references point to episodes in the myth of Demeter and Cora. The hymn refers in guarded terms to the *παράδοσις τῶν ἱερῶν*, the central act of the mystic ritual. Clement enumerates the simple objects that were displayed, and gives the formula in which each *μύστης* replied as he received from the hierophant the holy objects: "I have fasted, and I have drunk the *κυκεών*; I have taken from the *κίστη*; after tasting I have deposited in the *κάλαθος*, and from the *κάλαθος* in the *κίστη*."[8] In these words he professed that he had fulfilled the sacred duties.

This whole myth bears most evidently the character of having been acted continuously at one time. It could not have been divided without losing its power over the attention and emotions of the *μύσται*. But it seems almost certain that there were two nights of mystic ceremonial, 22 and 23 Boedromion.[9] It is probable therefore, that another play with a distinct subject was acted on one of these nights, and as the play just described is certainly the original and central point in the Eleusinian ritual it was probably acted on the first night. Again, it is certain that there was a distinction between *μύσται* and *ἐπόπται* at Eleusis. As the *μύσται* were not admitted to witness the ritual of *ἐποψις*, it is highly probable that the second night was devoted to the higher ceremonial. It would be exceedingly difficult to effect a change in the middle of the night from the *μύησις* to the *ἐποψις*, and the good order and regularity for which the Eleusinia were famed could hardly have been maintained. The *Hymn* refers in covert terms to the holy child Iacchus, to his death and resurrection (262-4). There seems no place for Iacchus in the ritual as yet described. It is therefore a plausible conjecture that the *ἐποψις* was devoted more especially to the mystic child; and further examination will make this conjecture almost a certainty.

The development of the Eleusinian religion is a matter of speculation, but cannot be wholly passed over. Several elements must be distinguished.

1. Demeter always represents the productive and nourishing power of the earth. (*a*) In the simplest form of her cultus the act by which the earth-goddess is fertilised is conceived as an outrage and a deed of violence. The goddess, enraged, hides herself in a cave; winter and death reign in the world. At last she is appeased; she bathes in the sacred stream; her child is born, and the life of spring blooms on the earth. This cultus is most distinctly seen in Arcadia. (*b*) The worship of Demeter Thesmophorus is the religion of a more educated race; the goddess is the giver of all law, especially of the law of marriage, on which all society is founded. The worship of Demeter Thesmophorus is restricted more or less completely to women. It appears to have been the national religion of the Cadmeones, and the house of Cadmus at Thebes was the first temple of the goddess; but it spread early into Attica. The Argolic Demeter is very similar, but her cultus has been affected by Eleusinian influence. The Thesmophoric rites are so obscure that no sure idea can be gained of the relation between them and the simpler Arcadian cultus. The anger of Demeter Achea or Achaia formed part of them, and the ritual has, as A. Mommsen observes,[10] an Oriental character of vehement mourning; but we know not how the wrath of the goddess was kindled and allayed, how the alternation of winter and summer was conceived. (*c*) Eleusis was apparently the original seat of a modified form of this cultus, in which Demeter was associated with Cora. The modification perhaps arose through the fusion of the religions of two races which united in the fertile Eleusinian plain.

2. The marriage of Cora is a form of the widespread idea that the marriage of the god and goddess each spring is the pledge and cause of the fertility of earth. The "holy marriage" was celebrated in Samos, Argos, &c., with the rites of an earthly marriage, and vestiges of the primitive custom of marriage by capture can be traced in the ceremony. According to the *ἱερὸς λόγος* of Eleusis the rape of Cora takes place in the spring (*Hymn*, l. 6, 425); it is the holy marriage by capture. But the Eleusinian myth is marked as composite and not original by an important fact; it does not explain the vicissitude of winter and summer. The abduction takes place once in the spring; winter arises from the anger of Demeter; but ever afterwards Cora goes to her husband in the autumn with her mother's consent and returns in the spring. The myth has ceased to be closely and obviously connected with the life of nature. The two cults each lost something when they were amalgamated. The annual Theogamia, a central point in the original worship of Cora,[11] becomes a mere disagreeable episode in the life of the two

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[1] See l. 24, *ὅσα δὲ δεῖ διασκευάζεσθαι εἰς θεῶν διάθεσιν*, with Sauppe's and Foucart's commentaries.

[2] Ap. Euseb., *Præp. Evang.*, iii. 12, p. 117.

[3] Themist., *Or.*, xvi. p. 244, *τὴν εἰρήνην εἰσῆγεν ὥσπερ ἐν τελετῇ ἀψοφητὶ καὶ ἀπραγμόνως*; Stob., *Serm.*, cxix. p. 604; Aristid., *Or.*, xix. 416, &c.

[4] Cl. Alex., *Protrept.*, ii. p. 12.

[5] Themist., *Or.*, xx. p. 235 (p. 288, ed. Dind.); Lobeck, p. 52; Claudian, *De Rapt. Proserp.*, l. 5-15; Lucian, *Catapl.*, 22; Plut. ap. Stob., *Serm.*, cxix. p. 604, and Plut., *Prof. Virt. Sent.*, i. p. 312 (ed. Wytt).

[6] Ar., *Ran.*, 340-52; Soph., *Œd. Col.*, 1045; Eur., *Ion*, 1075 *sq.*; Æsch., *Fragm.*, quoted by schol. on Soph., l.c., &c.

[7] Procl. on Plat., *Polit.*, p. 384, *αὐτῆς τῆς μεγίστης θεᾶς ἱεροὺς τινας ἐν ἀπορρήτοις θρήνους αἱ τελεταὶ παραδιδόασι*; Apollod. ap. schol. Theocr., ii. 36, *Ἀθήνῃσι τὸν ἱεροφάντην τῆς Κόρης ἐπικαλουμένης ἐπικρούειν τὸ καλούμενον ἠχεῖον*; Hecate appeared on the stage (*Hymn*, l. 52); Claud., *Rapt. Pros.*, 15; Helios and Hermes (*Hymn*, l. 74, 346) both appeared on the stage, see note 2 above.

[8] *Protrept.*, p. 18; Arnob., v. 26, "quæ rogati sacrorum in acceptionibus respondeant."

[9] Mommsen and Lenormant have given several reasons to think that there were two nights of Mysteries.

[10] *Heortol.*, under "Thesmophoria"; cf. Plut., *Solon*, 12.

[11] At Nysa, Cyzicus, and elsewhere.

goddesses. Demeter ceases to be directly connected with the life of the year, and affects it only through the fortunes of her daughter. It is an important point that the vehement self-forgetting enthusiasm characterizing devotees who feel their complete dependence on their deities can be traced from the beginning in the worship of the mother of all earthly life. This enthusiasm was increased by the next stage in the development of the Mysteries, the fusion of the cults of Demeter-Persephone and of Dionysus. It is uncertain how and when this fusion began; it is certain that it was not completed till after the union of Eleusis and Athens.

3. The worship of Dionysus can be traced in two phases. The cultus of the wine-god with simple rural character, rude and gross symbolism, was the religion of uneducated peasants, its chief seat being in the borderland of Attica and Bœotia. Another form of the religion of Dionysus with its orgiastic enthusiasm and its mystic character penetrated into Greece from Thrace, was accepted at Delphi alongside of the Apolline worship,[1] and established itself at Eleutheræ and on Mount Parnassus, where the women of Phocis and Attica united in the rites and revels of the god every second winter. The Dionysus of Eleutheræ was carried to Athens when the places were united, and the worship of Dionysus Eleuthereus was one of the most splendid and most impressive in the state; under its shelter grew the Attic drama.

The unification of the Attic land required as its pledge and completion the unification of the Attic religion. A common religion bound together every association in Greece; a people united politically, yet divided religiously, was an unintelligible idea to the ancient mind. When, through the decay of the Megarian power, the Eleusinian valley was incorporated in the Attic state, the worship of the Eleusinian goddess was established under the Athenian acropolis, and the whole land united in her worship. Eleusis always occupied a peculiarly independent position in Attica; it retained its own cultus in its own hands, and it had, like Salamis, the right of issuing coins.[2] It seems to have been only at a late date that the religious fusion was completed, and the relation between the Eleusinian and Attic religions was conceived in a very different style from the crude fictions by which at an earlier time Poseidon and Apollo had been incorporated in the Attic state religion.[3] The political and religious system which produced peace among the warring sections of the Attic people was due to Solon. His friendship with the mystic Epimenides, an historical fact encrusted with much legend, shows the tone in which the religious part of the task was executed. But the work of Solon would not have proved efficient if it had done more than formulate and legalize the actual tendencies of the country. Especially in religion the system was growing before Solon and continued to grow after him. To this period—*i.e.*, the 6th century B.C.—and to the spirit of mysticism which was so strong in Attica and in Greece generally at this time we must attribute the final moulding of the Eleusinian ritual.

According to the mystic theory, the multitude of deities are merely forms of the ultimate single divine nature dividing itself into male and female to become the origin of life on the earth. This theory was that of the Orphic theology, and many facts show that the Orphic theology moulded the Eleusinian ritual. Dionysus, under the mystic name Iacchus, was identified with the son of Demeter, Plutus, the prosperity that she bestows on the world. Eleusis and Athens were united in one mystic ritual, part of which was performed in Athens, part on the road from Athens to Eleusis, and the most important rites in Eleusis. The process by which the shrines along the Sacred Way became connected with the religion of Demeter and Iacchus was doubtless gradual; but the outlines of the system were certainly complete before the battle of Salamis (Herod., viii. 65). Not only in the Eleusinian ritual, but throughout Attic religion, a tendency to mix the cult of Athena with that of Demeter can be traced. They are very often enshrined in the same temple. In the autumn the holy ploughings were performed in the Rharian plain, at Sciron, and under the acropolis by the βουζύγης. Demeter in her anger wears the γοργόνειον on her breast; she was so represented in the colossal statue at Eleusis, a fragment of which is now in Cambridge. The religious thought which expressed itself in this way obviously identified Demeter with Athena. Again, we find through Attic art and literature in the 5th century B.C. a tendency to mix Apollo and Dionysus, to show an Apollo Cisseus, a Dionysus Melpomenus, to invoke δέσποτα φιλόδαφνε Βάκχε παιὰν Ἄπολλον εὔλυρε. Apollo and Dionysus shared the presidency of Delphi.[4] The tendency which Gerhard has proved to represent Demeter and Cora as undistinguishable springs from the same mystic system. The identification of Artemis and Persephone, which Æschylus makes, was probably taught at Eleusis (*Hymn*, l. 440).

If material existed to study the ritual of the shrines along the Sacred Way, we should find abundant examples of the working of the mystic system. Pausanias tells that the cultus of Apollo in the pass of Dafni grew into a worship of Demeter, Cora, Athena, and Apollo. Again, in reference to the worship of the hero Cyamites on the Sacred Way, he says that those who have been initiated at Eleusis, or who have read the Orphic books, will understand his religious silence. The same writer[5] mentions that Orphic hymns were used in the Eleusinian ritual, and Preller has conclusively proved the great influence exerted by Orphic teaching at Eleusis. Through this close connexion of Orphism with the Eleusinian Mysteries, we understand how, when the family of the Dadouchi died out in the 4th century B.C., the office was not filled up from the closely related family of the Ceryces, but given to the Lycomidæ, who held in their hands the Orphizing mystic cultus of Phlya. If there had not been a great similarity between the ritual of Eleusis and of Phlya, it is inconceivable that the high office of δᾳδοῦχος should have been given to a family unconnected with Eleusis. It is easy to trace the same mystic tendency in later time. In the Alexandrine period it was usual to identify Isis with Demeter, and even to maintain that the Eleusinian Mysteries were derived from Egypt. In later times the Neo-Platonic philosophy acquired influence at Eleusis, and hence we find that, according to Porphyry, the hierophant represented the "demiurgos."

There is every reason to believe that the Bacchic rites can be traced through Thrace to Phrygian influence, and that the spirit of Orphism was that of the Oriental Phrygian cultus. Moreover, the most holy and perfect rite in the Eleusinian Mysteries was to show an ear of corn mowed down in silence,[6] and this was a symbol of the Phrygian Atys. Now Clement describes in great detail a mystic ceremony, some parts of which he attributes to Phrygia, though the general tone of the passage rather refers it to Eleusis; some of the grossest details of this ceremony are expressly referred to Eleusis by other Christian writers.[7] These facts lead to the belief—(1) that Clement purposely mixes up two ceremonies which were similar to one another, Phrygian and Eleusinian Mysteries; (2) that this scene was acted at Eleusis on the eve of Boedr. 23; (3) that it was introduced under the influence of the Orphic mystic philosophy. Knowing that the Phrygian rites were decried by many who praised the Eleusinian, Clement delights to emphasize points of resemblance between them. The details given in the long account of Clement fully justify the invectives of the Christian writers. It is, however, easy to understand the answer that the Neo-Platonic philosophers who admired the Mysteries would make to their assailants. Religion places men face to face with the actual facts of life; when the mind is exalted and ennobled by intense religious enthusiasm it is able to look with pure insight at phenomena of life in which the vulgar unpurified mind sees nothing but gross materialism. The language of religion is plainer and more direct than the language of common life. Those who distinguished between the character of the Eleusinian and Phrygian rites might say that the same symbolism can be looked at with gross eyes or with idealized eyes, and might quote the contrast between the Aphrodite of Praxiteles and its rude Phœnician prototype; the attitude, the position of the hands is the same, but the whole meaning is changed.

It is unnecessary to enter into the question whether the Mysteries go back to a primitive "Pelasgic" religion, or are borrowed from Oriental religion. All that gives elevation and ideality to them was added by the Hellenic genius. But that spirit of enthusiastic self-abandonment which made the μύσται forget themselves in the divine nature never belonged to the true Hellenic temperament; the Mysteries were an attempt of the Hellenic genius to take into its service the spirit of Oriental religion.

It is impossible here to speak of the other Mysteries; subjects of similar nature are referred to under Mithras, Orpheus, Phrygia. The Eleusinian Mysteries were the most perfect example of the type in Greece; but our scanty information leads to the belief that all Hellenic Mysteries tried more or less successfully to attain the same results. Those non-Hellenic Mysteries which found their way into Greece from the 5th century B.C. onwards are of course excluded from this statement.[8] (W. M. RA.)

MYSTERY; or Miracle Play. See Drama, vol. vii. p. 413.

MYSTICISM is a phase of thought, or rather perhaps of feeling, which from its very nature is hardly susceptible of exact definition. It appears in connexion with the endeavour of the human mind to grasp the divine essence or the ultimate reality of things, and to enjoy the blessedness of actual communion with the Highest. The first is the philosophic side of mysticism; the second, its religious side. The first effort is theoretical or speculative; the second, practical. The thought that is most intensely present with the mystic is that of a supreme, all-pervading, and indwelling power, in whom all things are one. Hence the speculative utterances of mysticism are always more or less pantheistic in character. On the practical side, mysticism maintains the possibility of direct intercourse with this Being of beings—intercourse, not through any external media such as an historical revelation, oracles, answers to prayer, and the like, but by a species of ecstatic transfusion or identification, in which the individual becomes in very truth "partaker of the divine nature." God ceases to be an object to him and becomes an experience. In the writings of the mystics, ingenuity exhausts itself in the invention of phrases to express the closeness of this union. Mysticism differs, therefore, from ordinary pantheism in that its inmost motive is religious. Pantheism, considered merely as such, may be either an elevating or a degrading theory; it expresses merely the resolution of all things into one metaphysical power or substance. But the mystic is animated not merely by the desire of intellectual harmony; he seeks the deepest ground of his own being, in order that he may cast aside whatever separates him from the true life. This religious impulse is shown in the fact that, whereas pantheism, as such, seems to lead logically to passive acquiescence in things as they are—all things being already as divine as it is their nature to be—mysticism, on the contrary, is penetrated by the thought of alienation from the divine. Even where it preaches most our essential unity with God, its constant and often painful effort is directed towards overcoming an admitted alienation. In other words, the identity with God which it teaches is not a mere natural identity, as in ordinary pantheism, but one which is the goal of achievement.

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[1] Apollo ruled at Delphi for nine months of the year, Dionysus for the other three.

[2] Köhler in *Mittheil. Inst. Ath.*, iv. 250.

[3] The god Ποσειδῶν Γαιήοχος καὶ Ἐρεχθεύς, a fiction of the state religion; Apollo, a son of Athena and Hephæstus in Attic legend; cf. Harpocr. on θεὸς πατρῷος with Cic., *N. D.*, iii. 22.

[4] Eur., *Ion*, 1075 *sq.*

[5] Paus., i. 14; ix. 27.

[6] *Philosophumena*, ed. Miller, v. 8, p. 115.

[7] Cl., *Protr.*, p. 11; see quotations in Lobeck, p. 199 *sq.*

[8] On these non-Hellenic Mysteries see Foucart, *Assoc. Relig.*

These considerations do not serve, however, to differentiate mysticism sufficiently from the general course of religious thought. Alienation from, and yet implicit oneness with, the divine are the two poles on which all religious speculation and practice revolve. It follows from the above that mysticism is distinguished from other religious theories of the relation of man to God by the intensity with which it realises the divine factor in the relation. The realization is so vivid that, though the theory takes its rise in the needs of the individual, the individual tends in the sequel to be lost altogether in the excess of the divine light. All relations tend to become unreal for the mystic except that between himself and God; his very sense of personality is weakened. The mystical ideal, therefore, is not a life of ethical energy among mankind; it is the eye turned wholly inwards, the life spent in contemplation and devout communion. The type of character to which mysticism is allied is passive, sensuous, and feminine, rather than independent, masculine, and ethically vigorous. In full-blown mysticism the individual may be said to be deprived of the rights which belong to him as an ethical personality.

The speculative bias, it will be seen, is much stronger in the mystic than in the generality of religious persons; and his speculative insight, it may be added, is usually much finer than theirs. The ordinary man, in religious matters as in others, constantly speaks of the infinite in such a way as virtually to make it finite. As Spinoza says, he passes confidently from finite to infinite and contrariwise, but never attempts to bring the two ideas together. Now mysticism does bring them together, but unfortunately in such a way as to paralyse the individual for action. Ultimately stated, the explanation of this result is to be found in the mistaken categories under which the relation is conceived. The conception of a universal substance or ground of things is naturally the first resort of the mind awakened to speculation; and it is a form which constantly recurs when men are roused afresh to philosophical activity. Nevertheless, the conception is evidently rude. It expresses properly a relation existing between material things in space; and, when applied elsewhere, is necessarily inadequate, analogical, metaphorical. But it is characteristic of mysticism that it does not distinguish between what is metaphorical and what is susceptible of a literal interpretation. Hence it is prone to treat a relation of ethical harmony as if it were one of substantial identity, or chemical fusion; and, taking the sensuous language of religious feeling literally, it bids the individual aim at nothing less than an interpenetration of essence. And, as this goal is unattainable while reason and the consciousness of self remain, the mystic begins to consider these as impediments to be cast aside. Our consciousness of self is the condition under which we possess a world to know and to enjoy; but it likewise isolates us from all the world beside. Reason is the revealer of nature and of God; but, by its very act, reason seems to separate the things reasoned about. Hence mysticism demands a faculty above reason, by which the subject shall be placed in immediate and complete union with the object of his desire,—a union in which the consciousness of self has disappeared, and in which, therefore, subject and object are one. This is the intuition or ecstasy or mystical swoon which appears alike among the Hindus, the Neo-Platonists, and the mediæval saints. And here it will be observed that the original acceptance of metaphor as speculative truth has terribly avenged itself; for, with the renunciation of self-conscious reason, the divine has been degraded into an object of sense, and its highest realization has come to be placed either in a state of brutish torpor or in a moment of equally unnatural nervous excitation. Not that mysticism always appears in this extreme form, but such is the goal towards which it constantly tends. If the sensuous metaphors of unsophisticated religious feeling be put forward as a metaphysical theory of the supersensuous, it is only to be expected that the practice deduced from such a theory will be a sophisticated or morbid development of sense, a strain put upon the bodily organs to make them yield a realization of the theory and achieve what is impossible to the sane and conscious reason. The morbid play of the nerves is objectified by the over-driven brain and treated as a sensuous union of the created with the creative spirit, an actual seeing, nay, tasting, of the divine essence.

To sum up, then, we may say that, compared with pantheism, mysticism is dependent upon a specifically religious impulse; but, whereas religion is ordinarily occupied with a practical problem and develops its theory in an ethical reference, mysticism displays a predominatingly speculative bent, starting from the divine nature rather than from man and his surroundings, taking the symbolism of religious feeling as literally or metaphysically true, and straining after the present realization of an ineffable union. The union which sound religious teaching represents as realized in the submission of the will and the ethical harmony of the whole life is then reduced to a passive experience, to something which comes and goes in time, and which may be of only momentary duration.

From these general remarks it will be sufficiently apparent that mysticism is not a name applicable to any particular system. It may be the outgrowth of many differing modes of thought and feeling. Most frequently it appears historically, in relation to some definite system of belief, as a reaction of the spirit against the letter. When a religion begins to ossify into a system of formulas and observances, those who protest in the name of heart-religion are not unfrequently known by the name of mystics. At times they merely bring into prominence again the ever-fresh fact of personal religious experience; at other times mysticism develops itself as a powerful solvent of definite dogmas.

A review of the historical appearances of mysticism will serve to show how far the above characteristics are to be found, separately or in combination, in its different phases.

In the East, mysticism is not so much a specific phenomenon as a natural deduction from the dominant philosophic systems, and the normal expression of religious feeling in the lands in which it appears. Brahmanic pantheism and Buddhistic nihilism alike teach the unreality of the seeming world, and preach mystical absorption as the highest goal; in both, the sense of the worth of human personality is lost. India consequently has always been the fertile mother of practical mystics and devotees. The climate itself encourages to passivity, and the very luxuriance of vegetable and animal life tends to blunt the feeling of the value of life. Silent contemplation and the total deadening of consciousness by perseverance for years in unnatural attitudes are among the commonest forms assumed by this mystical asceticism. But the most revolting methods of self-torture and self-destruction are also practised as a means of rising in sanctity. The sense of sin can hardly be said to enter into these exercises; that is, they are not undertaken as penance for personal transgression. They are a despite done to the principle of individual or separate existence.

The so-called mysticism of the Persian Sufis is less intense and practical, more airy and literary in character. Sufism (probably derived from σοφός) appears in the 9th century among the Mohammedans of Persia as a kind of reaction against the rigid monotheism and formalism of Islam (see MOHAMMEDANISM, vol. xvi. p. 594). It is doubtless to be regarded as a revival of ancient habits of thought and feeling among a people who had adopted the Koran, not by affinity, but by compulsion. Persian literature after that date, and especially Persian poetry, is full of an ardent natural pantheism, in which a mystic apprehension of the unity and divinity of all things heightens the delight in natural and in human beauty. Such is the poetry of Hafiz and Saadi, whose verses are chiefly devoted to the praises of wine and women. Even the most licentious of these have been fitted by Mohammedan theologians with a mystical interpretation. The delights of love are made to stand for the raptures of union with the divine, the tavern symbolizes an oratory, and intoxication is the bewilderment of sense before the surpassing vision. Very often, if not most frequently, it cannot be doubted that the occult religious significance depends on an artificial exegesis; but there are also poems of Hafiz, Saadi, and other writers, religious in their first intention. These are unequivocally pantheistic in tone, and the desire of the soul to escape and rest with God is expressed with all the fervour of Eastern poetry. This speculative mood, in which nature and beauty and earthly satisfaction appear as a vain show, is the counterpart of the former mood of sensuous enjoyment.

For opposite reasons, neither the Greek nor the Jewish mind lent itself readily to mysticism,—the Greek, because of its clear and sunny naturalism; the Jewish, because of its rigid monotheism and its turn towards worldly realism and statutory observance. It is only with the exhaustion of Greek and Jewish civilization that mysticism becomes a prominent factor in Western thought. It appears, therefore, contemporaneously with Christianity, and is a sign of the world-weariness and deep religious need that mark the decay of the old world. Whereas Plato's main problem had been the organization of the perfect state, and Aristotle's intellect had ranged with fresh interest over all departments of the knowable, political speculation had become a mockery with the extinction of free political life, and knowledge as such had lost its freshness for the Greeks of the Roman empire. Knowledge is nothing to these men if it does not show them the infinite reality which is able to fill the aching void within. Accordingly, the last age of Greek philosophy is theosophical in character, and its ultimate end is a practical satisfaction. Neo-Platonism seeks this in the ecstatic intuition of the ineffable One. The systematic theosophy of Plotinus and his successors does not belong to the present article, except so far as it is the presupposition of their mysticism; but, inasmuch as the mysticism of the mediæval church is directly derived from Neo-Platonism through the speculations of the Pseudo-Dionysius, Neo-Platonic mysticism fills an important section in any historical review of the subject.

Neo-Platonism owes its form to Plato, but its underlying motive is the widespread feeling of self-despair and the longing for divine illumination characteristic of the age in which it appears. Before the rise of Neo-Platonism proper we meet with various mystical or semi-mystical expressions of the same religious craving. The contemplative asceticism of the Essenes of Judæa may be mentioned, and, somewhat later, the life of the Therapeutæ on the shores of Lake Mœris. In Philo, Alexandrian Judaism had already seized upon Plato as "the Attic Moses," and done its best to combine his speculations with the teaching of his Jewish prototype. Philo's God is described in terms of absolute transcendency; his doctrine of the Logos or Divine Sophia is a theistical transformation of the Platonic world of ideas; his allegorical interpretation of the Old Testament represents the spiritualistic dissolution of historical Judaism. Philo's ethical ideal is renunciation, contemplation, complete surrender to the divine influence. Apollonius of Tyana and the so-called Neo-Pythagoreans drew similar ethical consequences from their eclectic study of Plato. Wonder-workers like Alexander of Aboniteichos exhibit the grosser side of the longing for spiritual communion. The traits common to Neo-Platonism and all these speculations are well summed up by Zeller (*Philos. der Griechen*, iii. 2. 214) as consisting in—"(1) the dualistic opposition of the divine and the earthly; (2) an abstract conception of God, excluding all *knowledge* of the divine nature; (3) contempt for the world of the senses, on the ground of the Platonic doctrines of matter and of the descent of the soul from a superior world into the body; (4) the theory of intermediate potencies or beings, through whom God acts upon the world of phenomena; (5) the requirement of an ascetic self-emancipation from the bondage of sense and faith in a higher revelation to man when in a state called enthusiasm." Neo-Platonism appears in the first half of the 3d century, and has its greatest representative in Plotinus (204-269 A.D.). He develops the Platonic philosophy into an elaborate system by means of the doctrine of emanation. The One, the Good, and the Idea of the Good were identical in Plato's mind, and the Good was therefore not deprived of intelligible essence. It was not separated from the world of ideas, of which it was represented as either the crown or the sum. By Plotinus, on the contrary, the One is explicitly exalted above the νοῦς and the "ideas"; it transcends existence altogether (ἐπέκεινα τῆς οὐσίας), and is not cognizable by reason. Remaining itself in repose, it rays out, as it were, from its own fulness an image of itself, which is called νοῦς, and which constitutes the system of ideas or the intelligible world. The soul is in turn the image or product of the νοῦς, and the soul by its motion begets corporeal matter. The soul thus faces two ways—towards the νοῦς, from which it springs, and towards the material life, which is its own product. Ethical endeavour consists in the repudiation of the sensible; material existence is itself estrangement from God. (Porphyry tells us that Plotinus was unwilling to name his parents or his birthplace, and seemed ashamed of being in the body.) Beyond the *καθάρσεις*, or virtues which purify from sin, lies the further stage of complete identification with God (*οὐκ ἔξω ἁμαρτίας εἶναι, ἀλλὰ θεὸν εἶναι*). To reach the ultimate goal, thought itself must be left behind; for thought is a form of motion, and the desire of the soul is for the motionless rest which belongs to the One. The union with transcendent deity is not so much knowledge or vision as ecstasy, coalescence, *contact* (*ἔκστασις, ἅπλωσις, ἁφή*, *Ennead.*, vi. 9. 8-9). But in our present state of existence the moments of this ecstatic union must be few and short; "I myself," says Plotinus simply, "have realized it but three times as yet, and Porphyry hitherto not once."

It will be seen from the above that Neo-Platonism is not mystical as regards the faculty by which it claims to apprehend philosophic truth. It is first of all a system of complete rationalism; it is assumed, in other words, that reason is capable of mapping out the whole system of things. But, inasmuch as God is affirmed beyond reason, the mysticism becomes in a sense the necessary complement of the would-be all-embracing rationalism. The system culminates in a mystical act, and in the sequel, especially with Iamblichus and the Syrian Neo-Platonists, mystical practice tended more and more to overshadow the theoretical groundwork.

It was probably about the end of the 5th century, just as ancient philosophy was dying out in the schools of Athens, that the speculative mysticism of Neo-Platonism made a definite lodgment in Christian thought through the literary forgeries of the Pseudo-Dionysius. The doctrines of Christianity were by that time so firmly established that the church could look upon a symbolical or mystical interpretation of them without anxiety. The author of the *Theologia Mystica* and the other works ascribed to the Areopagite proceeds, therefore, to develop the doctrines of Proclus with very little modification into a system of esoteric Christianity. God is the nameless and supra-essential One, elevated above goodness itself. Hence "negative theology," which ascends from the creature to God by dropping one after another every determinate predicate, leads us nearest to the truth. The return to God (*ἕνωσις, θέωσις*) is the consummation of all things and the goal indicated by Christian teaching. The same doctrines were preached with more of churchly fervour by Maximus the Confessor (580-622). Maximus represents almost the last speculative activity of the Greek Church, but the influence of the Pseudo-Dionysian writings was transmitted to the West in the 9th century by Erigena, in whose speculative spirit both the scholasticism and the mysticism of the Middle Ages have their rise. Erigena translated Dionysius into Latin along with the commentaries of Maximus, and his system is essentially based upon theirs. The negative theology is adopted, and God is stated to be predicateless Being, above all categories, and therefore not improperly called Nothing. Out of this Nothing or incomprehensible essence the world of ideas or primordial causes is eternally created. This is the Word or Son of God, in whom all things exist, so far as they have substantial existence. All existence is a theophany, and as God is the beginning of all things, so also is He the end. Erigena teaches the restitution of all things under the form of the Dionysian *adunatio* or *deificatio*. These are the permanent outlines of what may be called the philosophy of mysticism in Christian times, and it is remarkable with how little variation they are repeated from age to age.

In Erigena mysticism has not yet separated itself in any way from the dogma of the church. There is no revulsion, as later, from dogma as such, nor is more stress laid upon one dogma than upon another; all are treated upon the same footing, and the whole dogmatic system is held, as it were, in solution by the philosophic medium in which it is presented. No distinction is drawn, indeed, between what is reached by reason and what is given by authority; the two are immediately identical for Erigena. In this he agrees with the speculative mystics everywhere, and differentiates himself from the scholastics who followed him. The distinguishing characteristic of scholasticism is the acceptance by reason of a given matter, the truth of which is independent of rational grounds, and which remains a presupposition even when it cannot be understood. Scholasticism aims, it is true, in its chief representatives, at demonstrating that the content of revelation and the teaching of reason are identical. But what was matter of immanent assumption with Erigena is in them an equating of two things which have been dealt with on the hypothesis that they are separate, and which, therefore, still retain that external relation to one another. This externality of religious truth to the mind is fundamental in scholasticism, while the opposite view is equally fundamental in mysticism. Mysticism is not the voluntary demission of reason and its subjection to an external authority. In that case, all who accept a revelation without professing to understand its content would require to be ranked as mystics; the fierce sincerity of Tertullian's *credo quia absurdum*, Pascal's reconciliation of contradictions in Jesus Christ, and Bayle's half-sneering subordination of reason to faith would all be marks of this standpoint. But such a temper of mind is much more akin to scepticism than to mysticism; it is characteristic of those who either do not feel the need of philosophizing their beliefs, or who have failed in doing so and take refuge in sheer acceptance. Mysticism, on the other hand, is marked on its speculative side by even an overweening confidence in human reason. Nor need this be wondered at if we consider that the unity of the human mind with the divine is its underlying presupposition. Hence where reason is discarded by the mystic it is merely reason overleaping itself; it occurs at the end and not at the beginning of his speculations. Even then there is no appeal to authority; nothing is accepted from without. The appeal is still to the individual, who, if not by reason then by some higher faculty, claims to realize absolute truth and to taste absolute blessedness.

Mysticism first appears in the mediæval church as the protest of practical religion against the predominance of the dialectical spirit. It is so with Bernard of Clairvaux (1091-1153), who condemns Abelard's distinctions and reasonings as externalizing and degrading the faith. Bernard's mysticism is of a practical cast, dealing mainly with the means by which man may attain to the knowledge and enjoyment of God. Reason has three stages, in the highest of which the mind is able, by abstraction from earthly things, to rise to *contemplatio* or the vision of the divine. More exalted still, however, is the sudden *ecstatic* vision, such as was granted, for example, to Paul. This is the reward of those who are dead to the body and the world. Asceticism is thus the counterpart of mediæval mysticism; and, by his example as well as by his teaching in such passages, Bernard unhappily encouraged practices which necessarily resulted in self-delusion. Love grows with the knowledge of its object, Bernard proceeds, and at the highest stage self-love is so merged in love to God that we love ourselves only for God's sake or because God has loved us. "Te enim quodammodo perdere tanquam qui non sis, et omnino non sentire te ipsum et a te ipso exinaniri et pene annullari, cœlestis est conversationis. . . . Sic affici deificari est." "As the little water-drop poured into a large measure of wine seems to lose its own nature entirely and to take on both the taste and the colour of the wine, or as iron heated red-hot loses its own appearance and glows like fire, or as air filled with sunlight is transformed into the same brightness so that it does not so much appear to be illuminated as to be itself light,—so must all human feeling towards the Holy One be self-dissolved in unspeakable wise, and wholly transfused into the will of God. For how shall God be all in all if anything of man remains in man? The substance will indeed remain, but in another form, another glory, another power" (*De diligendo Deo*, c. 10). These are the favourite similes of mysticism, wherever it is found.

Mysticism was more systematically developed by Bernard's contemporary Hugo of St Victor (1096-1141). The Augustinian monastery of St Victor near Paris became the headquarters of mysticism during the 12th century. It had a wide influence in awakening popular piety, and the works that issued from it formed the text-books of mystical and pietistic minds in the centuries that followed. Hugo's pupil, Richard of St Victor, declares, in opposition to dialectic scholasticism, that the objects of mystic contemplation are partly above reason, and partly, as in the intuition of the Trinity, contrary to reason. He enters at length into the conditions of ecstasy and the yearnings that precede it. Walter, the third of the Victorines, carried on the polemic against the dialecticians. Bonaventura (1221-74) was a diligent student of the Victorines, and in his *Itinerarium mentis ad Deum* maps out the human faculties in a similar fashion. He introduces the terms "apex mentis" and "scintilla" (also "synderesis" or συντήρησις) to describe the faculty of mystic intuition. Bonaventura runs riot in phrases to describe the union with God, and his devotional works were much drawn upon by mystical preachers. Fully a century later, when the system of scholasticism was gradually breaking up under the predominance of Occam's nominalism, Pierre d'Ailly (1350-1425), and his more famous scholar John Gerson (1363-1429), chancellor of the university of Paris, are found endeavouring to combine the doctrines of the Victorines and Bonaventura with a nominalistic philosophy. They are the last representatives of mysticism within the limitations imposed by scholasticism.

From the 12th and 13th centuries onward there is observable in the different countries of Europe a widespread reaction against the growing formalism and worldliness of the church and the scandalous lives of many of the clergy. Men began to feel a desire for a theology of the heart and an unworldly simplicity of life. Thus there arose in the Netherlands the Beguines and Beghards, in Italy the Waldenses (without, however, any mystical leaning), in the south of France and elsewhere the numerous sect or sects of the Cathari, and in Calabria the apocalyptic gospel of Joachim of Floris, all bearing witness to the commotion of the time. The lay societies of the Beghards and Beguines (for men and women respectively) date from the end of the 12th century, and soon became extremely popular both in the Low Countries and on the Rhine. They were free at the outset from any heretical taint, but were never much in favour with the church. In the beginning of the 13th century the foundation of the Dominican and Franciscan orders furnished a more ecclesiastical and regular means of supplying the same wants, and numerous convents sprang up at once throughout Germany. The German mind was a peculiarly fruitful soil for mysticism, and, in connexion either with the Beguines or the church organization, a number of women appear about this time, combining a spirit of mystical piety and asceticism with sturdy reformatory zeal directed against the abuses of the time. Even before this we hear of the prophetic visions of Hildegard of Bingen (a contemporary of St Bernard) and Elizabeth of Schönau. In the 13th century Elizabeth of Hungary, the pious landgravine of Thuringia, assisted in the foundation of many convents in the north of Germany. For an account of the chief of these female saints the reader is referred to the first volume of Preger's *Geschichte der deutschen Mystik*. Mechthild of Magdeburg appears to have been the most influential, and her book *Das fliessende Licht der Gottheit* is important as the oldest work of its kind in German. It proves that much of the terminology of German mysticism was current before Eckhart's time. Mechthild's clerico-political utterances show that she was acquainted with the "eternal gospel" of Joachim of Floris. Joachim had proclaimed the doctrine of three world-ages—the kingdom of the Father, of the Son, and of the Spirit. The reign of the Spirit was to begin with the year 1260, when the abuses of the world and the church were to be effectually cured by the general adoption of the monastic life of contemplation. Very similar to this in appearance is the teaching of Amalrich of Bena (*ob.* 1207); but, while the movements just mentioned were reformatory without being heretical, this is very far from being the case with the mystical pantheism derived by Amalrich from the writings of Erigena. His followers held a progressive revelation of God in the ages of the Father, Son, and Holy Spirit. Just as the Mosaic dispensation came to an end with the appearance of Christ, so the sacraments of the new dispensation have lost their meaning and efficacy since the incarnation of God as Holy Spirit in the Amalricans. With this opposition to the church they combine a complete antinomianism, through the identification of all their desires with the impulses of the divine Spirit. Amalrich's teaching was condemned by the church, and his heresies led to the public burning of Erigena's *De divisione naturæ* in 1225. The sect of the New Spirit, or of the Free Spirit as it was afterwards called, spread widely through the north of France and into Switzerland and Germany. They were especially numerous in the Rhineland in the end of the 13th and during the 14th century; and they seem to have corrupted the originally orthodox communities of Beghards, for Beghards and Brethren of the Free Spirit are used henceforward as convertible terms, and the same immoralities are related of both. Such was the seed-ground in which what is specifically known as German mysticism sprang up.

In Meister Eckhart (1260-1329;—see ECKHART) the German mind definitively asserts its pre-eminence in the sphere of speculative mysticism. Eckhart was a distinguished son of the church; but in reading his works we feel at once that we have passed into quite a different sphere of thought from that of the churchly mystics; we seem to leave the cloister behind and to breathe a freer atmosphere. The scholastic mysticism was, for the most part, practical and psychological in character. It was largely a devotional aid to the realization of present union with God; and, so far as it was theoretical, it was a theory of the faculties by which such a union is attainable. Mysticism was pieced on somewhat incongruously to a scholastically accepted theology; the feelings and the intellect were not brought together. But in Eckhart the attitude of the churchman and traditionalist is entirely abandoned. Instead of systematizing dogmas, he appears to evolve a philosophy by the free exercise of reason. His system enables him to give a profound significance to the doctrines of the church; but, instead of the system being accommodated to the doctrines, the doctrines—and especially the historical facts—acquire a new sense in the system, and often become only a mythical representation of speculative truth. The freedom with which Eckhart treats historical Christianity allies him much more to the German idealists of the 19th century than to his scholastic predecessors. In his speculative depth as well as in the fondness for reconciling apparent contradictions which often lends an air of paradox to his statements Eckhart bears a striking resemblance to Hegel; but in some determinations of his system, such as his doctrine of the Absolute, he approaches more nearly to Schelling. In view of these affinities, it has been customary to say that his interest is prevailingly intellectual, and that he is lacking in religious warmth. But this is largely due to the fusion of intellect and feeling which is often found in highly speculative natures. Eckhart's system is in itself the expression or formulation of religious feeling, and the speculative statement possesses for him a rich spiritual unction of its own. In this he is the typical representative of German, in opposition to what is often called Romanic, mysticism. The latter, both in scholastic times and in its later Catholic representatives, confines itself to the facts of religious feeling without showing itself attracted by ontological speculation.

Eckhart distinguishes between the godhead and God. The godhead is the absolute Essence (Wesen), unknowable not only by man but also by itself; it is darkness and absolute indeterminateness, "Nicht" in contrast to "Icht" or definite and knowable existence. Yet it is the potentiality of all things, and its nature is, in a triadic process, to come to consciousness of itself as the triune God. Creation is not a temporal act, but an eternal necessity of the divine nature. I am as necessary to God, Eckhart is fond of saying, as God is necessary to me. In my knowledge and love God knows and loves Himself. "The eye with which I see God is the same eye with which God sees me. My eye and God's eye are one eye, one vision, one recognition, one love." To know God, we must become ignorant of ourselves and of all creatures. "Couldst thou annihilate thyself for a moment, thou wouldst possess all that God is in Himself." The complete renunciation of selfhood is called by Eckhart "decease;" and when I am in this state God brings forth His Son in me. Or, conversely, it is I who beget God anew in my soul; "God has begotten me from eternity that I may be Father and beget Him who begat me." Our identity with God is recognized by the purely rational and uncreated activity of the soul, which Eckhart calls the "Fünklein," or spark. By this we press on beyond God into the abyss of the godhead, and Eckhart prays paradoxically "to be rid of God, that is, that God by His grace would bring him into the Essence—that Essence which is above God and above distinction."

In spite of Eckhart's daring assertions of the identity of the human and the divine, there is no reason to call in question his genuinely religious and Christian spirit. His spirit, however, was Christian in a wide sense rather than ecclesiastical; it showed itself in zeal for the upbuilding of Christian life among the people. The condemnation of the church had its effect in later times in obscuring Eckhart's importance, but it did not avail to check his powerful influence upon his contemporaries. They constantly appeal to him as "the master," the "wise," the "divine" master, "from whom God concealed nothing."

The political circumstances of Germany in the first half of the 14th century were in the last degree disastrous. The war between the rival emperors, Frederick of Austria and Louis of Bavaria, and the interdict under which the latter was placed in 1324 inflicted extreme misery upon the unhappy people. From some places the interdict was not removed for twenty-six years. Men's minds were pained and disquieted by the conflict of duties and the absence of spiritual consolation. The country was also visited by a succession of famines and floods, and in 1348 the Black Death swept over Europe like a terrible scourge. In the midst of these unhappy surroundings religion became more inward in men of real piety, and the desire grew among them to draw closer the bonds that united them to one another. Thus arose the society of the Friends of God (*Gottesfreunde*) in the south and west of Germany, spreading as far as Switzerland on the one side and the Netherlands on the other. They formed no exclusive sect. They often took opposite sides in politics, and they also differed in the type of their religious life; but they uniformly desired to strengthen one another in living intercourse with God. Among them chiefly the followers of Eckhart were to be found. Such were Heinrich Suso of Constance (1295-1366) and John Tauler of Strasburg (1300-61), the two most celebrated of his immediate disciples. Suso was a remarkable combination of self-torturing austerity with an inexhaustible play of poetic fancy. He has been called "the minnesinger of the love of God." Tauler's eloquence may be said to have made him the centre of religious life in the south-west of Germany for more than quarter of a century. In his sermons, while the standpoint is the same as Eckhart's, the speculative groundwork tends, as is natural, to be less insisted on, and more scope is given to its practical consequences and to direct religious exhortation. Nicolas of Basel, the mysterious layman from whose visit Tauler dates his true religious life, seems to have been the chief organizing force among the Gottesfreunde. He was known as "the great friend of God in the Oberland," and Basel continued to be a quiet haven of reunion for the members of the society. Tauler and others retired thither at intervals from the political storms of the time. The society counted many members among the pious women in the convents of southern Germany. Such were Christina Ebner of Engelthal near Nuremberg, and Margaretha Ebner of Medingen in Swabia. Laymen also belonged to it, like Hermann von Fritzlar and Rulman Merswin, the rich banker of Strasburg (author of a mystical work, *Buch der neun Felsen*, on the nine rocks or upward steps of contemplation). Letters passed between the members, as well as presents of books or relics. Some of them, like Heinrich von Nördlingen, the friend of Margaretha Ebner, went much from place to place, and in that way helped to keep up a living connexion among the friends. It was doubtless one of their number who sent forth anonymously from the house of the Teutonic Order in Frankfort the famous handbook of mystical devotion called *Eine deutsche Theologie*. Shortly after the middle of the century most of the friends of whom anything is known drop out of sight. But the combination of warm piety and spiritual freedom in Tauler's sermons and the *Deutsche Theologie* exercised a continuous influence on the religious life of Germany till the time of Luther. As is well known, the *Deutsche Theologie* was first published in 1516 by Luther, who accompanied it by a preface expressing his own obligations to the "noble book," and ranking it inferior only to the Bible and St Augustine. The fact that the book was put into his hands by Staupitz, the vicar-general of the Augustinian order, shows that Luther's high estimate was not singular at the time.

John Ruysbroeck (1293-1381), the father of mysticism in the Netherlands, stood in connexion with the Friends of God, and Tauler is said to have visited him in his seclusion at Vauvert (Grünthal) near Brussels. He was decisively influenced by Eckhart, though there is noticeable occasionally a shrinking back from some of Eckhart's phraseology. The sect of the Free Spirit is the frequent object of his polemic, and this leads him into somewhat careful definitions of truth and error. For the rest, Ruysbroeck's mysticism is more of a practical than a speculative cast. He is chiefly occupied with the means whereby the *unio mystica* is to be attained, whereas Eckhart dwells on the union as an ever-present fact, and dilates on its metaphysical implications. Towards the end of Ruysbroeck's life, in 1378, he was visited by the fervid lay-preacher Gerhard Groot (1340-84), who was so impressed by the life of the community at Vauvert that he conceived the idea of founding a Christian brotherhood bound by no monastic vows, but living together in simplicity and piety with all things in common, after the apostolic pattern. This was the origin of the Brethren of the Common Lot (or Common Life). The first house of the Brethren was founded at Deventer by Gerhard Groot and his youthful friend Florentius Radewyn. Similar brother-houses soon sprang up in different places throughout the Low Countries and Westphalia, and even Saxony. Thomas a Kempis (1380-1471), to whom the brotherhood chiefly owes its fame, forms the subject of a separate article.

It has been customary for Protestant writers to represent the mystics of Germany and Holland as precursors of the Reformation. In a sense this is true; and the direct influence of Tauler and the *Deutsche Theologie* upon Luther has already been referred to. But it conveys a false impression if it is understood to mean that these men protested against the doctrines of the church in the way the Reformers felt themselves called upon to do. There is no sign that Tauler, for example, or Ruysbroeck, or Thomas a Kempis had felt the dogmatic teaching of the church jar in any single point upon their religious consciousness. Nevertheless, mysticism did prepare men in a very real way for a break with the traditional system. Mysticism instinctively recedes from formulas that have become stereotyped and mechanical into the perennially fresh experience of the individual. In the first place, therefore, it brings into prominence only those broad and universal doctrines which it finds to be of vital and present moment for the inward life, while others, though they may have an important place in the churchly system, are (unconsciously) allowed to slip into temporary forgetfulness. It is thus we must explain that almost total absence of distinctively Romish doctrine in Thomas a Kempis which makes the *Imitation* as acceptable to the Protestant as to the devout Catholic. In the second place, mysticism accustoms men to deal with their experience for themselves at first hand, and to test the doctrines presented to them by that standard. This growth of spiritual freedom is especially to be marked in the German mystics. It is to be noted, however, that mysticism affords in itself no foundation for a religious community. Its principle is pure inwardness, but it possesses no norm by which the extravagances of the individual may be controlled. Thus, when the Reformers appeared to do their work, the mystics were found opposing the new authority of Scripture to the full as bitterly as they had opposed the old authority of the church. To the thoroughgoing mystic individualist the one standard is as external as the other. When Cellarius was called upon by Luther to substantiate his positions by reference to Scripture, he struck the table with his fist and declared it an insult to speak so to a man of God. A germ of reason may be discerned in this indignation, but none the less we must recognize that, while mysticism showed itself capable at the Reformation of dissolving society into anarchy and atomism, it showed itself perfectly destitute of a reconstructive power. The same people who would claim the pre-Reformation mystics as Protestants in disguise are indignant at the way in which the later mystics oppose, or hold aloof from, the Reformation movement. But the truth seems to be that, in both cases, mysticism was true to its principle. Without some fixed letter to attach itself to, it sinks away into utter formlessness; but its relation to the system is always more or less one of opposition to what it regards as external.

The wild doctrines of Thomas Münzer and the Zwickau prophets, merging eventually into the excesses of the Peasants' War and the doings of the Anabaptists in Münster, first roused Luther to the dangerous possibilities of mysticism as a disintegrating force. He was also called upon to do battle for his principle against men like Schwenkfeld (1490-1561) and Sebastian Frank (1500-45), the latter of whom developed a system of pantheistic mysticism, and went so far in his opposition to the letter as to declare the whole of the historical element in Scripture to be but a mythical representation of eternal truth. Valentin Weigel (1533-88), who stands under manifold obligations to Frank, represents also the influence of the semi-mystical physical speculation that marked the transition from scholasticism to modern times. The final breakdown of scholasticism as a rationalized system of dogma may be seen in Nicolaus of Cusa (1401-64), who received his education, like Thomas a Kempis, at Deventer, and afterwards rose to be a cardinal of the church. He distinguishes between the *intellectus* and the discursively acting *ratio* almost precisely in the style of later distinctions between the reason and the understanding. The intellect combines what the understanding separates; hence Nicolaus teaches the principle of the *coincidentia contradictoriorum*. If the results of the understanding go by the name of knowledge, then the higher teaching of the intellectual intuition may be called ignorance—ignorance, however, that is conscious of itself, *docta ignorantia*. "Intuitio," "speculatio," "visio sine comprehensione," "comprehensio incomprehensibilis," "mystica theologia," "tertius cœlus," are some of the terms he applies to this knowledge above knowledge; but in the working out of his system he is remarkably free from extravagance. Nicolaus's doctrines were of influence upon Giordano Bruno and other physical philosophers of the 15th and 16th centuries. All these physical theories are blended with a mystical theosophy, of which the most remarkable example is, perhaps, the chemico-astrological speculations of Paracelsus (1493-1541). The influence of Nicolaus of Cusa and Paracelsus mingled in Valentin Weigel with that of the *Deutsche Theologie*, Osiander, Schwenkfeld, and Frank. Weigel, in turn, handed on these influences to Jacob Boehme (1575-1624), *philosophus teutonicus*, and father of the chief developments of theosophy in modern Germany. See BOEHME.

Mysticism did not cease within the Catholic Church at the Reformation. In St Theresa (1515-82) and John of the Cross the counter-reformation can boast of saints second to none in the calendar for the austerity of their mortifications and the rapture of the visions to which they were admitted. But, as was to be expected, their mysticism moves in that comparatively narrow round, and consists simply in the heaping up of these sensuous experiences. The speculative character has entirely faded out of it, or rather has been crushed out by the tightness with which the directors of the Roman Church now held the reins of discipline. Their mysticism represents, therefore, no widening or spiritualizing of their theology; in all matters of belief they remain the docile children of their church. The gloom and harshness of these Spanish mystics are absent from the tender, contemplative spirit of François de Sales (1567-1622); and in the quietism of Madame Guyon (1648-1717) and Miguel de Molinos (1627-96) here is again a sufficient implication of mystical doctrine to rouse the suspicion of the ecclesiastical authorities. Quietism, name and thing, became the talk of all the world through the bitter and protracted controversy to which it gave rise between Fénelon and Bossuet.

In the 17th century mysticism is represented in the philosophical field by the so-called Cambridge Platonists, and especially by Henry More (1614-87), in whom the influence of the Kabbalah is combined with a species of Christianized Neo-Platonism. Pierre Poiret (1646-1719) exhibits a violent reaction against the mechanical philosophy of Descartes, and especially against its consequences in Spinoza. He was an ardent student of Tauler and Thomas a Kempis, and became an adherent of the quietistic doctrines of Madame Bourignon. His philosophical works emphasize the passivity of the reason. The first influence of Boehme was in the direction of an obscure religious mysticism. J. G. Gichtel (1638-1710), the first editor of his complete works, became the founder of a sect called the Angel-Brethren. All Boehme's works were translated into English in the time of the Commonwealth, and regular societies of Behmenists were formed in England and Holland. Later in the century he was much studied by the members of the Philadelphian Society, John Pordage, Thomas Bromley, Jane Lead, and others. The mysticism of William Law (1686-1761) and of St Martin in France (1743-1803), who were also students of Boehme, is of a much more elevated and spiritual type. The "Cherubic Wanderer," and other poems, of Johann Scheffler (1624-77), known as Angelus Silesius, are more closely related in style and thought to Eckhart than to Boehme.

The religiosity of the Quakers, with their doctrines of the "inner light" and the influence of the Spirit, has decided affinities with mysticism; and the quaint autobiography of George Fox (1624-91), the founder of the sect, proceeds throughout on the assumption of supernatural guidance. Stripped of its definitely miraculous character, the doctrine of the inner light may be regarded as the familiar mystical protest against formalism, literalism, and scripture-worship. Swedenborg, though selected by Emerson in his *Representative Men* as the typical mystic, belongs rather to the history of spiritualism than to that of mysticism as understood in this article. He possesses the cool temperament of the man of science rather than the fervid Godward aspiration of the mystic proper; and the speculative impulse which lies at the root of this form of thought is almost entirely absent from his writings. Accordingly, his supernatural revelations resemble a course of lessons in celestial geography more than a description of the beatific vision.

Philosophy since the end of the last century has frequently shown a tendency to diverge into mysticism. This has been especially so in Germany. The term mysticism is, indeed, often extended by popular usage and philosophical partisanship to the whole activity of the post-Kantian idealists. In this usage the word would be equivalent to the more recent and scarcely less abused term, transcendentalism, and as such it is used even by a sympathetic writer like Carlyle; but this looseness of phraseology only serves to blur important distinctions. However absolute a philosopher's idealism may be, he is erroneously styled a mystic if he moves towards his conclusions only by the patient labour of the reason. Hegel, therefore, to take an instance, can no more fitly be classed as a mystic than Spinoza can. It would be much nearer the truth to take both as types of a thoroughgoing rationalism. In either case it is of course open to any one to maintain that the apparent completeness of synthesis really rests on the subtle intrusion of elements of feeling into the rational process. But in that case it might be difficult to find a systematic philosopher who would escape the charge of mysticism; and it is better to remain by long-established and serviceable distinctions. Where philosophy despairs of itself, exults in its own overthrow, and yet revels in the "mysteries" of a speculative Christianity, as in J. G. Hamann (1730-88), the term mysticism may be fitly applied. So, again, it is in place where the movement of revulsion from a mechanical philosophy takes the form rather of immediate assertion than of reasoned demonstration, and where the writers, after insisting generally on the spiritual basis of phenomena, either leave the position without further definition, or expressly declare that the ultimate problems of philosophy cannot be reduced to articulate formulas. Examples of this are men like Novalis, Carlyle, and Emerson, in whom philosophy may be said to be impatient of its own task. Schelling's explicit appeal in the "*Identitäts-philosophie*" to an intellectual intuition of the Absolute, is of the essence of mysticism, both as an appeal to a supra-rational faculty and as a claim not merely to know but to realize God. The opposition of the reason to the understanding, as used by Coleridge, is not free from the first of these faults. The later philosophy of Schelling and the philosophy of Franz von Baader, both largely founded upon Boehme, belong rather to theosophy than to mysticism proper.

Authorities.—The authorities for the teaching of individual mystics will be found under their names. Besides the sections on mysticism in the general histories of philosophy by Erdmann and Ueberweg, and in works on church history and the history of dogma, reference may be made for the mediæval period to Heinrich Schmid, *Der Mysticismus in seiner Entstehungsperiode*, Jena, 1824; Helfferich, *Die christliche Mystik*, Hamburg, 1842; Noack, *Die christliche Mystik des Mittelalters*, Königsberg, 1853. On the German mystics the works are very numerous, but decidedly the best is the *Geschichte der deutschen Mystik*, in course of publication by W. Preger. The first volume, published at Leipsic in 1874, deals with Meister Eckhart and his precursors; the second, which appeared in 1881, deals with Suso and the general development of mysticism in Eckhart's school, but without including Tauler. The works of Eckhart and his precursors are contained in Pfeiffer's *Deutsche Mystiker des 14ten Jahrhunderts*, vol. i. (1845), vol. ii. (1857). The *Theologia Germanica* and a selection from Tauler's *Sermons* have been translated into English by Miss Susannah Winkworth. (A. SE.)

MYTHOLOGY

MYTHOLOGY (μυθολογία) is the science which examines μῦθοι, or legends of cosmogony and of gods and heroes. Mythology is also used as a term for these legends themselves. Thus when we speak of "the mythology of Greece" we mean the whole body of Greek divine and heroic and cosmogonic legends. When we speak of the "science of mythology" we refer to the various attempts which have been made to explain those ancient narratives. Very early indeed in the history of human thought men awoke to the consciousness that their religious stories were much in want of explanation. The myths of civilized peoples, as of Greeks and the Aryans of India, contain two elements, the rational and the irrational. The rational myths are those which represent the gods as beautiful and wise beings. The Artemis of the *Odyssey* "taking her pastime in the chase of boars and swift deer, while with her the wild wood-nymphs disport them, and high over them all she rears her brow, and is easily to be known where all are fair," is a perfectly rational mythic representation of a divine being. We feel, even now, that the conception of a "queen and huntress, chaste and fair," the lady warden of the woodlands, is a beautiful and natural fancy which requires no explanation. On the other hand, the Artemis of Arcadia, who is confused with the nymph Callisto, who, again, is said to have become a she-bear, and later a star, and the Brauronian Artemis, whose maiden ministers danced a bear-dance (ἀρκτεύειν; compare Harpocration on this word), are goddesses whose legend seems unnatural, and is felt to need explanation. Or, again, there is nothing not explicable and natural in the conception of the Olympian Zeus as represented by the great chryselephantine statue of Zeus at Olympia, or in the Homeric conception of Zeus as a god who "turns everywhere his shining eyes" and beholds all things. But the Zeus whose grave was shown in Crete, or the Zeus who played Demeter an obscene trick by the aid of a ram, or the Zeus who, in the shape of a swan, became the father of Castor and Pollux, or the Zeus who was merely a rough stone, or the Zeus who deceived Hera by means of a feigned marriage with an inanimate object, or the Zeus who was afraid of Attes, is a being whose myth is felt to be unnatural and in great need of explanation. It is this irrational and unnatural element—as Mr Max Müller says, "the silly, senseless, and savage element"—that makes mythology the puzzle which men have so long found it.

Early Explanations of Myths.—The earliest attempts at a crude science of mythology were efforts to reconcile the legends of the gods and heroes with the religious sentiment which recognized in these beings objects of worship and respect. Closely as religion and myth are intertwined, it is necessary to hold them apart for the purposes of this discussion. Religion may here be defined as the conception of divine or at least supernatural powers, entertained by men in moments of gratitude or of need and distress, in hours of weakness, when, as Homer says, "all folk yearn after the gods." Now this conception may be rude enough, and it is nearly related to purely magical ideas, to efforts to secure supernatural aid by magical ceremonies. Still the roughest form of spiritual prayer has for its basis the hypothesis of beneficent beings, visible or invisible. The senseless stories or myths about the gods are soon felt to be at variance with this hypothesis. As an example we may take the instance of Qing, the Bushman hunter. Qing, when first he met white men, was asked about his religion. He began to explain, and mentioned Cagn. Mr Orpen, the chief magistrate of St John's Territory, asked, "Is Cagn good or malicious? how do you pray to him?" Answer (in a low imploring tone), "'O Cagn! O Cagn! are we not your children? do you not see our hunger? give us food;' and he gives us both hands full" (*Cape Monthly Magazine*, July 1874). Here we see the *religious* view of Cagn, the Bushman god. But in the *mythological* account of Cagn given by Qing he appears as a kind of grasshopper, supernaturally endowed, the hero of a most absurd cycle of senseless adventures. Even religion is affected by these irrational notions, and the gods of savages and of many civilized peoples are worshipped with cruel, obscene, and irrational rites. But, on the whole, the religious sentiment strives to transcend the mythical conceptions of the gods, and is shocked and puzzled by the mythical narratives. As soon as this sense of perplexity is felt, by poets, by priests, or by most men in an age of nascent criticism, explanations of what is most crude and absurd in the myths are put forward. Men ask themselves why their gods are worshipped in the form of beasts, birds, and fishes; why their gods are said to have prosecuted their amours in bestial shapes; why they are represented as lustful and passionate—thieves, robbers, murderers, and adulterous. The answers to these questions sometimes become myths themselves. Thus both the Mangaians and the Egyptians have been puzzled by their own gods in the form of beasts. The Egyptians invented an explanation—itself a myth—that in some moment of danger the gods concealed themselves from their foes in the shapes of animals.[1] The Mangaians, according to Mr Gill, hold that "the heavenly family had taken up their abode in these birds, fishes, and reptiles."[2]

A people so curious and refined as the Greeks were certain to be greatly perplexed by even such comparatively pure mythical narratives as they found in Homer, still more by the coarser legends of Hesiod, and above all by the ancient local myths preserved by local priesthoods. Thus, in the 6th century before Christ, Xenophanes of Colophon severely blamed the poets for their unbecoming legends, and boldly called certain myths "the fables of men of old."[3] Theagenes of Rhegium (520 B.C. ?), according to the scholiast on *Iliad*, xx. 67,[4] was the author of a very ancient system of mythology. Admitting that the fable of the battle of the gods was "unbecoming," if literally understood, Theagenes represented it as an allegorical account of the war of the elements. Apollo, Helios, and Hephæstus were fire, Hera was air, Poseidon was water, Artemis was the moon, *καὶ τὰ λοιπὰ ὁμοίως*. Or, by another system, the names of the gods represented moral and intellectual qualities. Heraclitus, too, disposed of the myth of the bondage of Hera as allegorical philosophy. Socrates, in the *Cratylus* of Plato, expounds "a philosophy which came to him all in an instant," an explanation of the divine beings based on crude philological analyses of their names. Metrodorus, rivalling some recent flights of conjecture, resolved not only the gods but even heroes like Agamemnon, Hector, and Achilles "into elemental combinations and physical agencies."[5] Euripides makes Pentheus (but he was notoriously impious) advance a "rationalistic" theory of the story that Dionysus was stitched up in the thigh of Zeus. When Christianity became powerful the heathen philosophers evaded its satire by making more and more use of the allegorical and non-natural system of explanation. That method has two faults. First (as Arnobius and Eusebius reminded their heathen opponents), the allegorical explanations are purely arbitrary, depend upon the fancy of their author, and are all equally plausible and equally unsupported by evidence.[6] Secondly, there is no proof at all that, in the distant age when the myths were developed, men entertained the moral notions and physical philosophies which are supposed to be "wrapped up," as Cicero says, "in impious fables." Another system of explanation is that associated with the name of Euemerus (316 B.C.). According to this author, the myths are history in disguise. All the gods were once men, whose real feats have been decorated and distorted by later fancy. This view suited Lactantius, St Augustine, and other early Christian writers very well. They were pleased to believe that Euemerus "by historical research had ascertained that the gods were once but mortal men." Precisely the same convenient line was taken by Sahagun in his account of Mexican religious myths. As there can be no doubt that the ghosts of dead men have been worshipped in many lands, and as the gods of many faiths are tricked out with attributes derived from ancestor-worship, the system of Euemerus retains some measure of plausibility. While we need not believe with Euemerus and with Mr Herbert Spencer that the god of Greece or the god of the Hottentots was once a man, we cannot deny that the myths of both these gods have passed through and been coloured by the imaginations of men who practised the worship of real ancestors. For example, the Cretans showed the tomb of Zeus, and the Phocians (Pausanias, x. 5) daily poured blood of victims into the tomb of a hero, obviously by way of feeding his ghost. The Hottentots show many tombs of their god, Tsui-Goab, and tell tales about his death; they also pray regularly for aid at the tombs of their own parents.[7] We may therefore say that, while it is rather absurd to believe that Zeus and Tsui-Goab were once real men, yet their myths are such as would be developed by people accustomed, among other forms of religion, to the worship of dead men. Very probably portions of the legends of real men have been attracted into the mythic accounts of gods of another character, and this is the element of truth at the bottom of Euemerism. This is not the place to deal fully with the modern form of the system as set forth by Mr Herbert Spencer.

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[1] Plutarch, *De Iside et Osiride*.

[2] *Myths and Songs from the South Pacific*, p. 35, 1876.

[3] Xenoph., *Fr.*, i. 42.

[4] Dindorf's ed., vol. iv. p. 231.

[5] Grote, *Hist. of Greece*, i. 404, ed. 1869.

[6] Cf. Lobeck, *Aglaophamus*, i. 151-152, on allegorical interpretation of myths in the mysteries.

[7] Hahn, *Tsuni-Goam, the Supreme Being of the Khoi-Khoi*, p. 113.

Later Explanations of Mythology.—The ancient systems of explaining what needed explanation in myths were, then, physical, ethical, religious, and historical. One student, like Theagenes, would see a physical philosophy underlying Homeric legends. Another, like Porphyry, would imagine that the meaning was partly moral, partly of a dark theosophic and religious character. Another would detect moral allegory alone, and Aristotle expresses the opinion that the myths were the inventions of legislators "to persuade the many, and to be used in support of law" (*Met.*, xi. 8, 19). A fourth, like Euemerus, would get rid of the supernatural element altogether, and find only an imaginative rendering of actual history. When Christians approached the problem of heathen mythology, they sometimes held, with St Augustine, a form of the doctrine of Euemerus.[1] In other words, they regarded Zeus, Aphrodite, and the rest as real persons, diabolical not divine. Some later philosophers, especially of the 17th century, misled by the resemblance between Biblical narratives and ancient myths, came to the conclusion that the Bible contains a pure, the myths a distorted, form of an original revelation. The abbé Banier published a mythological compilation in which he systematically resolved all the Greek myths into ordinary history.[2] Bryant published (1774) *A New System, or an Analysis of Ancient Mythology, wherein an Attempt is made to divest Tradition of Fable*, in which he talked very learnedly of "that wonderful people, the descendants of Cush," and saw everywhere symbols of the ark and traces of the Noachian deluge. Thomas Taylor, at the end of the 18th century, indulged in much mystical allegorizing of myths, as in the notes to his translation of Pausanias (1794). At an earlier date (1760) De Brosses struck on the true line of interpretation in his little work *Du Culte des Dieux Fétiches, ou Parallèle de l'ancienne Religion de l'Égypte avec la Religion actuelle de Nigritie*. In this tract De Brosses explained the animal-worship of the Egyptians as a survival among a civilized people of ideas and practices springing from the intellectual condition of savages, and actually existing among negroes. A vast symbolical explanation of myths and mysteries was attempted by Friedrich Creuzer.[3] The learning and sound sense of Lobeck, in his *Aglaophamus*, exploded the idea that the Eleusinian and other mysteries revealed or concealed matter of momentous religious importance. It ought not to be forgotten that Lafitau, a Jesuit missionary in North America, while inclined to take a mystical view of the secrets concealed by Iroquois myths, had also pointed out the savage element surviving in Greek mythology.[4]

The Most Recent Mythological Systems.—Up to a very recent date students of mythology were hampered by orthodox traditions, and still more by ignorance of the ancient languages and of the natural history of man. Only recently have Sanskrit and the Egyptian and Chaldæan languages become books not absolutely sealed. Again, the study of the evolution of human institutions from the lowest savagery to civilization is essentially a novel branch of research, though ideas derived from an unsystematic study of anthropology are at least as old as Aristotle. The new theories of mythology are based on the belief that "it is man, it is human thought and human language combined, which naturally and necessarily produced the strange conglomerate of ancient fable."[5] But, while there is now universal agreement so far, modern mythologists differ essentially on one point. There is a school (with internal divisions) which regards ancient fable as almost entirely "a disease of language," that is, as the result of confusions arising from misunderstood terms that have survived in speech after their original significance was lost. Another school (also somewhat divided against itself) believes that misunderstood *language* played but a very slight part in the evolution of mythology, and that the irrational element in myths is merely the survival from a condition of *thought* which was once common, if not universal, but is now only found among savages, and to a certain extent among children. The former school considers that the state of thought out of which myths were developed was produced by decaying language; the latter maintains that the corresponding phenomena of language were the reflexion of thought. For the sake of brevity we might call the former the "philological" system, as it rests chiefly on the study of language, while the latter might be styled the "historical" or "anthropological" school, as it is based on the study of man in the sum of his manners, ideas, and institutions.

The System of Mr Max Müller.—The most distinguished and popular advocate of the philological school is Mr Max Müller, whose ideas must now be stated. Their exposition is chiefly to be found in Mr Müller's *Selected Essays* and in his *Lectures on Language*. As the opposite system, the historical or anthropological system, is that which will be adopted in the remainder of this article, our criticism of Mr Müller's ideas must be accepted as that of an opponent. The problem set himself by Mr Müller is to explain what he calls "the silly, savage, and senseless" element in mythology (*Sel. Ess.*, i. 578).

(1.) Mr Müller says (speaking of the Greeks), "their poets had an instinctive aversion to everything excessive or monstrous, yet they would relate of their gods what would make the most savage of Red Indians creep and shudder,"—stories, that is, of the cannibalism of Demeter, of the mutilation of Uranus, the cannibalism of Cronus, who swallowed his own children, and the like. "Among the lowest tribes of Africa and America we hardly find anything more hideous and revolting."

(2.) Mr Müller refers the beginning of his system of mythology to the discovery of the connexion of the Indo-European or, as they are called, "Aryan" languages. Celts, Germans, speakers of Sanskrit and Zend, Latins and Greeks, all prove by their languages that their tongues may be traced to one family of speech. The comparison of the various words which, in different forms, are common to all Indo-European languages must inevitably throw much light on the original meaning of these words. Take, for example, the name of a god, Zeus, or Athene, or any other. The word may have no intelligible meaning in Greek, but its counterpart in the allied tongues, especially in Sanskrit or Zend, may reveal the original significance of the terms. "To understand the origin and meaning of the names of the Greek gods, *and to enter into the original intention of the fables told of each*, we must take into account the collateral evidence supplied by Latin, German,

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[1] *De Civ. Dei*, vii. 18; viii. 26.

[2] *La Mythologie et les Fables expliquées par l'Histoire*, Paris, 1738, 3 vols. 4to.

[3] *Symbolik und Mythologie der Alten Völker*, Leipsic and Darmstadt, 1836-43.

[4] *Mœurs des Sauvages*, Paris, 1724.

[5] Max Müller, *Lectures on Language*, 2d series, p. 410, 1864.

Sanskrit, and Zend philology" (*Lect. on Lang.*, 2d ser., p. 406). A name may be intelligible in Sanskrit which has no sense in Greek. Thus Athene is a divine name without meaning in Greek, but Mr Müller advances reasons for supposing that it is identical with *ahana*, "the dawn," in Sanskrit. It is his opinion, apparently, that whatever story is told of Athene must have originally been told of the dawn, and that we must keep this before us in attempting to understand the legends of Athene. Thus (*op. cit.*, p. 410), he says, "we have a right to explain all that is told of him" (Agni, "fire") "as originally meant for fire." To take another example, Mr Müller proves by aid of Sanskrit philology that Zeus originally meant the sky, and, as a result, "there was nothing that could be told of the sky that was not in some form or other ascribed to Zeus." If, then (to take an example of our own), we read that Zeus, to pacify the jealousy of Demeter, mutilated a ram, and pretended to have mutilated himself, are we to suppose that this story had originally a meaning in reference to the sky? The system, at all events, is simply this: the original meaning of the names of gods must be ascertained by comparative philology. The names, as a rule, will be found to denote elemental phenomena. And the silly, savage, and senseless elements in the legends of the gods will be shown to have a natural significance, as descriptions of sky, storms, sunset, water, fire, dawn, twilight, the life of earth, and other celestial and terrestrial existences. Stated in the barest form, these results do not differ greatly from the conclusions of Theagenes of Rhegium, who held that "Hephæstus was fire, Hera was air, Poseidon was water, Artemis was the moon, *καὶ τὰ λοιπὰ ὁμοίως*." But Mr Müller's system is based on scientific philology, not on conjecture, and is supported by a theory, which we shall try to explain, of the various processes in the evolution of myths out of language.

(3.) The following is an abstract of Mr Müller's theory of one process by which myths were developed out of language. "The keenest eye of the antiquary and the philosopher" cannot see farther back, he says, than the period when expressions were coined for the most necessary ideas, and when a grammar began which was destitute of national peculiarities, but contained the germ of all the Turanian as well as the Aryan and Semitic forms of speech. This age Mr Müller calls the *Rhematic* period (*Sel. Ess.*, i. 306). (As yet there were no myths, or none alluded to by Mr Müller.) This was followed by an age in which at least two families of language, the Aryan and Semitic, left "the nomadic stage of grammar," and received once for all the peculiar impress of their formative system. There were as yet no such tongues as the Greek, Sanskrit, and Latin we know, only the Aryan speech from which these languages differentiated themselves. This was the *Dialectic* period. (As yet we understand that there were no myths, or none which Mr Müller takes into account.) We now come to the *Mythopœic* age. It was "half-way between the Dialectical period, presenting the human race gradually diverging into different families and languages, and the National period, exhibiting to us the earliest traces of nationalized language, and a nationalized literature in India, Persia, Greece, Italy, and Germany" (*op. cit.*, i. p. 311). The Mythopœic age, according to Mr Müller (*op. cit.*, i. 308), came *after* the "unavoidable divergence of dialects and languages," between that period and the age of "the establishment of laws and customs and the first beginnings of religion and poetry." Mr Müller's next step is to examine the intellectual and social conditions of man in the Mythopœic age. This he does by aid of philology. He analyses the words which, being common to Sanskrit, Greek, Latin, and German, must have existed in Aryan speech before the nations that talked these languages separated from the common stock. Although, as we have seen, the Mythopœic age came *before* "the earliest concentrations of political societies, the establishment of laws and customs," yet Mr Müller demonstrates that man, in the Mythopœic age, had political societies, and customs if not laws. Man, in the age called Mythopœic, the age when myths were made, already possessed the modern, or at all events the patriarchal, form of the family. His life was "half nomadic, half pastoral." He had abundance of domesticated animals, he practised agriculture, and had invented the plough. His political institutions included kingship. He was a builder of cities and a constructor of roads. He could weave, and work the metals, including iron. He possessed a system of decimal arithmetic, "which could only have been secured," says Mr Müller, "by the wear and tear of language in literary and practical use." Thus, as he possessed a literature, his language must have been tolerably definite and, so to say, stereotyped in meaning. "This earliest period, then, previous to any national separation, is what I call the Mythopœic period, for every one of these common Aryan words is, in a certain sense, a myth" (*op. cit.*, i. p. 355). It will be observed that, in the Mythopœic age, man was essentially civilized, and that his language had passed through "literary wear and tear."

(4.) Having thus defined the social, political, and literary status of men in the Mythopœic age, Mr Müller goes on to describe the style of their conversation, which in the long run was the source of their myths. In the language of that day (as we gather from an examination of Aryan words) a number of terms, which later became abstract, "expressed something substantial, something open to sensuous perceptions." "In ancient languages every one of these words" (such as "day," "night," "earth," "spring," "dawn") "had necessarily a termination expressive of gender, and this naturally produced the corresponding idea of sex, so that these names received not only an individual but a sexual character. . . . What must have been the result of this? As long as people thought in language it was simply impossible to speak of morning or evening, of spring and winter, without giving to these conceptions something of an individual, active, sexual, and at last personal character. They were either nothings, as they are nothings to our withered thought, or they were something; and then they could not be conceived as mere powers, but as beings powerful." Now let us take an example to show how, if the original sense of the names of those "powerful beings" were lost, while the names themselves survived in language as part of a traditional saying, a myth would arise where no myth was intended. Let us suppose that in the Mythopœic age some one said "the shining one pursues the burning one," meaning the sun follows the dawn. Let it further be supposed that the word for "shining one" was an Aryan prototype of the Greek ἥλιος, "the sun," and that the word for the "burning one" was, similarly, an Aryan prototype of the Sanskrit *ahana* or *dahana*, "the dawn." Then grant that the term for Helios came to be confused with Apollo (a god who has points in common with the sun), grant that the word for the "burning one" became, from something like *ahana* or *dahana*, *Daphne*, and admit that a certain tree was also called daphne, because its wood burned easily. When all these changes had happened and had been forgotten, Greeks would find in their language this expression, "Apollo pursues Daphne." They would see that "Apollo" was a masculine, "Daphne" a feminine, word. And they would thus be led to suppose that Apollo was a young amorous god who chased a fair reluctant nymph Daphne, and that Daphne, to avoid his pursuit, changed herself, or was changed, into a tree bearing the same name.[1] "All this seems to me as clear as daylight" says Mr Müller.

So far two linguistic influences have been exhibited in their effect on mythology. One is the existence of gender terminations, producing in the human mind the belief that inanimate things spoken of as sexual must be sexual living powers. The other process (illustrated to some extent by the change of a phrase meaning "sunrise *follows* dawn" into "Phœbus *chases* Daphne") is the retention by a verb of its full original activity. The full theory of "auxiliary verbs" which originally possessed "a more material and expressive character" than they now retain will be found in *Selected Essays*, i. 365. Thus the Latin *fui*, "I was," corresponds to φύω, and in Greek "still shows its original and material power of growing." The theory is, then, that both substantives and auxiliary verbs "said more than they ought to say" in the Mythopœic age, and that this surplus of meaning, misunderstood, became the "Aberglaube," the irrational surplus of faith, in the myths.

(5.) The philological processes in the evolution of mythology are still unexhausted. It is plain that as long as every one knew that language "said more than it ought to say," as long as it was discounted and understood at its true value, it would not produce much mythology. "It is," says Mr Müller, "the essential character of a true myth that it should no longer be intelligible by a reference to spoken language." For the full development of myths, then, the old rich overweighted terms must have gone on existing, stereotyped in phrases, but their original significance must have ceased to be intelligible. But *how* did spoken language retain the words and the sayings, while it utterly lost their meaning? The process must be explained in the words of Mr Müller himself.

> "Most nouns, as we have seen before, were originally appellatives or predicates expressive of what seemed at the moment the most characteristic attribute of an object. But as most objects have more than one attribute, and as, under different aspects, one or the other attribute might seem more appropriate to form the name, it happened by necessity that most objects during the early period of language had more than one name. In the course of time the greater number of these names became useless, and they were mostly replaced in literary languages by one fixed name, which might be called the proper name of such objects. The more ancient a language, the richer it is in synonyms. Synonyms, again, if used constantly, must naturally give rise to a number of homonyms. If we may call the sun by fifty names expressive of different qualities, some of these names will be applicable to other objects also, which would happen to possess the same quality. These different objects would then be called by the same name, they would become homonyms." (*Sel. Ess.*, i. 376-8.)

Thus, while one thing had many names, many things would have the same name. Again, "as the meanings of metaphors are forgotten, or the meanings of roots whence words were derived became dimmed and changed, many of these words would lose their radical as well as their poetical meaning. They would become mere names handed down in the conversation of a family; understood, perhaps, by the grandfather, familiar to the father, but strange to the son, and misunderstood by the grandson." As an example, Mr Müller gives *Ζεύς*, which, "originally a name of the sky, like the Sanskrit *Dyaus*," became gradually a proper name, which betrayed its appellative meaning only in a few proverbial expressions, such as *Ζεὺς ὕει* ("Zeus, or the sky, rains"), or *sub Jove frigido* ("under the chill air"). In this example, it is true, we have neither homonyms nor synonyms presented to us, nor do we see why the grandfather should have talked of the sky as a thing, while the grandson was driven to the inference that the sky was a person, and a very remarkable person too.

(6.) Mr Müller's next step is to collect illustrations of the processes he has described, and to adduce proofs that these processes really existed and acted. He looks for his proofs and his examples in Sanskrit poetry, in the poetry of the sacred hymns or *Vedas*. Here is his evidence for the action (in the Mythopœic age) of the processes he calls *synonymy* or *polyonymy* (many names for one thing) and *homonymy* (many things with one name):

> "In the *Veda* the earth is called urvî (wide), prithvî (broad), mahî (great), and many more names of which the Nighantu mentions twenty-one. These twenty-one words would be synonyms. But urvî (wide) is not only given as a name of the earth, but also means a river. Prithvî (broad) means not only earth, but sky and dawn. Mahî (great, strong) is used for air and speech, as well as for earth. Hence earth, river, sky, dawn, air, and speech would become homonyms." (*Sel. Ess.*, i. 371.)

It will therefore be evident that, if the great-grandsons of the people of the Vedic age did not know whether their traditional expressions referred to earth, dawn, sky, air, or speech, confusions would arise, and from the confusions myths. Mr Müller ends by analysing and explaining some Greek stories.

We have now given as clear and distinct an account of Mr Müller's system of mythology as is possible within our limited space. It will be observed that the explanation applies to people speaking Indo-European languages, is grounded on a view of their early history as elucidated by philology, and on the whole resolves itself into this, that "mythology is a disease of language," a result of misunderstood phrases and of the gender-terminations of words. We now approach the criticism of Mr Müller's system, and our criticism will lead up to a new examination of the problem of mythology.

(1.) Mr Müller started with the wish to explain how the Greek poets, with their aversion to everything excessive or monstrous, came to ascribe the most abominable offences to their own gods. The gods were incestuous, were sinners of nameless sins. They disguised themselves in animal shapes; they tasted human flesh; they amused themselves with obscene jests; they died and were buried; they were born, and their birth-places were known. The first objection to Mr Müller's system is that it does not explain, but usually keeps clear of, the very horrors that need explanation. True, he easily shows that the sun can be regarded, now as the child, now as the bridegroom, of the dawn, and hence a story of incest may arise. The growing crop (to take an instance familiar to the early heathen apologists) may be regarded as the child of the showery sky, and again as its bride, and hence an unbecoming story, like the loves of Zeus and Persephone, might come to be credited. Once more, Zeus may be regarded as the father of all men, and hence the separate myths of his physical amours, whence spring the royal families of Hellas, might have originated. But, even if we accept all these explanations, we still must ask Mr Müller the questions which the early Christians asked the heathen expositors of and apologists for the myths. How are the disgusting details, the "savage, silly, and senseless" details, to be explained? Zeus is the heaven, and woos the earth, or the lower air, but why does he take the form of a bull or a cuckoo, why does he deceive Hera by celebrating a false marriage with a log of wood? Why does he try to expiate his amour with Demeter by his conduct to the ram? Why, when conceived of as the father of noble houses, does he adopt the shape of an ant, a swan, an eagle, a bull, a serpent? What mean the amours and animal metamorphoses of the other gods? Grant that Procris is the dew, as Mr Müller says it is, and how do you explain her unspeakable services to King Minos? Grant that Cronion only means "the ancient of days," and that, being misunderstood to mean "son of Cronus," the name gave rise to the myth of Cronus, and how do you explain that god's mutilation of his father, and his habit of swallowing down alive each of his own children, whom he afterwards disgorged? Grant that Dionysus only means the vine and its influence, and how do you explain his unspeakable conduct as recorded in the mysteries at Halimus in Attica? How, in short, as Arnobius asked the heathen, how, if the myths represent pure natural facts and phenomena, do they come to be crowded with the obscene details which disgusted philosophers six hundred years before Christ? In what stage of society did this "impure way of stating pure facts" win favour? Mr Müller must fix the period at which such details were invented, some time between his Mythopœic age and the age of Xenophanes and Theagenes. In the meantime his system does not explain and scarcely touches on the very facts that most call for explanation. Why did the Greek poets relate divine myths of which we find the parallels "among the lowest tribes of Africa and America"?

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[1] This explanation of the myth of Daphne is compiled from *Selected Essays*, i. 398, 399, 607, 608. Meanwhile a well-known American Sanskrit scholar denies that *ahana* ever meant "dawn," or that it could become *dahana* and *daphne* by any philological process.

(2.) Mr Müller's system is a result of the philological discoveries that establish the linguistic unity of the Indo-European peoples, and is founded on an analysis of their language. But myths precisely similar in irrational and repulsive character to those of the Aryan races exist among Australians, South Sea Islanders, Eskimo, Bushmen in Africa, among Solomon Islanders, Iroquois, and so forth. The facts being identical, an identical explanation should be sought, and, as the languages in which the myths exist are essentially different, an explanation founded on the Aryan language is likely to prove too narrow. Mr Müller indeed, has ventured into Finnish philology and mythology, but a wider examination is needed. Once more, even if we discover the original meaning of a god's name, it does not follow that we can explain by aid of the significance of the name the myths about the god. For nothing is more common than the attraction of a more ancient story into the legend of a later god or hero. Myths of unknown antiquity, for example, have been attracted into the legend of Charlemagne, just as the *bons mots* of old wits are transferred to living humorists. Therefore, though we may ascertain that Zeus means "sky" and Agni "fire," we cannot assert, with Mr Müller, that all the myths about Agni and Zeus were originally told of fire and sky. When these gods became popular they would inevitably inherit any current exploits of earlier heroes or gods. These exploits would therefore be explained erroneously if regarded as originally myths of sky or fire. We cannot convert Mr Müller's proposition "there was nothing told of the sky that could not in some form or other be ascribed to Zeus" into "there was nothing ascribed to Zeus that had not at some time or other been told of the sky." This is also, perhaps, the proper place to observe that names derived from natural phenomena—sky, clouds, dawn, and sun—are habitually assigned by Brazilians, Ojibways, Australians, and other savages to living men and women. Thus the story originally told of a man or woman bearing the name "sun," "dawn," "cloud," may be mixed up later with myths about the real celestial dawn, cloud, or sun. For all these reasons the information obtained from philological analysis of names is to be distrusted. We must also bear in mind that early men when they conceived, and savage men when they conceive, of the sun, moon, wind, earth, sky, and so forth, have no such ideas in their minds as we attach to these names. They think of sun, moon, wind, earth, and sky as of living human beings with bodily parts and passions. Thus, even when we discover an elemental meaning in a god's name, that meaning may be all unlike what the word suggests to civilized men. A final objection is that philologists differ widely as to the true analysis and real meaning of the divine names. Mr Müller, for example, connects κρόνος with χρόνος, "time"; Preller with κραίνω, "I fulfil," and so forth.

(3.) The objection to Mr Müller's doctrine of the Rhematic and Dialectic periods of language as bearing on mythology is that he either supposes man to have had no myths in these periods, or takes no account of the myths they may have had. Yet it is certain, and admitted by himself, that we do find myths in languages of all known sorts. If man on his way to being Aryan or Semitic, if man in the Rhematic and Dialectic stages, possessed no myths, he must have differed from all men of whom we know anything. If he did possess myths these cannot have been produced by the conditions of Mr Müller's Mythopœic age, because that age had not yet been reached. And if man in the Rhematic and Dialectic periods had myths, and if they survived into the Mythopœic and later periods, they cannot be explained by Mr Müller's Mythopœic theory. Especially if these earlier myths crystallized round a god or hero of later date will the effort to explain the earlier stories by analysis of the later names be fruitless. As to the Mythopœic period itself, as described by Mr Müller, it was rather an age when the materials for myths were accumulated than when myths themselves were developed.

(4.) Mr Müller attempts to show how the conversation of men in the Mythopœic age became the source of myths. Here he is endeavouring, really, to account for that universal attribution of life, sex, action, and thought to all phenomena which is, indubitably, the essential condition of mythology. He explains this "animism" as an erroneous condition of thought into which men essentially civilized were driven by the nature of language. In language all words denoted *gender*, hence (he thinks) men were led to suppose that gender and sex, with all that follows, were possessed by all objects. But it is scarcely necessary to reply (the truth being so obvious) that the gender-terminations of words reflected, and must have arisen from, a state of the human intellect in which all things were regarded as persons. The civilized men of the Mythopœic age were not compelled, as Mr Müller thinks, to believe that all phenomena were persons, because the words which denoted the phenomena had gender-terminations. On the other hand, the gender-terminations were survivals from an early stage of thought in which personal characteristics, including sex, had been attributed to all phenomena. This condition of thought is demonstrated to be, and to have been, universal among savages, and it may notoriously be observed among children. Mr Müller explains it as the result of reflexions on gender-terminations, but how does he explain these terminations themselves? His theory is that, somehow, gender-terminations arose in language. Then, when they had become a tradition of language, they "reacted on the mind with irresistible power," and men, who had previously been as sensible as ourselves, felt themselves obliged to animate and personify all phenomena. Mr Müller remarks "there is some truth in this," (that is, in the contention that a belief in the personal character of phenomena reflected itself in gender-terminations), "but it only serves to confirm the right view of the influence of language on thought, for this tendency, though in its origin intentional, and therefore the result of thought, became soon a mere rule of tradition in language, and then it reacted on the mind with irresistible power" (*Sel. Ess.*, i. 604). Mr Müller thinks that men first held nature to be animated and personal. This belief reflected itself in language, but it (apparently) produced no myths. In a later and civilized age language brought back the old state of intellect, and myths were produced. This becomes a superfluous hypothesis of degradation, for the original state of intellect was enough for the genesis of myths, without the conjectured reaction of language.

(5.) The elaborate theory of the persistence of phrases without meaning in language is inconsistent with all that Mr Müller has told us about the civilization of Mythopœic man. He belonged to a settled society, with a literature of its own. No proof is given that men so advanced in civilization would forget the meanings of ordinary phrases and yet retain the phrases in their language. How could a society with such shifting speech develop "by literary wear and tear" a system of decimal arithmetic? But Mr Müller says that the rapid process of oblivion which begat myths might occur in four generations.

(6.) Again, no proof is given of the existence of the processes called homonymy and polyonymy. Mr Müller, by way of proof, quotes the *Vedas*,—artificial poems produced in a language which did not even exist in what he calls the Mythopœic age. An Englishman might as well illustrate the conversation of his ancestors by examples chosen from *Hymns Ancient and Modern*. Mr Müller gives instances of homonymy and polyonymy in the *Vedas*, but he does not show that these processes made it impossible for the descendants of the Vedic poets to know what they were talking about. He says the descendants of Mythopœic men did not know what their traditional phrases meant, but he advances no proof that Mythopœic men used the processes called homonymy and polyonymy. Finally, when he looks for illustrations, he finds them, not in the Mythopœic period at all, but in the established national languages of the Greeks and of the Aryans of India. And in these illustrations the very points which most demand explanation—the "silly, senseless, and savage" details—are left not only unexplained but almost untouched. Thus Mr Müller's theory that myths are "a disease of language" seems destitute of evidence, and inconsistent with what is historically known about the relations between the language and the social, political, and literary condition of men.

Theory of Mr Herbert Spencer.—The system of Mr Herbert Spencer, as explained in *Principles of Sociology*, has many points in common with that of Mr Müller. Mr Spencer attempts to account for the state of mind (the foundation of myths) in which man personifies and animates all phenomena. According to his theory, too, this habit of mind may be regarded as the result of degeneration, for in his view, as in Mr Müller's, it is not primary, but the result of misconceptions. But, while language is the chief cause of misconceptions with Mr Müller, with Mr Spencer it is only one of several forces all working to the same result. Statements which originally had a different significance are misinterpreted, he thinks, and names of human beings are also misinterpreted in such a manner that early races are gradually led to believe in the personality of phenomena. He too notes "the defect in early speech"—that is, the "lack of words free from implications of vitality"—as one of the causes which "favour personalization." Here, of course, we have to ask Mr Spencer, as we asked Mr Müller, *why* words in early languages "imply vitality." These words must reflect the thought of the men who use them before they react upon that thought and confirm it in its misconceptions. So far Mr Spencer seems at one with the philological school of mythologists, but he warns us that the misconstructions of language in his system are "different in kind, and the erroneous course of thought is opposite in direction." According to Mr Spencer (and his premises, at least, are correct), the names of human beings in an early state of society are derived from incidents of the moment, and often refer to the period of the day, or the nature of the weather. We find, among Australian natives, among Abipones in South America, and among Ojibways in the North, actual people named Dawn, Gold Flower of Day, Dark Cloud, Sun, and so forth. Mr Spencer's argument is that, given a story about real people so named, in process of time and forgetfulness the anecdote which was once current about a man named Storm and a woman named Sunshine will be transferred to the meteorological phenomena of sun and tempest. Thus these purely natural agents will come to be "personalized" (*Prin. Soc.*, 392), and to be credited with purely human origin and human adventures. Another misconception would arise when men had a tradition that they came to their actual seats from this mountain, or that lake or river, or from lands across the sea. They will mistake this tradition of local origin for one of actual parentage, and will come to believe that, like certain Homeric heroes, they are the sons of a river (now personified), or of a mountain, or, like a tribe mentioned by Garcilasso de la Vega, that they are descended from the sea. Once more, if their old legend told them that they came from the rising sun, they will hold, like many races, that they are actually the children of the sun. By this process of forgetfulness and misinterpretation, mountains, rivers, lakes, sun, and sea would receive human attributes, while men would degenerate from a more sensible condition into a belief in the personality and vitality of inanimate objects. As Mr Spencer thinks ancestor-worship the first form of religion, and as he holds that persons with such names as sun, moon, and the like became worshipped as ancestors, his theory results in the belief that nature-worship and the myths about natural phenomena—dawn, wind, sky, night, and the rest—are a kind of transmuted worship of ancestors and transmuted myths about real men and women. "Partly by confounding the parentage of the race with a conspicuous object marking the natal region of the race, partly by literal interpretation of birth names, and partly by literal interpretation of names given in eulogy" (such as Sun and Bull, among the Egyptian kings), and also through "implicit belief in the statements of forefathers," there has been produced belief in descent from mountains, sea, dawn, from animals which have become constellations, and from persons once on earth who now appear as sun and moon. A very common class of myths assures us that certain stocks of men are descended from beasts, or from gods in the shape of beasts. Mr Spencer explains these by the theory that the remembered ancestor of a stock had, as savages often have, an animal name, as Bear, Wolf, Coyote, or what not. In time his descendants came to forget that the name was a mere name, and were misled into the opinion that they were children of a real coyote, wolf, or bear. This idea, once current, would naturally stimulate and diffuse the belief that such descents were possible, and that the animals are closely akin to men.

The chief objection to these processes is that they require, as a necessary condition, a singular amount of memory on the one hand and of forgetfulness on the other. The lowest contemporary savages remember little or nothing of any ancestor farther back than the grandfather. But men in Mr Spencer's Mythopœic age had much longer memories. On the other hand, the most ordinary savage does not misunderstand so universal a custom as the imposition of names peculiar to animals or derived from atmospheric phenomena. He calls his own child Dawn or Cloud, his own name is Sitting Bull or Running Wolf, and he is not tempted to explain his great-grandfather's name of Bright Sun or Lively Raccoon on the hypothesis that the ancestor really was a raccoon or the sun. Moreover, savages do not worship ancestresses or retain lively memories of their great-grandmothers, yet it is through the female line in the majority of cases that the animal or other ancestral name is derived. The son of an Australian whose family name is Crane takes his mother's name, Swan or Cockatoo, or whatever it may be, and the same is the general rule in Africa and America among races who rarely remember their great-grandfathers. On the whole, then (though degeneracy, as well as progress, is a force in human evolution), we are not tempted to believe in so strange a combination of forgetfulness with long memory, nor so excessive a degeneration from common sense into a belief in the personality of phenomena, as are required no less by Mr Spencer's system than by that of Mr Müller.

A New Examination of Mythologies.—We have stated and criticized the more prominent modern theories of mythology. It is now necessary first to recapitulate the chief points in the problem, and then to attempt to explain them by a comparison of the myths of various races. The difficulty of mythology is to account for the following among other apparently irrational elements in myths: the wild and senseless stories of the beginnings of things, of the origin of men, sun, stars, animals, death, and the world in general; the infamous and absurd adventures of the gods; why divine beings are regarded as incestuous, adulterous, murderous, thievish, cruel, cannibals, and addicted to wearing the shapes of animals; the myths of metamorphosis into plants, beasts, and stars; the repulsive stories of the state of the dead; the descents of the gods into the place of the dead, and their return thence. It is extremely difficult to keep these different categories of myths separate from each other. If we investigate myths of the origin of the world, we often find gods in animal form active in the work of world-making. If we examine myths of human descent from animals, we find gods busy there, and if we try to investigate the myths of the origin of the gods, the subject gets mixed up with the mythical origins of things in general.

Our first question will be, Is there any stage of human society, and of the human intellect, in which facts that appear to us to be monstrous and irrational are accepted as ordinary occurrences of every-day life? Mr Lane, in his preface to the *Arabian Nights*, says that the Arabs have an advantage over us as story-tellers. They can introduce such incidents as the change of a man into a horse, or of a woman into a dog, or the intervention of an *afreet*, without any more scruple than our own novelists feel in describing a duel or the concealment of a will. Among the Arabs the actions of magic and of spirits are regarded as at least as probable and common as duels and concealments of wills in European society. It is obvious that we need look no farther for the explanation of the supernatural events in Arab romances. Now let us apply this system to mythology. It is admitted that Greeks, Romans, Aryans of India in the age of the Sanskrit commentators, Egyptians of the Ptolemaic and earlier ages, were as much puzzled as we are by the mythical adventures of their gods. But is there any known stage of the human intellect in which these divine adventures, and the metamorphoses of men into animals, trees, stars, and converse with the dead, and all else that puzzles us in the civilized mythologies, are regarded as possible incidents of daily human life? Our answer is that everything in the civilized mythologies which we regard as irrational seems only part of the accepted and rational order of things to contemporary savages, and in the past seemed equally rational and natural to savages concerning whom we have historical information. Our theory is, therefore, that the savage and senseless element in mythology is, for the most part, a legacy from ancestors of the civilized races who were in an intellectual state not higher than that of Australians, Bushmen, Red Indians, the lower races of South America, and other worse than barbaric peoples. As the ancestors of the Greeks, Aryans of India, Egyptians, and others advanced in civilization, their religious thought was shocked and surprised by myths (originally dating from the period of savagery, and natural in that period) which were preserved down to the time of Pausanias by local priesthoods, or which were stereotyped in the ancient poems of Hesiod and Homer, or in the *Brahmanas* and *Vedas* of India, or were retained in the popular religion of Egypt. This theory recommended itself to Lobeck. "We may believe that ancient and early tribes framed gods like themselves in action and in experience, and that the allegorical element in myths is the addition of later peoples who had attained to purer ideas of divinity, yet dared not reject the religion of their ancestors" (*Aglaoph.*, i. 153). The senseless element in the myths would by this theory be for the most part a "survival." And the age and condition of human thought from which it survived would be one in which our most ordinary ideas about the nature of things and the limits of possibility did not yet exist, when all things were conceived of in quite other fashion,—the age, that is, of savagery. It is universally admitted that "survivals" of this kind do account for many anomalies in our institutions, in law, politics, society, even in dress and manners. If isolated fragments of an earlier age abide in these, it is still more probable that other fragments will survive in anything so closely connected as mythology with the conservative religious sentiment. Again, if this view of mythology can be proved, much will have been done to explain a problem which we have not yet touched, namely, *the distribution of myths*. The science of mythology has to account, if it can, not only for the existence of certain stories in the legends of certain races, but also for the presence of stories practically the same among almost all races. In the long history of mankind it is impossible to deny that stories may conceivably have spread from a single centre, and been handed on from races like the Indo-European and the Semitic to races as far removed from them in every way as the Zulus, the Australians, the Eskimo, the natives of the South Sea Islands. But, while the possibility of the diffusion of myths by borrowing and transmission must be allowed for, the hypothesis of the origin of myths in the savage state of the intellect supplies a ready explanation of their wide diffusion. Archæologists are acquainted with objects of early art and craftsmanship, rude clay pipkins and stone weapons, which can only be classed as "human," and which do not bear much impress of any one national taste and skill. Many myths may be called "human" in this sense. They are the rough products of the early human mind, and are not yet characterized by the differentiations of race and culture. Such myths might spring up anywhere among untutored men, and anywhere might survive into civilized literature. Therefore where such myths are found among Greeks, Australians, Egyptians, Mangaians, and others it is unnecessary to account for their wide diffusion by any hypothesis of borrowing, early or late. The Greek "key" pattern found on objects in Peruvian graves was not necessarily borrowed from Greece, nor did Greeks necessarily borrow from Aztecs the "wave" pattern which is common to both. The same explanation may be applied to Greek and Aztec myths of the deluge, to Australian and Greek myths of the original theft of fire. Borrowed they may have been, but they may as probably have been independent inventions. It is true that some philologists (among others Professor Sayce) deprecate as unscientific the comparison of myths which are found in languages not connected with each other. The objection rests on the theory that myths are a disease of language, a morbid offshoot of language, and that the legends in unconnected languages must therefore be kept apart. But, as the theory which we are explaining does not admit that *language* is more than a subordinate cause in the development of myths, as it seeks for the origin of myths in a given condition of *thought* through which all races have passed, we need do no more than record the objection of Professor Sayce. Our next step must be briefly to examine the intellectual condition of savages, that is, of races varying from the condition of the Andaman islanders to that of the Solomon Islanders and the ruder Red Men of the American continent.

The Intellectual Condition of Savages. Nature of our Evidence.—In a developed treatise on the subject of mythology it would be necessary to criticize, with a minuteness which is impossible here, our evidence for the very peculiar mental condition of the lower races. Mr Max Müller has asked (when speaking of the mental condition of men when myths were developed), "was there a period of temporary madness through which the human mind had to pass, and was it a madness identically the same in the south of India and the north of Iceland?" To this we may answer that the human mind had to pass through the savage stage of thought, that this stage was for all practical purposes "identically the same" everywhere, and that to civilized observers it does resemble "a temporary madness." Many races are still abandoned to that temporary madness; many others which have escaped from it were observed and described while still labouring under its delusions. Our evidence for the intellectual ideas of man in the period of savagery we derive partly from the reports of voyagers, historians, missionaries, partly from an examination of the customs, institutions, and laws in which the lower races gave expression to their notions. As to the first kind of evidence, we must be on our guard against several sources of error. Where religion is concerned, travellers in general and missionaries in particular are biased in several distinct ways. The missionary is sometimes anxious to prove that religion can only come by revelation, and that certain tribes, having received no revelation, have no religion or religious myths at all. Sometimes the missionary, on the other hand, is anxious to demonstrate that the myths of his heathen flock are a corrupted version of the Biblical narrative. In the former case he neglects the study of savage myths; in the latter he unconsciously accommodates what he hears to what he calls "the truth." The traveller who is not a missionary may either have the same prejudices, or he may be a sceptic about revealed religion. In the latter case he is perhaps unconsciously moved to put burlesque versions of Biblical stories into the mouths of his native informants, or to represent the savages as ridiculing the Scriptural traditions which he communicates to them. Yet again we must remember that the leading questions of a European inquirer may furnish a savage with a thread on which to string answers which the questions themselves have suggested. "Have you ever had a great flood?" "Yes." "Was any one saved?" The question starts the invention of the savage on a deluge-myth, of which, perhaps, the idea has never before entered his mind. There still remain the difficulties of all conversation between civilized men and unsophisticated savages, the tendency to hoax, and other sources of error and confusion. In receiving this kind of evidence, then, we need to know the character of our informant, his means of communicating with the heathen, his power of testing evidence, and his good faith. His testimony will have additional weight if supported by the "undesigned coincidences" of other evidence, ancient and modern. If Strabo and Herodotus and Pomponius Mela, for example, describe a custom, rite, or strange notion in the Old World, and if mariners and missionaries find the same notion or custom or rite in Polynesia or Australia or Kamchatka, we can scarcely doubt the truth of the reports. The evidence is best when given by ignorant men, who are astonished at meeting with an institution which ethnologists are familiar with in other parts of the world. Another method of obtaining evidence is by the comparative study of savage laws and institutions. Thus we find in Asia, Africa, America, and Australia that the marriage laws of the lower races are based on a belief in kinship with animals. The evidence for this belief is thus entirely beyond suspicion. We find, too, that political power, sway, and social influence are based on the ideas of magic, of metamorphosis, and of the power which certain men possess to talk with the dead and to visit the abodes of death. All these ideas are the stuff of which myths are made, and the evidence of savage institutions, in every part of the world, proves that these ideas are the universal inheritance of savages. As to the quantity of evidence, it is actually overpowering in amount.

Savage Ideas about the World.—We all "move about in worlds not realized," though science is constantly occupied in winning over more material from the chaos of the unknown to the realm of rational knowledge. Savage men are like ourselves in curiosity and anxiety *causas cognoscere rerum*, but with our curiosity they do not possess our powers of attention. They are as easily satisfied with an explanation of phenomena as they are eager to possess an explanation. Inevitably they furnish themselves with their philosophy out of their scanty stock of acquired ideas, and these ideas and general conceptions seem almost imbecile to civilized men. Curiosity and credulity, then, are the characteristics of the savage intellect. When a phenomenon presents itself the savage requires an explanation, and that explanation he makes for himself, or receives from tradition, in the shape of a *myth*. The basis of these myths, which are just as much a part of early conjectural science as of early religion, is naturally the experience of the savage *as construed by himself*. Man's craving to know "the reason why" is already "among rude savages an intellectual appetite," and "even to the Australian scientific speculation has its germ in actual experience."[1] How does he try to satisfy this craving? Mr Tylor replies, "When the attention of a man in the myth-making stage of intellect is drawn to any phenomenon or custom which has to him no obvious reason, he invents and tells a story to account for it." Against this statement it has been urged that men in the lower stages of culture are not curious, but take all phenomena for granted. If there were no direct evidence in favour of Mr Tylor's opinion, it would be enough to point to the nature of savage myths themselves. It is not arguing in a circle to point out that almost all of them are nothing more than explanations of intellectual difficulties, answers to the question, How came this or that phenomenon to be what it is? Thus savage myths answer the questions,—What was the origin of the world, and of men, and of beasts? How came the stars by their arrangement and movements? How are the motions of sun and moon to be accounted for? Why has this tree a red flower, and this bird a black mark on the tail? What was the origin of the tribal dances, or of this or that law of custom or etiquette? Savage mythology, which is also savage science, has a reply to all these and all similar questions, and that reply is always found in the shape of a story. The answers cannot be accounted for without the previous existence of the questions.

We have now shown how savages come to have a mythology. It is their way of satisfying the early form of scientific curiosity, their way of realizing the world in which they move. But they frame their stories, necessarily and naturally, in harmony with their general theory of things, with what we may call "savage metaphysics." Now early man, as Mr Müller says, "not only did not think as we think, but did not think as we suppose he ought to have thought." The chief distinction between his mode of conceiving the world and ours is his vast extension of the theory of personality. The history of thought is the history of the process of narrowing the range and intensifying the conception of personality. To civilized man only human beings seem personal. We scarcely regard each of the more intelligent lower creatures as "an I," and we can hardly be said to attribute definite personality at all to the less intelligent creatures, such as fishes. It is only by the half-conscious survival of older thought in poetry that we attribute personality to the sun or the wind, or say, "at one stride comes the Dark." But to the savage, and apparently to men more backward than the most backward peoples we know, all nature was a congeries of animated personalities. The savage's notion of personality is more a universally diffused feeling than a reasoned conception, and this feeling of a personal self he impartially distributes all over the world as known to him. One of the Jesuit missionaries in North America thus describes the Red Man's philosophy:[1] "Les sauvages se persuadent que non seulement les hommes et les autres animaux, mais aussi que toutes les autres choses sont animées." Crevaux, in the Andes, found that the Indians believed that the beasts have *piays* (sorcerers and doctors) like themselves.[2] This opinion we may name *personalism*, and it is the necessary condition of savage (and, as will be seen, of civilized) mythology. The Jesuits could not understand how spherical bodies like sun and moon could be mistaken for human beings. Their catechumens put them off with the answer that the drawn bows of the heavenly bodies gave them their round appearance. "The wind was formerly a person; he became a bird," say the Bushmen, and *g'ōō ka ! kai*, a respectable Bushman once saw the personal wind at Haarfontein.[3] The Egyptians, according to Herodotus (iii. 16), believed fire to be *θηρίον ἔμψυχον*, a live beast. The Bushman who saw the Wind meant to throw a stone at it, but it ran into a hill. From the wind as a person the Bhinyas in India (Dalton, p. 140) claim descent, and in Indian epic tradition the leader of the ape army was a son of the wind. The Wind, by certain mares, became the father of wind-swift steeds mentioned in the *Iliad*. The loves of Boreas are well known. These are examples of the animistic theory applied to what, in our minds, seems one of the least personal of natural phenomena. The sky (which appears to us even less personal) has been regarded as a personal being by Samoyeds, Red Indians, Zulus,[4] and traces of this belief survive in Chinese, Greek, and Roman religion.

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[1] Tylor, *Primitive Culture*, i. 369, 1871.

Thus the savage mind regards even the most abstract phenomena as persons, with human parts and passions. That idea alone will account for much that is strange in mythology. But we must remember that, to the savage, Sky, Sun, Sea, Wind are not only persons, but they are savage persons. Their conduct is not what civilized men would attribute to characters so august; it is what uncivilized men think probable and befitting among beings like themselves. Now savage man's view of his own place and his own powers in the world is so unlike our modern view of human relations to the universe that it requires a separate explanation.

Savage Theory of Man's Relations with the World.—It has already been shown that the savage regards even the most abstract phenomena (sky, earth, wind, and so forth) as animated and personal. It must be added that he has the same opinion of the personality and human character of all animals. "Ils tiennent les poissons raisonnables, comme aussi les cerfs," says a Jesuit father about the North-American Indians (*Relations*, *loc. cit.*). In Australia the natives believe that the wild dog has the power of speech, like the cat of the Coverley witch in the *Spectator*. The Breton peasants, according to M. Sébillot, credit all birds with language, which they even attempt to interpret. The old English and the Arab superstitions about the language of beasts are examples of this opinion surviving among civilized races. The bear in Norway is regarded as almost a man, and his dead body is addressed and his wrath deprecated by Samoyeds and Red Indians. "The native bear *Kur-bo-roo* is the sage counsellor of the aborigines in all their difficulties. When bent on a dangerous expedition, the men will seek help from this clumsy creature, but in what way his opinions are made known is nowhere recorded."[5] Schoolcraft mentions a Red Indian story explaining how "the bear does not die," but this tale Mr Schoolcraft (like Herodotus in Egypt) "cannot bring himself to relate." He also gives examples of Iowas conversing with serpents. These may serve as examples of the savage belief in the human intelligence of animals. Man is on an even footing with them, and with them can interchange his ideas. But savages carry this opinion much further. Man in their view is actually, and in no figurative sense, akin to the beasts. Certain tribes in Java "believe that women when delivered of a child are frequently delivered at the same time of a young crocodile."[6] The common European story of a queen accused of giving birth to puppies shows the survival of the belief in the possibility of such births among civilized races, while the Aztecs had the idea that women who saw the moon in certain circumstances would produce mice. But the chief evidence for the savage theory of man's close kinship with the lower animals is found in the institution called *totemism*. This is not the place to discuss totemism in all its bearings. It is, roughly speaking, the belief that certain stocks of men in the various tribes are descended by blood descent from certain objects animate or inanimate, but especially from beasts. The strength of the opinion is proved by its connexion with very stringent marriage laws. No man (according to the rigour of the custom) may marry a woman who bears the same family name as himself, that is, who is descended from the same inanimate object or animal. Nor may people (if they can possibly avoid it) eat the flesh of animals who are their kindred. We have only space to indicate briefly here the wide diffusion of this extraordinary belief. Among the Murri, or natives of Australia, the local tribes are divided into stocks which may not intermarry, and which regard themselves as being descended from kangaroos, cockatoos, emus, pelicans, and other animals. A man and a woman who both claim descent from the same animal consider themselves as "of one flesh," brother and sister in the emu or kangaroo stock, and therefore may not intermarry (Dawson, p. 26). As the cannibals of New Caledonia do not eat their own tribesmen, so these stocks abstain from the flesh of their animal tribe-fellow. The Australians have a still more curious division of all nature into groups of kindred, so that one man may be descended, indeed, from the fish-hawk, but he also counts cousins with smoke and the honeysuckle tree. Again, the kangaroo and men-kangaroos are akin to summer, the wind, and the shevak tree. "The South Australian savage looks upon the world as the Great Tribe, to one of whose divisions he himself belongs, and all things, animate or inanimate, which belong to his class are parts of the body corporate whereof he himself is part."[1] Turning from Australia to the west coast of Africa, we find similar ideas prevailing there. Among the Ashantees, as among the Australians, there are local divisions of the people, through which are scattered stocks claiming descent from animals, plants, and other natural objects.[2] As in Australia, the families may not eat the animals to which they are akin. The same notions prevail among the Basutos and other African tribes.[3] In America the amount of evidence for similar institutions grounded on similar creeds is too large to be dealt with here. The old missionaries, as Charlevoix and Bancroft, the old historian of the Peruvian tribes, Garcilasso de la Vega, the travels of Franklin, the collections of Bancroft and Schoolcraft, bear irrefutable testimony to the American belief in descent from animals and from inanimate objects, the kinship being recognized, as in Australia, by marriage laws of the strictest character. In India the idea of animal kinship is just as powerful as elsewhere.[4] The Hos and Mundas exhibit this creed in their marriage law. "The Mundaris, like the Oraons, adopt as their tribal distinction the name of some animal, and the flesh of that animal is tabooed to them as food; for example, the eel and the tortoise" (Dalton, pp. 189, 254). Turner describes analogous institutions in his *Polynesia* (p. 196). The Samoans, like the Egyptians, refuse to eat their own tribal gods, but consume those of their neighbours. Siberian examples are given in Sir John Lubbock's *Origin of Civilisation*, under the head of the Jakuts. Among the Bonis (negroes relapsed into savagery out of slavery in Cayenne) one family reveres the red ape, another the cayman, a third the turtle.[5] The higher religion of the Bonis is a survival of Christianity. The language is a mixture of English, Dutch, and Creole patois. These instances from almost every quarter of the globe, from Siberia to Peru, from Bengal to Canada, from Ashantee to the Cape, will suffice to indicate the strength and wide diffusion of the savage belief in animal kinship with men. Considerable proof of the survival of this sentiment among the Semitic races is given by Professor Robertson Smith in "Animal Worship and Animal Tribes among the Arabs and in the Old Testament," *Journal of Philology*, vol. ix. No. 17.[6]

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[1] *Relations*, 1636, p. 114.

[2] *Voyages*, p. 159.

[3] *South African Folk-Lore Journal*, May 1880.

[4] Tylor, *op. cit.*, ii. 256.

[5] Brough Smyth, *Aborigines of Victoria*, i. 446, 1878.

[6] Hawkesworth, *Voyages*, iii. 756.

Savage man, then, regards all objects as animate and personal, and himself as physically akin to plants, animals, and other animate and inanimate things. He also believes that many of his own tribe-fellows have the power of assuming the shapes of animals, and that the souls of his dead kinsfolk revert to animal forms. Sir A. C. Lyal, writing from Hindustan, observes that "to those who live in a country where wicked people and witches are constantly taking the form of wild beasts the explanation of lycanthropy by a confusion between λευκός (white) and λύκος (a wolf) seems wanton." Our sense of the wantonness and inadequacy of this etymological explanation is increased when we find phenomena like LYCANTHROPY (*q. v.*) believed in everywhere, whatever the language spoken by the believers. Mr Lane, in his introduction to the *Arabian Nights* (i. p. 58), says he found the belief in these transmigrations accepted solemnly in Cairo. Bancroft brings evidence to prove that the Mexicans supposed pregnant women would turn into beasts, and sleeping children into mice, if things went wrong in the ritual of a certain solemn sacrifice. There is a well-known Scotch legend to the effect that a certain old witch was once fired at in her shape as a hare, and that where the hare was hit there the old woman was found to be wounded. Lafitau tells the same story as current among his Red Indian flock, except that the old witch and her son took the form of birds, not of hares. A Scandinavian witch does the same in the Egil saga. In Lafitau's tale the birds were wounded by the magic arrows of a medicine man, and the arrow-heads were found in the bodies of the human culprits. In Japan[7] people chiefly transform themselves into badgers. The sorcerers of Honduras (Bancroft, i. 740) "possessed the power of transforming men into wild beasts." Regnard, the French dramatist, found in Lapland (1681) that witches could turn men into cats, and could themselves assume the forms of swans, crows, falcons, and geese. Among the Bushmen[8] "sorcerers assume the form of beasts and jackals." Dobrizhofer, a missionary in Paraguay (1717-1791), learned that "sorcerers arrogate to themselves the power of changing men into tigers" (Eng. transl., i. p. 63). He was present at a conversion of this sort, though the miracle beheld by the people was invisible to the missionary. Near Loanda Livingstone noted that "a chief may metamorphose himself into a lion, kill any one he chooses, and resume his proper form." The same accomplishments distinguish the Barotse and Balonda.[9] Among the Mayas of Central America sorcerers could transform themselves "into dogs, pigs, and other animals; their glance was death to a victim" (Bancroft, ii. 797). The Thlinkeets hold that their shamans have the same powers.[10] A bamboo in Sarawak is known to have been a man. Metamorphoses into stones are as common among Red Indians and Australians as in Greek mythology. Compare the cases of Niobe and the victims of the Gorgon's head.[11] Zulus, Red Indians, Aztecs,[12] Andaman Islanders, and other races believe that their dead assume the shapes of serpents and of other creatures, often reverting to the form of the animal from which they originally descended. In ancient Egypt "the usual prayers demand for the deceased the power of going and coming from and to everywhere *under any form they like.*"[13] A trace of this opinion may be noticed in the *Æneid*. The serpent that appeared at the sacrifice of Æneas was regarded as possibly a "manifestation" of the soul of Anchises (*Æneid*, v. 84)—

> "Dixerat hæc, adytis quum lubricus anguis ab imis
> Septem ingens gyros, septena volumina, traxit,"

and Æneas is

> "Incertus, Geniumne loci, famulumne parentis
> Esse putet."

On the death of Plotinus, as he gave up the ghost, a snake glided from under his bed into a hole in the wall.[14] Compare Pliny[15] on the cave "in quo manes Scipionis Africani majoris custodire draco dicitur."

Without further investigating the survivals of these ideas among civilized races (the most notorious examples are the Indian and Pythagorean theories of transmigration), enough has been said to prove the savage belief in man's kinship with the animals and its survival in civilization. The last peculiarity in savage philosophy to which we need call attention here is the belief in spirits and in human intercourse with the shades of the dead. The topic has been so exhaustively treated by Mr Tylor in his *Primitive Culture*, and the evidence so fully set forth, that we need do little more than set on record the general facts. With the savage natural death is not a universal and inevitable ordinance. "All men must die" is a generalization which he has scarcely reached; in his philosophy the proposition is more like this, "all men who die die by violence." A natural death is explained as the result of a sorcerer's spiritual violence, and the disease is attributed to magic, or to the action of hostile spirits. After death the man survives as a spirit, sometimes taking an animal form, sometimes invisible, sometimes to be observed "in his habit as he lived." As to the origin of the belief in the continued existence and activity of the dead, the current theories will be found in the article APPARITIONS. The philosophy is shortly put in the speech of Achilles (*Iliad*, xxiii. 103) after he has beheld the dead Patroclus in a dream: "Ay me, there remaineth then even in the house of Hades a spirit and phantom of the dead, *for* all night long hath the ghost of hapless Patroclus stood over me, wailing and making moan." It is almost superfluous to quote here the voluminous evidence for the intercourse with spirits which savage chiefs and medicine men are believed to maintain. They can call up ghosts, or can go to the ghosts, in Australia, New Caledonia, New Zealand, North America, Zulu-land, among the Eskimo, and generally in every quarter of the globe. The men who enjoy this power are the same as they who can change themselves and others into animals. They too command the weather, and, says an old French missionary, "are regarded as very Jupiters, having in their hands the lightning and the thunder" (*Relations, loc. cit.*). They make good or bad seasons, and control the vast animals who, among ancient Persians and Aryans of India, as among Zulus and Iroquois, are supposed to grant or withhold the rain, and to thunder with their enormous wings in the region of the clouds.

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[1] Fison, *Kamilaroi and Kurnai*, p. 169. Sir George Grey's *Travels* and Mr G. S. Lang's lecture on *The Aborigines of Australia* may also be consulted.

[2] Bowditch, *Mission to Ashantee*, pp. 180, 181, 1873.

[3] Casalis, p. 211; Livingstone, p. 13.

[4] Evidence will be found in Dalton, *Ethnology of Bengal*, pp. 63, 166.

[5] Crevaux, *Voyage dans l'Amérique du Sud*, p. 59.

[6] For similar survivals among Aryans see FAMILY (vol. ix. pp. 20, 21), and *The Politics of Aristotle* (Bolland and Lang), p. 96. The original observer of these institutions and ideas, Mr M'Lennan, printed his remarkable papers on "The Worship of Plants and Animals" in the *Fortnightly Review*, Nov. 1869, Feb. 1870.

[7] Mitford, *Tales of Old Japan*, 1871.

[8] Bleek, *Brief Account of Bushman Folk-Lore*, pp. 15, 40.

[9] *Missionary Travels*, pp. 615, 642.

[10] Dall, *Alaska*, p. 423, 1870.

[11] Dorman, *Origin of Primitive Superstitions*, pp. 130, 134.

[12] Sahagun, French Transl., p. 226.

[13] *Records of the Past*, x. 10.

[14] *Plotini Vita*, p. 2, 95.

[15] *H. N.*, xv. 44, 85.

We are now in a position to sum up the ideas of savages about man's relations to the world. We started on this inquiry because we found that savages regarded sky, wind, sun, earth, and so forth as practically men, and we had then to ask, what sort of men, men with what powers? The result of our examination, so far, is that in savage opinion sky, wind, sun, sea, and many other phenomena have, being personal, all the powers attributed to real human persons. These powers and qualities are—(1) relationship to animals and ability to be transformed and to transform others into animals and other objects; (2) magical accomplishments, as—(*a*) power to visit or to procure the visits of the dead, (*b*) other magical powers, such as control over the weather.

Once more, the great forces of nature, considered as persons, are involved in that inextricable confusion in which men, beasts, plants, stones, stars, are all on one level of personality and animated existence. This is the philosophy of savage life, and it is on these principles that the savage constructs his myths, while these, again, are all the scientific explanations of the universe with which he has been able to supply himself.

Examples of Mythology.—Myths of the origin of the world and man are naturally most widely diffused. Man has everywhere asked himself whence things came and how, and his myths are his earliest extant form of answer to this question. So confused and inconsistent are the mythical answers that it is very difficult to classify them according to any system. If we try beginning with myths of creative gods, we find that the world is sometimes represented as pre-existent to the divine race. If we try beginning with myths of the origin of the world, we frequently find that it owes its origin to the activity of pre-existent supernatural beings. According to all modern views of creation, the creative mind is prior to the universe which it created. There is no such consistency of opinion in myths, whether of civilized or savage races. Perhaps the plan least open to objection is to begin with myths of the gods. But when we speak of gods, we must not give to the word a modern significance. As used here, gods merely mean non-natural and powerful beings, sometimes "magnified non-natural men," sometimes beasts, birds, or insects, sometimes the larger forces and phenomena of the universe conceived of as endowed with human personality and passions. When Plutarch examined the Osirian myth (*De Isid.*, xxv.) he saw that the "gods" in the tale were really "demons," "stronger than men, but having the divine part not wholly unalloyed,"—"magnified non-natural men," in short. And such are the gods of mythology. In examining the myths of the gods we propose to begin with the conceptions of the most backward tribes, and to advance to the divine legends of the ancient civilized races. It will appear that, while the non-civilized gods are often theriomorphic, made in accordance with the ideas of non-civilized men, the civilized gods retain many characteristics of the savage gods, and these characteristics are the "irrational element" in the divine myths.

Myths of Gods. Savage ideas.—The Boo-noo-rong, an Australian coast-tribe, regard as an early creative god a being named Bun-jel or Pund-jel. He is the chief of a supernatural set of beings, earlier than men, with human relationships. He has a wife whose face (in accordance with a widely-diffused scruple of savage etiquette) he has never seen, any more than Urvasi in the Vedic myth was allowed to see Pururavas without his garments, "for such is the custom" (says the *Veda*) "of women." The name Bun-jel means "eagle-hawk," and the eagle-hawk is a "totem," or worshipful ancestral animal, among certain Australian tribes. Conceived as a supernatural bird-god, Pund-jel answers to the birds as they describe themselves in Aristophanes (*Aves*, 703)—

> *ὧδε μέν ἐσμεν*
> *πολὺ πρεσβύτατοι πάντων μακάρων.*

He belongs to the age of birds, "altogether wiser and more skilful in all things than men," "by far the most ancient of all gods." In an anthropomorphic myth of the Kurnai, Pund-jel figures as "an old man who lives at the sources of the Yarra river" and is rich in cattle. The term Bun-jel is also used as a kind of title of honour bestowed on the older men of the Kurnai and Briakolung, some of whom have magical powers. In the northern parts of Victoria the aborigines believe in Pund-jel in his bird-form as a creative Eagle. Pund-jel takes the part, not only of a creator, but of an instructor—a "culture-hero," to use a fashionable compound term. He instructed man in the arts of life, taught the males how to spear kangaroos, and the women how to dig roots. Pund-jel disappeared from the world he had made when a rival power, the Jay, opened certain great bags of wind he possessed, and blew Pund-jel into the heavens. The Australians draw no very hard-and-fast line between their "birraarks," or sorcerers, and their gods. The Kurnai give the name of Brewin to a powerful spirit, but the name was also conferred on a birraark who disappeared for many days, holding converse with the invisible. The native bear is a beast they adore, and they have given his name to a famous sorcerer. The West Wind is the name of a human sorcerer who happens to be able to make the west wind blow with violence. There is thus a come and go of titles, powers, and attributes between sorcerers, totems, and vague powerful spirits, and in this medley of beliefs a god may have the form of a bird, a man the attributes of a god, so that every sort of irrational transformation is not only not unnatural but is inevitable in such a system. The basis of that system, of course, is the belief in the equal personality and common kindred of all things. Pund-jel, and his rivals the Crow and the Jay, appear to belong to the supernatural prehuman race of Nurrumbunguttias, or "old spirits," answering to the divine races of Titans and gods in Greece, and to the Californian and Ovaherero "old ones in heaven."[1]

Before leaving the Australian divine myths it should be remarked that the widely-spread dualistic myth is found among the Australians. "Why do things go wrong?" men ask, and answer, in Australia as in Persia, by the myth of the mischievous power who thwarted the maker of things. Among the Australians the Crow was always at war with the creative Eagle. The Eagle, by the way (like the elder brothers of Zeus), was once swallowed by a powerful god who afterwards became the moon, and was disgorged alive. The Eagle's adventures as a creator will more properly be considered among cosmogonic myths. His share in the dispersion of mankind, and in causing the deluge, cannot but be regarded with some suspicion, though they bear but distant resemblances to the Biblical narratives.

The chief being among the supernatural characters of Bushman mythology is the insect called the Mantis.[2] Cagn or Ikaggen, the Mantis, is sometimes regarded with religious respect as a benevolent god. But his adventures are the merest nightmares of puerile fancy. He has a wife, an adopted daughter, whose real father is the "swallower" in Bushman swallowing-myths, and the daughter has a son, who is the Ichneumon. The Mantis made an eland out of the shoe of his son-in-law. The moon was also created by the Mantis out of his shoe, and it is red, because the shoe was covered with the red dust of Bushman-land. The Mantis is defeated in an encounter with a cat which happened to be singing a song about a lynx. The Mantis (like Poseidon, Hades, Metis, and other Greek gods) was once swallowed, but disgorged alive. The swallower was the monster Ilkhwái-hemm. Like Heracles when he leaped into the belly of the monster which was about to swallow Hesione, the Mantis once jumped down the throat of a hostile elephant, and so destroyed him. The heavenly bodies are gods among the Bushmen, but their nature and adventures must be discussed among other myths of sun, moon, and stars. As a creator, Cagn is sometimes said to have "given orders, and caused all things to appear and be made." He struck snakes with his staff and turned them into men, as Zeus did with the ants in Ægina. But the Bushmen's mythical theory of the origin of things must, as far as possible, be kept apart from the fables of the Mantis, the Ichneumon, and other divine beings. Though animals, these gods have human passions and character, and possess the usual magical powers attributed to sorcerers.

Concerning the mythology of the Hottentots and Namas, we have a great deal of information in a book named *Tsuni-Goam, the Supreme Being of the Khoi-Khoi* (1881), by Dr T. Hahn. This author has collected the old notices of Hottentot myths, and has added material from his own researches. The chief god of the Hottentots is a being named Tsuni-Goam, who is universally regarded by his worshippers as a deceased sorcerer. According to one old believer, "Tsui-Goab" (an alternative reading of the god's name) "was a great powerful chief of the Khoi-Khoi—in fact, he was the first Khoi-Khoib from whom all the Khoi-Khoi tribes took their name." He is always represented as at war (in the usual crude dualism of savages) with "another chief" named Gaunab. The prayers addressed to Tsui-Goab are simple and natural in character, the "private ejaculations" of men in moments of need or distress. As usual, religion is more advanced than mythology. It appears that, by some accounts, Tsui-Goab lives in the red sky and Gaunab in the dark sky. The neighbouring race of Namas have another old chief for god, a being called Heitsi Eibib. His graves are shown in many places, like those of Osiris, which, says Plutarch, abounded in Egypt. He is propitiated by passers-by at his sepulchres. He has intimate relations in peace and war with a variety of animals whose habits are sometimes explained (like those of the serpent in Genesis) as the result of the curse of Heitsi Eibib. Heitsi Eibib was born in a mysterious way from a cow, as Indra in the *Black Yajur-Veda* entered into and was born from the womb of a being who also bore a cow. The *Rig-Veda* (iv. 18, 1) remarks, "His mother, a cow, bore Indra, an unlicked calf,"—probably a metaphorical way of speaking. Heitsi Eibib, like countless other gods and heroes, is also said to have been the son of a virgin who tasted a particular plant, and so became pregnant, as in the German and Gallophrygian märchen of the almond tree, given by Grimm and Pausanias. Incest is one of the feats of Heitsi Eibib. Tsui-Goab, in the opinion of his worshippers, as we have seen, is a deified dead sorcerer, whose name means Wounded Knee, the sorcerer having been injured in the knee by an enemy. Dr Hahn tries to prove (by philology's "artful aid") that the name really means "red dawn," and is a Hottentot way of speaking of the infinite. The philological arguments advanced are extremely weak, and by no means convincing. If we grant, however, for the sake of argument, that the early Hottentots worshipped the infinite under the figure of the dawn, and that, by forgetting their own meaning, they came to believe that the words which really meant "red dawn" meant "wounded knee," we must still admit that the devout have assigned to their deity all the attributes of an ancestral sorcerer. In short, their "Red Dawn," if red dawn he be, is a person, and a savage person, adored exactly as the actual fathers and grandfathers of the Hottentots are adored. We must explain his legend, then, on these principles, and not as an allegory of the dawn as the dawn appears to civilized people. About Gaunab (the Ahriman to Tsui-Goab's Ormuzd) Dr Hahn gives two distinct opinions. "Gaunab was at first a ghost, a mischief-maker and evil-doer" (*op. cit.*, p. 85). But Gaunab he declares to be "the night-sky" (p. 126). Whether we regard Gaunab, Heitsi Eibib, and Tsui-Goab as originally mythological representations of natural phenomena, or as deified dead men, it is plain that they are now venerated as non-natural human beings, possessing the customary attributes of sorcerers. Thus of Tsui-Goab it is said, "He could do wonderful things which no other man could do, because he was very wise. He could tell what would happen in future times. He died several times, and several times he rose again" (statement of old Kχarab in Hahn, p. 61).

The mythology of the Zulus as reported by Callaway (*Unkulunkulu*, 1868-70) is very thin and uninteresting. The Zulus are great worshippers of ancestors (who appear to men in the form of snakes), and they regard a being called Unkûlunkûlu as their first ancestor, and sometimes as the creator, or at least as the maker of men. It does not appear they identify Unkûlunkûlu, as a rule, with "the lord of heaven," who, like Indra, causes the thunder. The word answering to our lord is also applied "even to beasts, as the lion and the boa." The Zulus, like many distant races, sometimes attribute thunder to the "thunder-bird," which, as in North America, is occasionally seen and even killed by men. "It is said to have a red bill, red legs, and a short red tail like fire. The bird is boiled for the sake of the fat, which is used by the heaven-doctors to puff on their bodies, and to anoint their lightning-rods." The Zulus are so absorbed in propitiating the shades of their dead (who, though in serpentine bodies, have human dispositions) that they appear to take little pleasure in mythological narratives. At the same time, the Zulus have many "nursery tales," the plots and incidents of which often bear the closest resemblance to the heroic myths of Greece, and to the märchen of European peoples.[1] These indications will give a general idea of African divine myths. On the west coast the "ananzi" or spider takes the place of the mantis insect among the Bushmen. For some of his exploits Dasent's *Tales from the Norse* (2d ed., Appendix) may be consulted.

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[1] The chief sources used here are Fison and Ridley's *Kamilaroi and Kurnai*, with Brough Smyth's *Aborigines of Victoria*. Dawson's work, and Gason on the Dieyries, with Sir George Grey's *Travels*, may also be consulted.

[2] Accounts of the Mantis and of his performances will be found in the *Cape Monthly Magazine*, July 1874, and in Dr Bleek's *Brief Account of Bushman Folk-Lore*.

Turning from the natives of Australia, and from African races of various degrees of culture, to the Papuan inhabitants of Melanesia, we find that mythological ideas are scarcely on a higher level. There is an excellent account of the myths of the Banks Islanders and Solomon Islanders in *Journ. Anthropol. Inst.* (February 1881), by the Rev. R. H. Codrington. The article contains a critical description of the difficulty with which missionaries obtain information about the prior creeds. The people of the Banks Islands are chiefly ancestor-worshippers, but they also believe in, and occasionally pray to, a being named I Qat, one of the prehuman race endowed with supernatural powers who here, as elsewhere, do duty as gods. Here is an example of a prayer to Qat,—the devotee is supposed to be in danger with his canoe. "Qate! Marawa! look down on me, smooth the sea for us two that I may go safely on the sea. Beat down for me the crests of the tide-rip; let the tide-rip settle down away from me, beat it down level that it may sink and roll away, and I may come to a quiet landing-place." Compare the prayer of Odysseus to the river, whose mouth he had reached after three days' swimming on the tempestuous sea: "'Hear me, O king, whosoever thou art, unto thee I am come as to one to whom prayer is made . . . nay, pity me, O king, for I avow myself thy suppliant.' So spake he, and the god stayed his stream, and withheld his waves, and made the water smooth before him" (*Odyssey*, v. 450). The prayer of the Melanesian is on rather a higher religious level than that of the Homeric hero. The myths of Qat's adventures, however, are very crude, though not so wild as some of the Scandinavian myths about Odin and Loki, while they are less immoral than the adventures of Indra and Zeus. Qat was born in the isle of Vanua Levu; his mother was either a stone at the time of his birth, or was turned into a stone afterwards, like Niobe. The mother of Apollo, according to Ælian, had the misfortune to be changed into a wolf. Qat had eleven brothers, not much more reputable than the Osbaldistones in *Rob Roy*. The youngest brother was "Tangaro Loloqong, the Fool." His pastime was to make wrong all that Qat made right, and he is sometimes the Ahriman to Qat's Ormuzd. The creative achievements of Qat must be treated of in the next section. Here it may be mentioned that, like the hero in the Breton märchen, Qat "brought the dawn" by introducing birds whose notes proclaimed the coming of morning. Before Qat's time there had been no night, but he purchased a sufficient allowance of darkness from I Qong, that is, night considered as a person in accordance with the law of savage thought already explained. Night is a person in Greek mythology, and in the fourteenth book of the *Iliad* we read that Zeus abstained from punishing Sleep "because he feared to offend swift Night." Qat produced dawn, for the first time, by cutting the darkness with a knife of red obsidian. Afterwards "the fowls and birds showed the morning." On one occasion an evil power (Vui) slew all Qat's brothers, and hid them in a food-chest. As in the common "swallowing-myths" which we have met among Bushmen and Australians, and will find among the Greeks, Qat restored his brethren to life. Qat is always accompanied by a powerful supernatural spider named Marawa. He first made Marawa's acquaintance when he was cutting down a tree for a canoe. Every night (as in the common European story about bridge-building and church-building) the work was all undone by Marawa, whom Qat found means to conciliate. In all his future adventures the spider was as serviceable as the cat in *Puss-in-Boots* or the other grateful animals in European legend. Qat's great enemy, Qasavara, was dashed against the hard sky, and was turned into stone, like the foes of Perseus. The stone is still shown in Vanua Levu, like the stone which was Zeus in Laconia. Qat, like so many other "culture-heroes," disappeared mysteriously, and white men arriving in the island have been mistaken for Qat. His departure is sometimes connected with the myth of the deluge. In the New Hebrides, Tagar takes the rôle of Qat, and Suqe of the bad principle, Loki, Ahriman, Tangaro Loloqong, the Australian Crow, and so forth. These are the best-known divine myths of the Melanesians, and it is obvious that such gods as exist there are magnified non-natural men or animals with the powers of sorcerers. So far there seems to be no good reason for connecting the gods (if gods they can be called) with the elemental phenomena.

It is "a far cry" from Vanua Levu to Vancouver's Island, and, ethnologically, the Ahts of the latter region are extremely remote from the Papuans with their mixture of Malay and Polynesian blood. The Ahts, however, differ but little in their mythological beliefs from the races of the Banks Islands or of the New Hebrides. In Sproat's *Scenes from Savage Life* (1868) there is a good account of Aht opinions by a settler who had won the confidence of the natives between 1860 and 1868. "There is no end to the stories which an old Indian will relate," says Mr Sproat, when "one quite possesses his confidence." "The first Indian who ever lived" is a divine being, something of a creator, something of a first father, like Unkulunkulu among the Zulus. His name is Quawteaht. He married a pre-existent bird, the thunder-bird Tootah (we have met him among the Zulus), and by the bird he became the father of Indians. Wispohahp is the Aht Noah, who, with his wife, his two brothers, and their wives, escaped from the deluge in a canoe. Quawteaht is inferior as a deity to the Sun and Moon. He is the Yama of an Aht paradise, or home of the dead, where "everything is beautiful and abundant." From all that is told of Quawteaht he seems to be an ideal and powerful Aht, imaginatively placed at the beginning of things, and quite capable of intermarriage with a bird. His creative exploits must be considered later. Quawteaht is the Aht Prometheus Purphoros, or fire-stealer.

Passing down the American continent from the north-west, we find Yehl the chief hero-god and mythical personage among the Thlinkeets. Like many other heroes or gods, Yehl had a miraculous birth. His mother, a Thlinkeet woman, whose sons had all been slain, met a friendly dolphin, which advised her to swallow a pebble and a little sea-water. The birth of Yehl was the result. In his youth he shot a supernatural crane, and can always fly about in its feathers, like Odin and Loki in Scandinavian myth. He is usually, however, regarded as a raven, and holds the same relation to men and the world as the eagle-hawk Pund-jel does in Australia. His great opponent (for the eternal dualism comes in) is Khanukh, who is a wolf, and the ancestor or totem of the wolf-race of men as Yehl is of the raven. The opposition between the Crow and Eagle-hawk in Australia will be remembered. Both animals or men or gods take part in creation. Yehl is the Prometheus Purphoros of the Thlinkeets, but myths of the fire-stealer would form matter for a separate section. Yehl also stole water, in his bird-shape, exactly as Odin stole "Suttung's mead" when in the shape of an eagle.[1] Yehl's powers of metamorphosis and of flying into the air are the common accomplishments of sorcerers, and he is a rather crude form of first father, "culture-hero," and creator.[2]

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[1] These are collected by Callaway, *Zulu Nursery Tales*, 1868. Similar Kaffre stories, also closely resembling the popular fictions of European races, have been published by Theal. Many other examples are published in the *South African Folk-Lore Journal*, 1879, 1880.

Among the Cahroc Indians we find the great hero and divine benefactor in the shape of, not a raven, nor an eagle-hawk, nor a mantis insect, nor a spider, but a coyote. Among both Cahrocs and Navajos the Coyote is the Prometheus Purphoros, or, as the Aryans of India call him, Matarisvan the fire-stealer. Among the Papagos, on the eastern side of the Gulf of California, the Coyote or Prairie Wolf is the creative hero and chief supernatural being. In Oregon the Coyote is also the "demiurge," but most of the myths about him refer to his creative exploits, and will be more appropriately treated in the next section.

Moving up the Pacific coast to British Columbia, we find the Musk-rat taking the part played by Vishnu, when in his avatar as a boar he fished up the earth from the waters. Among the Tinnehs a miraculous dog, who, like an enchanted fairy prince, could assume the form of a handsome young man, is the chief divine being of the myths. He too is chiefly a creative or demiurgic being, answering to Purusha in the *Rig-Veda*. So far the peculiar mark of the wilder American tribe legends is the bestial character of the divine beings, which is also illustrated in Australia and Africa, while the bestial clothing, feathers or fur, drops but slowly off Indra, Zeus and the Egyptian Ammon, and the Scandinavian Odin. All these are more or less anthropomorphic, but retain, as will be seen, numerous relics of a theriomorphic condition.

Passing from the lower savage myths, of which space does not permit us to offer a larger selection, we turn to races in the upper strata of barbarism. Among these the Maoris of New Zealand, and the Polynesian people generally, are remarkable for a mythology largely intermixed with early attempts at more philosophical speculation. The Maoris and Mangaians, and other peoples, have had speculators among them not very far removed from the mental condition of the earliest Greek philosophers, Empedocles, Anaximander, and the rest. In fact the process from the view of nature which we call personalism to the crudest theories of the physicists was apparently begun in New Zealand before the arrival of Europeans. In Maori mythology it is more than usually difficult to keep apart the origin of the world and the origin and nature of the gods. Long traditional hymns give an account of the "becoming out of nothing" which resulted in the evolution of the gods and the world. In the beginning (as in the Greek myths of Uranus and Gaea), Heaven (Rangi, conceived of as a person) was indissolubly united to his wife Earth (Papa), and between them they begat gods which necessarily dwelt in darkness. These gods were some in vegetable, some in animal form; some traditions place among these gods Tiki the demiurge, who (like Prometheus) made men out of clay. The offspring of Rangi and Papa (kept in the dark as they were) held a council to determine how they should treat their parents, "Shall we slay them, or shall we separate them?" In the Hesiodic fable, Cronus separates the heavenly pair by mutilating his oppressive father Uranus. Among the Maoris the god Tutenganahan cut the sinews which united Earth and Heaven, and Tane Mahuta wrenched them apart, and kept them eternally asunder. The new dynasty now had earth to themselves, but Tawhiramatea, the wind, abode aloft with his father. Some of the gods were in the forms of lizards and fishes; some went to the land, some to the water. As among the gods and Asuras of the *Vedas*, there were many wars in the divine race, and as the incantations of the Indian *Brahmanas* are derived from those old experiences of the Vedic gods, so are the incantations of the Maoris. The gods of New Zealand, the greater gods at least, may be called "departmental;" each person who is an elementary force is also the god of that force. As Te Heu, a powerful chief, said, there is division of labour among men, and so there is among gods. "One made this, another that; Tane made trees, Ru mountains, Tanga-roa fish, and so forth."[3] The "departmental" arrangement prevails among the polytheism of civilized peoples, and is familiar to all from the Greek examples. Leaving the high gods whose functions are so large, while their forms (as of lizard, fish, and tree) are often so mean, we come to Maui, the great divine hero of the supernatural race in Polynesia. Maui in some respects answers to the chief of the Adityas in Vedic mythology; in others he answers to Qat, Quawteaht, and other savage divine personages. Like the son of the Vedic Aditi,[4] Maui is a rejected and abortive child of his mother, but afterwards attains to the highest reputation. As Qat brought the hitherto unknown night, so Maui settled the sun and moon in their proper courses. He induced the sun to move orderly by giving him a violent beating. A similar feat was performed by the Sun-trapper, a famous Red Indian chief. These tales belong properly to the department of solar myths. Maui himself is thought by Mr E. B. Tylor to be a myth of the sun, but the sun could hardly give the sun a drubbing. Maui slew monsters, invented barbs for fish-hooks, frequently adopted the form of various birds, acted as Prometheus Purphoros the fire-stealer, drew a whole island up from the bottom of the deep; he was a great sorcerer and magician. Had Maui succeeded in his attempt to pass through the body of Night (considered as a woman) men would have been immortal. But a little bird which sings at sunset wakened Night, she snapped up Maui, and men die. This has been called a myth of sunset, but the sun does what Maui failed to do, he passes through the body of night unharmed. The adventure is one of the myths of the origin of death, which are almost universally diffused. Maui, though regarded as a god, is not often addressed in prayer.[5]

The whole system, as far as it can be called a system, of Maori mythology is obviously based on the savage conceptions of the world which have already been explained. The Polynesian system differs mainly in detail; we have the separation of heaven and earth, the animal-shaped gods, the fire-stealing, the exploits of Maui, and scores of minor myths in Gill's *Myths and Songs of the South Pacific*, in the researches of Ellis, of Williams, in Turner's *Polynesia*, and in many other accessible works.

The Maoris and other Polynesian peoples are perhaps the best examples of a race which has risen far above the savagery of Bushmen and Australians, but has not yet arrived at the stage in which great centralized monarchies appear. The Mexican and Peruvian civilizations were far ahead of Maori culture, in so far as they possessed the elements of a much more settled and highly-organized society. Their religion had its fine lucid intervals, but their mythology and ritual were little better than savage ideas, elaborately worked up by the imagination of a cruel and superstitious priesthood. In cruelty the Aztecs surpassed perhaps all peoples of the Old World, except certain Semitic stocks, and their gods, of course, surpassed almost all other gods in bloodthirstiness. But in grotesque and savage points of faith the ancient Egyptians, the Greeks, and the Vedic Indians ran even the Aztecs pretty close.

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[1] Dasent, *Bragi's Telling: Younger Edda*, p. 94.

[2] Bancroft, vol. iv.

[3] Taylor, *New Zealand*, p. 108.

[4] *Rig-Veda*, x. 72, 1, 8; Muir, *Sanskrit Texts*, iv. 13, where the fable from the *Satapatha-Brahmana* is given.

[5] The best authorities for the New Zealand myths are the old traditional priestly hymns, collected and translated in the works of Sir George Grey, in Taylor's *New Zealand*, in Shortland's *Traditions of New Zealand* (1857), and in Bastian's *Heilige Sage der Polynesier*.

Bernal Diaz, the old "conquistador," has described the hideous aspect of the idols which Cortes destroyed, "idols in the shape of hideous dragons as big as calves," idols half in the form of men, half of dogs, and serpents which were worshipped as divine. The old contemporary missionary Sahagun has left one of the earliest detailed accounts of the natures and myths of these gods, but, though Sahagun took great pains in collecting facts, his speculations must be accepted with caution. He was convinced (like Caxton in his *Destruction of Troy*, and like St Augustine) that the heathen gods were only dead men worshipped. Ancestor-worship is a great force in early religion, and the qualities of dead chiefs and sorcerers are freely attributed to gods, but it does not follow that each god was once a real man, as Sahagun supposes. Euemerism cannot be judiciously carried so far as this. Of Huitzilopochtli, the famed god, Sahagun says that he was a necromancer, loved "shape-shifting," like Odin, metamorphosed himself into animal forms, was miraculously conceived, and, among animals, is confused with the humming-bird, whose feathers adorned his statues.[1] This humming-bird god should be compared with the Roman Picus (Servius, 189). That the humming-bird (Nuitziton), which was the god's old shape, should become merely his attendant (like the owl of Pallas, the mouse of Apollo, the goose of Priapus, the cuckoo of Hera), when the god received anthropomorphic form, is an example of a process common in all mythologies. Plutarch observes that the Greeks, though accustomed to the conceptions of the animal attendants of their own gods, were amazed when they found animals worshipped as gods by the Egyptians. Müller[2] mentions the view that the humming-bird, as the most beautiful flying thing, is a proper symbol of the heaven, and so of the heaven-god, Huitzilopochtli. This vein of symbolism is so easy to work that it must be regarded with distrust. Perhaps it is safer to attribute theriomorphic shapes of gods, not to symbolism (Zeus was a cuckoo), but to survivals from that quality of early thought which draws no line between man and god and beast and bird and fish. If spiders may be great gods, why not the more attractive humming-birds? Like many other gods, Huitzilopochtli slew his foes at his birth, and hence received names analogous to Δειμός and Φόβος. Mr Tylor (*Primitive Culture*, ii. 307) calls Huitzilopochtli an "inextricable compound parthenogenetic god." His sacrament, when paste idols of him were eaten by the communicants, was at the winter solstice, whence it may, perhaps, be inferred that Huitzilopochtli was not only a war-god but a nature-god,—in both respects anthropomorphic, and in both bearing traces of the time when he was but a humming-bird, as Yehl was a raven (Müller, *op. cit.*, p. 595). As a humming-bird, Huitzilopochtli led the Aztecs to a new home, as a wolf led the Hirpini, and as a woodpecker led the Sabines. Quetzalcoatl, the Toltec deity, is as much a sparrow (or similar small bird) as Huitzilopochtli is a humming-bird. Acosta says he retained the sparrow's head in his statue. For the composite character of Quetzalcoatl as a "culture-hero" (a more polished version of Qat), as a "nature-god," and as a theriomorphic god see Müller (*op. cit.*, pp. 583-584). Müller frankly recognizes that not only are animals symbols of deity and its attributes, not only are they companions and messengers of deity (as in the period of anthropomorphic religion), but they have been divine beings in and for themselves during the earlier stages of thought. The Mexican "departmental" gods answer to those of other polytheisms; there is an Aztec Ceres, an Aztec Lucina, an Aztec Vulcan, an Aztec Flora, an Aztec Venus. The creative myths and sun myths are crude and very early in character.

Egyptian Myths.—On a much larger and more magnificent scale, and on a much more permanent basis, the society of ancient Egypt somewhat resembled that of ancient Mexico. The divine myths of the two nations had points in common, but there are few topics more obscure than Egyptian mythology. Writers are apt to speak of Egyptian religion as if it were a single phenomenon of which all the aspects could be observed at a given time. In point of fact Egyptian religion (conservative though it was) lasted through perhaps five thousand years, was subject to innumerable influences, historical, ethnological, philosophical, and was variously represented by various schools of priests. We cannot take the Platonic speculations of Iamblichus about the nature and manifestations of Egyptian godhead as evidence for the belief of the peoples who first worshipped the Egyptian gods an innumerable series of ages before Iamblichus and Plutarch. Nor can the esoteric and pantheistic theories of priests (according to which the various beast-gods were symbolic manifestations of the divine essence) be received as an historical account of the origin of the local animal worships. It has already been shown that the lowest and least intellectual races indulge in local animal-worship, each stock having its parent bird, beast, fish, or even plant, or inanimate object. It has also been shown that these backward peoples recognize a non-natural race of men or animals, or both, as the first fathers, heroes, and, in a sense, gods. Such ideas are consonant with, and may be traced to the confused and nebulous condition of, savage thought. Precisely the same ideas are found at various periods among the ancient Egyptians. If we are to regard the Egyptian myths about the gods in animal shape, and about the non-natural superhuman heroes, and their wars and loves, as esoteric allegories devised by civilized priests, perhaps we should also explain Pund-jel, Qat, Quawteaht, the Mantis god, the Spider creator, the Coyote and Raven gods as priestly inventions, put forth in a civilized age, and retained by Australians, Bushmen, Hottentots, Ahts, Thlinkeets, Papuans, who preserve no other vestiges of high civilization. Or we may take the opposite view, and regard the story of Osiris and his war with Seth (who shut him up in a box and mutilated him) as a dualistic myth, originally on the level of the battle between Gaunab and Tsui-Goab, or between Tagar and Suqe. We may regard the local beast-and plant-gods of Egypt as survivals of totems and totem-gods like those of Australia, India, America, Africa, Siberia, and other countries. In this article the latter view is adopted. The beast-gods and dualistic and creative myths of savages are looked on as the natural product of the savage reason and fancy. The same beast-gods and myths in civilized Egypt are looked on as survivals from the rude and early condition of thought to which such conceptions are natural.

In the most ancient Egyptian records the gods are not pictorially represented, and we have not obtained from these records any descriptions of adoration and sacrifice. There is a prayer to the Sky on the coffin of the king of Dynasty IV., known as Mycerinus to the Greeks. The king describes himself as the child of Sky and Earth. He also somewhat obscurely identifies himself with Osiris.

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[1] See also Bancroft, iii. 288-290, and Acosta, pp. 352-361.

[2] *Geschichte der Amerikanischen Urreligionen*, p. 592.

We thus find Osiris very near the beginning of what is known about Egyptian religion. This being is rather a culture-hero, a member of a non-natural race of men like Qat or Manabozho, than a god. His myth, to be afterwards narrated, is found pictorially represented in a tomb and in the late temple of Philæ, is frequently alluded to in the litanies of the dead about 1400 B.C., is indicated with reverent awe by Herodotus, and after the Christian era is described at full length by Plutarch. Whether the same myth was current in the far more distant days of Mycerinus, it is, of course, impossible to say with dogmatic certainty. The religious history of Egypt, from perhaps Dynasty X. to Dynasty XX., is interrupted by an invasion of Semitic conquerors and Semitic ideas. Prior to that invasion the gods, when mentioned in monuments, are always represented by animals, and these animals are the object of strictly local worship. The name of each god is spelled in hieroglyphs beside the beast or bird. The jackal stands for Anup, the hawk for Har, the frog for Hekt, the baboon for Tahuti, and Ptah, Asiri, Hesi, Nebhat, Hat-hor, Neit, Khnum, and Amun-hor are all written out phonetically, but never represented in pictures. Different cities had their different beast-gods. Pasht, the cat, was the god of Bubastis; Apis, the bull, of Memphis; Hapi, the wolf, of Sioot; Ba, the goat, of Mendes. The evidence of Herodotus, Plutarch, and the other writers shows that the Egyptians of each district refused to eat the flesh of the animal they held sacred. So far the identity of custom with savage totemism is absolute. Of all the explanations, then, of Egyptian animal-worship, that which regards the practice as a survival of totemism and of savagery seems the most satisfactory. So far Egyptian religion only represented her gods in theriomorphic shape. Beasts also appeared in the royal genealogies, as if the early Egyptians had filled up the measure of totemism by regarding themselves as actually descended from animals.

With one or two exceptions, "the first (semi-anthropomorphic) figures of gods known in the civilized parts of Egypt are on the granite obelisk of Bezig in the Fayyûm, erected by Usertesen I. of Dynasty XII., and here we find the forms all full-blown at once. The first group of deities belongs to a period and a district in which Semitic influences had undoubtedly begun to work."[1] From this period the mixed and monstrous figures, semi-theriomorphic, semi-anthropomorphic, hawk-headed and ram-headed and jackal-headed gods become common. This may be attributed to Semitic influence, or we may suppose that the process of anthropomorphizing theriomorphic gods was naturally developing itself; for Mexico has shown us and Greece can show us abundant examples of these mixed figures, in which the anthropomorphic god retains traces of his theriomorphic past. The heretical worship of the solar disk interrupted the course of Egyptian religion under some reforming kings, but the great and glorious Ramesside Dynasty (XIX.) restored "Orus and Isis and the dog Anubis" with the rest of the semi-theriomorphic deities. These survived even their defeat by the splendid human gods of Rome, and only "fled from the folding star of Bethlehem."

Though Egypt was rich in gods, her literature is not fertile in myths. The religious compositions which have survived are, as a rule, hymns and litanies, the funereal service, the "Book of the Dead." In these works the myths are taken for granted, are alluded to in the course of addresses to the divine beings, but, naturally, are not told in full. As in the case of the *Vedas*, hymns are poor sources for the study of mythology, just as the hymns of the church would throw little light on the incidents of the gospel story or of the Old Testament. The "sacred legends" which the priests or temple servants freely communicated to Herodotus are lost through the pious reserve of the traveller. Herodotus constantly alludes to the most famous Egyptian myth, that of Osiris, and he recognizes the analogies between the Osirian myth and mysteries and those of Dionysus. But we have to turn to the very late authority of Plutarch (*De Iside et Osiride*) for an account, confessedly incomplete and expurgated, of what mythology had to tell about the great Egyptian "culture-hero," "dæmon," and god. Osiris, Horus, Typhon (Seth), Isis, and Nephthys were the children of Seb (whom the Greeks identified with Cronus); the myths of their birth were peculiarly savage and obscene. Osiris introduced civilization into Egypt, and then wandered over the world, making men acquainted with agriculture and the arts, as Pund-jel in his humbler way did in Australia. On his return Typhon laid a plot for him. He had a beautiful carved chest made which exactly fitted Osiris, and at an entertainment offered to give it to any one who could lie down in it. As soon as Osiris tried, Typhon had the box nailed up, and threw it into the Tanaite branch of the Nile. Isis wandered, mourning, in search of the body, as Demeter sought Persephone, and perhaps in Plutarch's late version some incidents may be borrowed from the Eleusinian legend. At length she found the chest, which in her absence was again discovered by Typhon. He mangled the body of Osiris (as so many gods of all races were mangled) and tossed the fragments about. Wherever Isis found a portion of Osiris she buried it; hence Egypt was as rich in graves of Osiris as Namaqualand in graves of Heitsi Eibib. The phallus alone she did not find, but she consecrated a model thereof; hence (says the myth) came the phallus-worship of Egypt. Afterwards Osiris returned from the shades, and (in the form of a wolf) urged his son Horus to revenge him on Typhon. The gods fought in animal shape (Birch, in Wilkinson, iii. 144). Plutarch purposely omits as "too blasphemous" the legend of the mangling of Horus. Though the graves of these non-natural beings are shown, the priests (*De Is. et Os.*, xxi.) also show the stars into which they were metamorphosed, as the Eskimo and Australians and Aryans of India and Greeks have recognized in the constellations their ancient heroes. Plutarch remarked the fact that the Greek myths of Cronus, of Dionysus, of Apollo and the Python, and of Demeter, "all the things that are shrouded in mystic ceremonies and are presented in rites," "do not fall short in absurdity of the legends about Osiris and Typhon." Plutarch naturally presumed that the myths which seem absurd shrouded some great moral or physical mystery. But we apply no such explanation to similar savage legends, and our theory is that the Osirian myth is only one of these retained to the time of Plutarch by the religious conservatism of a race which, to the time of Plutarch, preserved in full vigour most of the practices of totemism. As a slight confirmation of the possibility of this theory we may mention that Greek mysteries retained two of the features of savage mysteries. The first was the rite of daubing the initiated with clay.[2] This custom prevails in African mysteries, in Guiana, among Australians, Papuans, and Andaman Islanders. The other custom is the use of the *turndun*, as the Australians call a little fish-shaped piece of wood tied to a string, and waved so as to produce a loud booming and whirring noise and keep away the profane, especially women. It is employed in New Mexico, South Africa, New Zealand, and Australia. This instrument, the *κῶνος*, was also used in Greek mysteries.[1] Neither the use of the *κῶνος* nor of the clay can very well be regarded as a civilized practice retained by savages. The hypothesis that the rites and the stories are savage inventions surviving into civilized religion seems better to meet the difficulty. That the Osirian myth (much as it was elaborated and allegorized) originated in the same sort of fancy as the Tacullie story of the dismembered beaver out of whose body things were made is a conclusion not devoid of plausibility. Typhon's later career, "committing dreadful crimes out of envy and spite, and throwing all things into confusion," was parallel to the proceedings of most of the divine beings who put everything wrong, in opposition to the being who makes everything right. This is perhaps an early "dualistic" myth.

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[1] This extract, with much of what goes before, is from a paper read to the Royal Literary Society by Mr Flinders Petrie.

[2] Demosthenes, *De Corona*, p. 313, *καὶ καθαίρων τοὺς τελουμένους καὶ ἀπομάττων τῷ πηλῷ καὶ τοῖς πιτύροις.*

Among other mythic Egyptian figures we have Ra, who once destroyed men in his wrath with circumstances suggestive of the deluge; Khnum, a demiurge, is represented at Philæ as making man out of clay on a potter's wheel. Here the wheel is added to the Maori conception of the making of man. Khnum is said to have reconstructed the limbs of the dismembered Osiris. Ptah is the Egyptian Hephæstus; he is represented as a dwarf; men are said to have come out of his eye, gods out of his mouth,—a story like that of Purusha in the *Rig-Veda*. As creator of man, Ptah is a frog. Bubastis became a cat to avoid the wrath of Typhon. Ra, the sun, fought the big serpent Apap, as Indra fought Vrittra. Seb is a goose, called "the great cackler;" he laid the creative egg.[2]

Divine Myths of the Aryans of India. Indra.—The gods of the *Vedas* and *Brahmanas* (the ancient hymns and canonized ritual-books of Aryan India) are, on the whole, of the usual polytheistic type. More than many other gods they retain in their titles and attributes the character of elemental phenomena personified. That personification is, as a rule, anthropomorphic, but traces of theriomorphic personification are still very apparent. The ideas which may be gathered about the gods from the hymns are (as is usual in heathen religions) without consistency. There is no strict orthodoxy. As each bard of each bardic family celebrates his favourite god he is apt to make him for the moment the pre-eminent deity of all. This way of thinking about the gods leads naturally in the direction of a pantheistic monotheism in which each divine being may be regarded as a manifestation of the one divine essence. No doubt this point of view was attained in centuries extremely remote by sages of the civilized Vedic world. It is easy, however, to detect certain peculiar characteristics of each god. As among races much less advanced in civilization than the Vedic Indians, each of the greater powers has his own separate department, however much his worshippers may be inclined to regard him as an absolute premier with undisputed latitude of personal government. Thus Indra is mainly concerned with thunder and other atmospheric phenomena; but Vayu is the wind, the Maruts are wind-gods, Agni is fire or the god of fire, and so connected with lightning. Powerful as Indra is in the celestial world, Mitra and Varuna preside over night and day. Ushas is the dawn, and Tvashtri is the mechanic among the gods, corresponding to the Egyptian Ptah and the Greek Hephæstus. Though lofty moral qualities and deep concern about the conduct of men are attributed to the gods in the Vedic hymns, yet the hymns contain traces (and these are amplified in the ritual books) of a divine *chronique scandaleuse*. In this *chronique* the gods, like other gods, are adventurous warriors, adulterers, incestuous, homicidal, given to animal transformations, cowardly, and in fact charged with all human vices, and credited with magical powers.[3] It would be difficult to speak too highly of the ethical nobility of many Vedic hymns. The "hunger and thirst after righteousness" of the sacred poet recalls the noblest aspirations and regrets of the Hebrew psalmist. But this aspect of the Vedic deities is essentially matter for the science of religion rather than of mythology, which is concerned with the stories told about the gods. Religion is always forgetting, or explaining away, or apologizing for these stories. Now the Vedic deities, so imposing when regarded as vast natural forces (as such forces seem to us), so benignant when appealed to as forgivers of sins, have also their mythological aspect. In this aspect they are natural phenomena still, but phenomena as originally conceived of by the personifying imagination of the savage, and credited, like the gods of the Maori or the Australian, with all manner of freaks, adventures, and disguises. The *Veda*, it is true, does not usually dilate much on the worst of these adventures. The *Veda* contains devotional hymns; we can no more expect much narrative here than in the psalms of David. Again, the religious sentiment of the *Veda* is half-consciously hostile to the stories. As M. Barth says, "Le sentiment religieux a écarté la plupart de ces mythes, mais il ne les a écartés tous." The *Brahmanas*, on the other hand, later compilations, canonized books for the direction of ritual and sacrifice, are rich in senseless and irrational myths. Sometimes these myths are probably later than the *Veda*, mere explanations of ritual incidents devised by the priests. Sometimes a myth probably older than the *Vedas*, and maintained in popular tradition, is reported in the *Brahmanas*. The gods in the *Veda* are by no means always regarded as equal in supremacy. There were great and small, young and old gods (*R.-V.*, i. 27, 13). Elsewhere this is flatly contradicted: "None of you, oh gods, is small or young, ye are all great" (*R.-V.*, viii. 30, 1). As to the immortality and the origin of the gods, there is no orthodox opinion in the *Veda*. Many of the myths of the origin of the divine beings are on a level with the Maori theory that Heaven and Earth begat them in the ordinary way. Again, the gods were represented as the children of Aditi. This may be taken either in a refined sense, as if Aditi were the "infinite" region from which the solar deities rise,[4] or we may hold with the *Taittirya-Brahmana*[5] that Aditi was a female who, being desirous of offspring, cooked a *brahmandana* offering for the Sadhyas. Various other fathers and mothers of the gods are mentioned. Some gods, particularly Indra, are said to have won divine rank by "austere fervour" and asceticism, which is one of the processes that makes gods out of mortals even now in India.[6] The gods are not always even credited with inherent immortality. Like men, they were subject to death, which they overcame in various ways. Like most gods, they had struggles for pre-eminence with Titanic opponents, the Asuras, who partly answer to the Greek Titans and the Hawaiian foes of the divine race, or to the Scandinavian giants and the enemies who beset the savage creative beings. Early man, living in a state of endless warfare, naturally believes that his gods also have their battles. The chief foes of Indra are Vrittra and Ahi, serpents which swallow up the waters, precisely as frogs do in Australian and Californian and Andaman myths. It has already been shown that such creatures, thunder-birds, snakes, dragons, and what not, people the sky in the imagination of Zulus, Red Men, Chinese, Peruvians, and all the races who believe that beasts hunt the sun and moon and cause eclipses.[1] Though hostile to Asuras, Indra was once entangled in an intrigue with a woman of that race, according to the *Atharva-Veda* (Muir, *S. T.*, v. 82). The gods were less numerous than the Asuras, but by a magical stratagem turned some bricks into gods (like a creation of new peers to carry a vote),—so says the *Black Yajur-Veda.*[2]

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[1] *Κῶνος ξυλάριον οὗ ἐξῆπται τὸ σπαρτίον, καὶ ἐν ταῖς τελεταῖς ἐδονεῖτο ἵνα ῥοιζῇ.* Quoted by Lobeck, *Aglaophamus*, i. 700, from Bastius ad Gregor., 241, and from other sources; cf. Arnobius, v. c. 19, where the word *turbines* is the Latin term.

[2] Wilkinson, iii. 62, see note by Dr. Birch. The authorities on Egyptian religion are given under EGYPT (vol. vii. pp. 714-719). Unfortunately Egyptologists have rarely a wide knowledge of the myths of the lower races, while anthropologists are seldom or never Egyptologists.

[3] For examples of the lofty morality sometimes attributed to the gods, see Max Müller, *Hibbert Lectures*, p. 284; *Rig-Veda*, ii. 28; iv. 12, 4; viii. 93 *sq.*; Muir, *Sanskrit Texts*, v. 218.

[4] Müller, *Hibbert Lectures*, p. 230.

[5] Muir, *S. T.*, v. 55; i. 27.

[6] See Sir A. Lyal, *Asiatic Studies*. For Vedic examples, see *R.-V.*, x. 167, 1; x. 159, 4; Muir, *S. T.*, v. 15.

Turning to separate gods, Indra first claims attention, for stories of Heaven and Earth are better studied under the heading of myths of the origin of things. Indra has this zoomorphic feature in common with Heitsi Eibib, the Namaqua god,[3] that his mother, or one of his mothers, was a cow (*R.-V.*, iv. 18, 1). This statement may be a mere way of speaking in the *Veda*, but it is a rather Hottentot way.[4] Indra is also referred to as a ram in the *Veda*, and in one myth this ram could fly, like the Greek ram of the fleece of gold. He was certainly so far connected with sheep that he and sheep and the Kshatriya caste sprang from the breast and arms of Prajapati, a kind of creative being. Indra was a great drinker of soma juice; a drinking-song by Indra, much bemused with soma, is in *R.-V.*, x. 119. On one occasion Indra got at the soma by assuming the shape of a quail. In the *Taitt. Samh.* (ii. 5; i. 1) Indra is said to "have been guilty of that most hideous crime, the killing of a Bráhmana."[5] Once, though uninvited, Indra drank some soma that had been prepared for another being. The soma disagreed with Indra; part of it which was not drunk up became Vrittra the serpent, Indra's enemy. Indra cut him in two, and made the moon out of half of his body. This serpent was a universal devourer of everything and everybody, like Kwai Hemm, the all-devourer in Bushman mythology. If this invention is a late priestly one, the person who introduced it into the *Satapatha-Brahmana* must have reverted to the intellectual condition of Bushmen. In the fight with Vrittra, Indra lost his energy, which fell to the earth and produced plants and shrubs. In the same way plants, among the Iroquois, were made of pieces knocked off Chokanipok in his fight with Manabozho. Vines, in particular, are the entrails of Chokanipok. In Egypt, vine was the blood of the enemies of the gods. The Aryan versions of this sensible legend will be found in *Satapatha-Brahmana.*[6] The civilized mind soon wearies of this stuff, and perhaps enough has been said to prove that, in the traditions of Vedic devotees, Indra was not a god without an irrational element in his myth. Our argument is, that all these legends about Indra, of which only a sample is given, have no necessary connexion with the worship of a pure nature-god as a nature-god would now be constructed by men. The legends are survivals of a time in which natural phenomena were regarded, not as we regard them, but as persons, and savage persons, and became the centres of legends in the savage manner. Space does not permit us to recount the equally puerile and barbarous legends of Vishnu, Agni, the loves of Vivasvat in the form of a horse, the adventures of Soma, nor the Vedic amours (paralleled in several savage mythologies) of Pururavas and Urvasi.[7]

Divine Myths of Greece.—If any ancient people was thoroughly civilized the Greeks were that people. Yet in the mythology and religion of Greece we find abundant survivals of savage manners and of savage myths. As to the religion, it is enough to point to the traces of human sacrifice and to the worship of rude fetich stones. The human sacrifices at Salamis in Cyprus and at Alos in Achaia Phthiotis may be said to have continued almost to the conversion of the empire (Grote, i. 125, ed. 1869). Pausanias seems to have found human sacrifices to Zeus still lingering in Arcadia in the 2d century of our era. "On this altar on the Lycæan hill they sacrifice to Zeus in a manner that may not be spoken, and little liking had I to pry far into that sacrifice. But let it be as it is, and as it hath been from the beginning." Now "from the beginning" the sacrifice, according to Arcadian tradition, had been a human sacrifice. In other places there were manifest commutations of human sacrifice, as at the altar of Artemis the Implacable at Patræ, where Pausanias saw the wild beasts being driven into the flames.[8] Many other examples of human sacrifice are mentioned in Greek legend. Pausanias gives full and interesting details of the worship of rude stones, the oldest worship, he says, among the Greeks. Almost every temple had its fetich stone on a level with the pumice stone, which is the Poseidon of the Mangaians.[9] The Argives had a large stone called Zeus Cappotas. The oldest idol of the Thespians was a rude stone. Another has been found beneath the pedestal of Apollo in Delos. In Achæan Pharæ were thirty squared stones, each named by the name of a god. Among monstrous images of the gods which Pausanias, who saw them, regarded as the oldest idols, were the three-headed Artemis, each head being that of an animal, the Demeter with the horse's head, the Artemis with the fish's tail, the Zeus with three eyes, the ithyphallic Hermes, represented after the fashion of the Priapic figures in paintings on the walls of caves among the Bushmen. We also hear of the bull and the bull-footed Dionysus. Phallic and other obscene emblems were carried abroad in processions in Attica both by women and men. The Greek custom of daubing people all over with clay in the mysteries results as we saw in the mysteries of Negroes, Australians, and American races, while the Australian *turndun* was exhibited among the toys at the mysteries of Dionysus. The survivals of rites, objects of worship, and sacrifices like these prove that religious conservatism in Greece retained much of savage practice, and the Greek mythology is not less full of ideas familiar to the lowest races. The authorities for Greek mythology are numerous and various in character. The oldest sources as literary documents are the Homeric and Hesiodic poems. In the *Iliad* and *Odyssey* the gods and goddesses are beautiful, powerful, and immortal anthropomorphic beings. The name of Zeus (Skr. *Dyaus*) clearly indicates his connexion with the sky. But in Homer he has long ceased to be merely the sky conceived of as a person; he is the chief personage in a society of immortals, organised on the type of contemporary human society. "There is a great deal of human nature" in his wife Hera (Skr. *Svar*, Heaven).[1] It is to be remembered that philologists differ widely as to the origin and meaning of the names of almost all the Greek gods. Thus the light which the science of language throws on Greek myths is extremely uncertain. Hera is explained as "the feminine side of heaven" by some authorities. The quarrels of Hera with Zeus (which are a humorous anthropomorphic study in Homer) are represented as a way of speaking about winter and rough weather. The other chief Homeric deities are Apollo and Artemis, children of Zeus by Leto, a mortal mother raised to divinity. Apollo is clearly connected in some way with light, as his name Φοῖβος seems to indicate, and with purity.[2] Homer knows the legend that a giant sought to lay violent hands on Leto (*Od.*, xi. 580). Smintheus, one of Apollo's titles in Homer, is connected with the field-mouse (σμίνθος), one of his many sacred animals. His names, Λύκιος, Λυκηγενής, were connected by antiquity with the wolf, by most modern writers with the light. According to some legends Leto had been a were-wolf.[3] The whole subject of the relations of Greek gods to animals is best set forth in the words of Plutarch (*De Is. et Os.*, lxxi.), where he says that the Egyptians worship actual beasts, "whereas the Greeks both speak and believe correctly, saying that the dove is the sacred animal of Aphrodite, the raven of Apollo, the dog of Artemis," and so forth. Each Greek god had a small menagerie of sacred animals, and it may be conjectured that these animals were originally the totems of various stocks, subsumed into the worship of the anthropomorphic god. Apollo, in any case, is the young and beautiful archer-god of Homer; Artemis, his sister, is the goddess of archery, who takes her pastime in the chase. She holds no considerable place in the *Iliad*; in the *Odyssey*, Nausicaa is compared to her, as to the pure and lovely lady of maidenhood. Her name is commonly connected with ἀρτεμής,—pure, unpolluted. Her close relations (un-Homeric) with the bear and bear-worship have suggested a derivation from ἄρκτος—Ἄρκτεμις. In Homer her "gentle shafts" deal sudden and painless death; she is a beautiful Azrael. A much more important daughter of Zeus in Homer is Athene, the "grey-eyed" or (as some take γλαυκῶπις, rather improbably) the "owl-headed" goddess. Her birth from the head of Zeus is not explicitly alluded to in Homer.[4] In Homer, Athene is a warlike maiden, the patron-goddess of wisdom and manly resolution. In the twenty-second book of the *Odyssey* she assumes the form of a swallow, and she can put on the shape of any man. She bears the ægis, the awful shield of Zeus. Another Homeric child of Zeus, or, according to Hesiod (*Th.*, 927), of Hera alone, is Hephæstus, the lame craftsman and artificer. In the *Iliad*[5] will be found some of the crudest Homeric myths. Zeus or Hera throws Hephæstus or Ate out of heaven, as in the Iroquois myth of the tossing from heaven of Ataentsic. There is, as usual, no agreement as to the etymology of the name of Hephæstus. Preller inclines to a connexion with ἧφθαι, to kindle fire, but Mr Max Müller differs from this theory. About the close relations of Hephæstus with fire there can be no doubt. He is a rough, kind, good-humoured being in the *Iliad*. In the *Odyssey* he is naturally annoyed by the adultery of his wife, Aphrodite, with Ares. Ares is a god with whom Homer has no sympathy. He is a son of Hera, and detested by Zeus (*Iliad*, v. 890). He is cowardly in war, and on one occasion was shut up for years in a huge brazen pot. This adventure was even more ignominious than that of Poseidon and Apollo when they were compelled to serve Laomedon for hire. The payment he refused, and threatened to "cut off their ears with the sword" (*Iliad*, xxi. 455). Poseidon is to the sea what Zeus is to the air, and Hades to the underworld in Homer.[6] His own view of his social position may be stated in his own words (*Iliad*, xv. 183, 211).

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[1] See Tylor, *Primitive Culture*, i. 288, 329, 356.

[2] The chief authority for the constant strife between gods and Asuras is the *Satapatha-Brahmana*, of which one volume is translated in *Sacred Books of the East* (vol. xii.).

[3] Hahn, *Tsuni-Goam, the Supreme Being of the Hottentots*, p. 68.

[4] See Muir, *S. T.*, v. 16, 17, for Indra's peculiar achievements with a cow.

[5] *Sacred Books of the East*, xii. 1, 48.

[6] *Ib.*, xii. 176, 177.

[7] On the whole subject, Dr Muir's *Ancient Sanskrit Texts*, with translations, Ludwig's translation of the *Rig-Veda*, the version of the *Satapatha-Brahmana* already referred to, and the translation of the *Aitareya-Brahmana* by Haug, are the sources most open to English readers. Mr Max Müller's translation of the *Rig-Veda* unfortunately only deals with the hymns to the Maruts. The Indian epics and the *Puranas* belong to a much later date, and are full of deities either unknown to or undeveloped in the *Rig-Veda* and the *Brahmanas.* It is much to be regretted that the *Atharva-Veda*, which contains the magical formulæ and incantations of the Vedic Indians is still untranslated, though, by the very nature of its theme, it must contain matter of extreme antiquity and interest.

[8] Pausanias, iii. 16; vii. 18. Human sacrifice to Dionysus, Paus., vii. 21; Plutarch, *De Is. et Os.* 35; Porphyry, *De Abst.* ii. 55.

[9] Gill, *Myths and Songs from the South Pacific*, p. 60.

> "Three brethren are we, and sons of Cronus, sons whom Rhea bare, even Zeus and myself, and Hades is the third, the ruler of the people in the underworld. And in three lots were all things divided, and each drew a lot of his own,[7] and to me fell the hoary sea, and Hades drew the mirky darkness, and Zeus the wide heaven in clear air and clouds, but the earth and high Olympus are yet common to all."

Zeus, however, is, as Poseidon admits, the elder-born, and therefore the revered head of the family. Thus Homer adopts the system of primogeniture, while Hesiod is all for the opposite and probably earlier custom of "*jüngsten-recht*," and makes supreme Zeus the youngest of the sons of Cronus. Among the other gods Dionysus is but slightly alluded to in Homer as the son of Zeus and Semele, as the object of persecution, and as connected with the myth of Ariadne. The name of Hermes is derived from various sources, as from ὁρμᾶν and ὁρμή, or, by Mr Max Müller, the name is connected with Sarameya (Sky). If he had originally an elemental character, it is now difficult to distinguish, though interpreters connect him with the wind. He is the messenger of the gods, the bringer of good luck, and the conductor of men's souls down the dark ways of death. In addition to the great Homeric gods, the poet knows a whole "Olympian consistory" of deities, nymphs, nereids, sea-gods and goddesses, river-gods, Iris the rainbow goddess, Sleep, Demeter who lay with a mortal, Aphrodite the goddess of love, wife of Hephæstus and leman of Ares, and so forth. As to the origin of the gods, Homer is not very explicit. He is acquainted with the existence of an older dynasty now deposed, the dynasty of Cronus and the Titans. In the *Iliad* (viii. 478) Zeus says to Hera, "For thine anger reck I not, not even though thou go to the nethermost bounds of earth and sea, where sit Iapetus and Cronus . . . and deep Tartarus is round about them." "The gods below that are with Cronus" are mentioned (*Il.*, xiv. 274; xv. 225). Rumours of old divine wars echo in the *Iliad*, as (i. 400) where it is said that when the other immortals revolted against and bound Zeus, Thetis brought to his aid Ægæon of the hundred arms. The streams of Oceanus (*Il.*, xiv. 246) are spoken of as the source of all the gods, and in the same book (290) "Oceanus and mother Tethys" are regarded as the parents of the immortals. Zeus is usually called Cronion and Cronides, which Homer certainly understood to mean "son of Cronus," yet it is expressly stated that Zeus "imprisoned Cronus beneath the earth and the unvintaged sea." The whole subject is only alluded to incidentally. On the whole it may be said that the Homeric deities are powerful anthropomorphic beings, departmental rulers, united by the ordinary social and family ties of the Homeric age, capable of pain and pleasure, living on heavenly food, but refreshed by the sacrifices of men (*Od.*, v. 100, 102), able to assume all forms at will, and to intermarry and propagate the species with mortal men and women. Their past has been stormy, and their ruler has attained power after defeating and mediatizing a more ancient dynasty of his own kindred.

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[1] Cf. Preller, *Griechische Mythologie*, i. 128, note 1, for this and other philological conjectures.

[2] The derivation of Ἀπόλλων remains obscure. The derivation of Leto from λαθεῖν, and the conclusion that her name means "the concealer," that is, the night, whence the sun is born, is disputed by Curtius (Preller, i. 190, 191, note 4), but appears to be accepted by Mr Max Müller (*Selected Essays*, i. 386), Latmos being derived from the same root as Leto, Latona, the night.

[3] Aristotle, *H. An.*, 6; Ælian, *N. A.*, 4, 4.

[4] Her name, as usual, is variously interpreted by various etymologists. Some connect Ἀθήνη with *αἰθ*, as in *αἰθήρ*. Mr Max Müller connects it with *ahana* (Skr., dawn), but it is not universally admitted that *ahana* does mean "dawn," nor that the derivation is correct.

[5] xiv. 257; xviii. 395; xix. 91, 132.

[6] The root of his name is sought in such words as *πότος* and *ποταμός*.

[7] We learn from the *Odyssey* (xiv. 209) that this was the custom of sons on the death of their father.

From Hesiod we receive a much more elaborate, probably a more ancient, certainly a more barbarous, story of the gods and their origin. In the beginning the gods (here used in a wide sense to denote an early non-natural race) were begotten by Earth and Heaven, conceived of as beings with human parts and passions (Hesiod, *Theog.*, 45). This idea recurs in Maori, Vedic, and Chinese mythology. Heaven and Earth, united in an endless embrace, produced children which never saw the light. In New Zealand, Chinese, Vedic, Indian, and Greek myths the pair had to be sundered.[1] Hesiod enumerates the children whom Earth bore "when couched in love with Heaven." They are Ocean, Cœus, Crius, Hyperion, Iapetus, Theia, Rhea, Themis, Mnemosyne, Phœbe, Tethys, and the youngest, Cronus, "and he hated his glorious father." Others of this early race were the Cyclopes, Bronte, Sterope, and Arge, and three children of enormous strength, Cottus, Briareus (Ægæon), and Gyes, each with one hundred hands and fifty heads. Uranus detested his offspring, and hid them in crannies of Earth. Earth excited Cronus to attack the father, whom he castrated with a sickle. From the blood of Cronus (this feature is common in Red Indian and Egyptian myths) were born furies, giants, ash-nymphs, and Aphrodite. A number of monsters, as Echidna, Geryon, and the hound of hell, were born of the loves of various elemental powers. The chief stock of the divine species was continued by the marriage of Rhea (probably another form of the Earth) with Cronus. Their children were Hestia, Demeter, Hera, Hades, and Poseidon. All these Cronus swallowed; and this "swallow-myth" occurs in Australia, among the Bushmen, in Guiana, in Brittany (where Gargantua did the swallow trick), and elsewhere. At last Rhea bore Zeus, and gave Cronus a stone in swaddling bands, which he disposed of in the usual way. Zeus grew up, administered an emetic to Cronus (some say Metis did this), and had the satisfaction of seeing all his brothers and sisters disgorged alive. The stone came forth first, and Pausanias saw it at Delphi (Paus., x. 24). Then followed the wars between Zeus and the gods he had rescued from the maw of Cronus against the gods of the elder branch, the children of Uranus and Gæa,—Heaven and Earth. The victory remained with the younger branch, the immortal Olympians of Homer. The system of Hesiod is a medley of later physical speculation and of poetic allegory, with matter which we, at least, regard as savage survivals, like the mutilation of Heaven and the swallow-myth.[2]

In Homer and in Hesiod myths enter the region of literature, and become, as it were, national. But it is probable that the local myths of various cities and temples, of the "sacred chapters" which were told by the priests to travellers and in the mysteries to the initiated, were older in form than the epic and national myths. Of these "sacred chapters" we have fragments and hints in Herodotus. Pausanias, in the mythographers, like Apollodorus, in the tragic poets, and in the ancient *scholia* or notes on the classics. From these sources come almost all the more inhuman, bestial, and discreditable myths of the gods. In these we more distinctly perceive the savage element. The gods assume animal forms: Cronus becomes a horse, Rhea a mare; Zeus begets separate families of men in the shape of a bull, an ant, a serpent, a swan. His mistress from whom the Arcadians claim descent becomes a she-bear. It is usual with mythologists to say that Zeus is the "all-father," and that his amours are only a poetic way of stating that he is the parent of men. But why does he assume so many animal shapes? Why did various royal houses claim descent from the ant, the swan, the she-bear, the serpent, the horse, and so forth? We have already seen that this is the ordinary pedigree of savage stocks in Asia, Africa, Australia, and America, while animals appear among Irish tribes, and in Egyptian and ancient English genealogies.[3] It is a plausible hypothesis that stocks which once claimed descent from animals, *sans phrase*, afterwards regarded the animals as avatars of Zeus. In the same way "the Minas, a non-Aryan tribe of Rajputana, used to worship the pig; when the Brahmans got a turn at them, the pig became an avatar of Vishnu" (Lyal, *Asiatic Studies*). The tales of divine cannibalism to which Pindar refers with awe, the mutilation of Dionysus Zagreus, the unspeakable abominations of Dionysus, the loves of Hera in the shape of a cuckoo, the divine powers of metamorphosing men and women into beasts and stars,—these tales come to us as echoes of the period of savage thought. Further evidence on this point will be given below in a classification of the principal mythic legends. The general conclusion is that many of the Greek deities were originally elemental, the elements being personified in accordance with the laws of savage imaginations. But we cannot explain each detail in the legends as a myth of this or that natural phenomenon or process as understood by ourselves. Various stages of late and early fancy have contributed to the legends. Zeus is the sky, but not our sky; he had originally a personal character, and that a savage or barbarous character. He probably attracted into his legend stories that did not originally belong to him. He became anthropomorphic, and his myth was handled by local priests, by family bards, by national poets, by early philosophers. His legend is a complex embroidery on a very ancient tissue. The other divine myths are equally complex.

Scandinavian Divine Myths.—The Scandinavian myths of the gods are numerous and interesting, but the evidence on which they have reached us demands criticism for which we lack space. That there are in the *Eddas* and *Sagas* early ideas and later ideas tinged by Christian legend seems indubitable, but philological and historical learning has by no means settled the questions of relative purity and antiquity in the myths. The Eddic songs, according to Mr Powell, one of the editors of the *Corpus Poeticum Septentrionale* (the best work on the subject), "cannot date earlier" in their present form "than the 9th century," and may be vaguely placed between 800-1100 A.D. The collector of the *Edda* probably had the old poems recited to him in the 13th century, and where there was a break in the memory of the reciters the *lacuna* was filled up in prose. "As one goes through the poems, one is ever and anon face to face with a myth of the most childish and barbaric type," which "carries one back to præ-Aryan days." Side by side with these old stories come fragments of a different stratum of thought, Christian ideas, the belief in a supreme God, the notion of Doomsday. The Scandinavian cosmogonic myth (with its parallels among races savage and civilized) is given elsewhere. The most important god is Odin, the son of Bestla and Bor, the husband of Frigg, the father of Balder and many other sons, the head of the Æsir stock of gods. Odin's name is connected with that of Wuotan, and referred to the Old High German verb *watan wuot = meare, cum impetu ferri* (Grimm, *Teut. Myth.*, Engl. transl., i. 131). Odin would thus (if we admit the etymology) be the swift goer, the "ganger," and it seems superfluous to make him (with Grimm) "the all-powerful, all-permeating being," a very abstract and scarcely an early conception. Odin's brethren (in *Gylfi's Mocking*) are Vile and Ve, who with him slew Ymir the giant, and made all things out of the fragments of his body. They also made man out of two stocks. In the *Hava-Mal* Odin claims for himself most of the attributes of the medicine-man. In *Loka Senna*, Loki, the evil god, says that "Odin dealt in magic in Samsey." The goddess Frigg remarks, "Ye should never talk of your old doings before men, of what ye two Æsir went through in old times." But many relics of these "old times," many traces of the medicine-man and the "skin-shifter," survive in the myth of Odin. When he stole Suttung's mead (which answers somewhat to nectar and the Indian soma), he flew away in the shape of an eagle.[1] The hawk is sacred to Odin; one of his names is "the Raven-god." He was usually represented as one-eyed, having left an eye in pawn that he might purchase a draught from Mimir's well. This one eye is often explained as the sun. Odin's wife was Frigg; their sons were Thor (the thunder-god) and Balder, whose myth is well known in English poetry. The gods were divided into two, not always friendly, stocks, the Æsir and Vanir. Their relations are, on the whole, much more amicable than those of the Asuras and Devas in Indian mythology. Not necessarily immortal, the gods restored their vigour by eating the apples of Iduna. Asa Loki was a being of mixed race, half god, half giant, and wholly mischievous and evil. His legend includes animal metamorphoses of the most obscene character. In the shape of a mare he became the mother of the eight-legged horse of Odin. He borrowed the hawk-dress of Freya, when he recovered the apples of Iduna. Another Eddic god, Hœne, is described in phrases from lost poems as "the long-legged one," "lord of the ooze," and his name is connected with that of the crane. The constant enemies of the gods, the giants, could also assume animal forms. Thus in Thiodolf's *Haust-long* (composed after the settlement of Iceland) we read about a shield on which events from mythology were painted; among these was the flight of "giant Thiazzi in an ancient eagle's feathers." The god Herindal and Loki once fought a battle in the shapes of seals. On the whole, the Scandinavian gods are a society on an early human model, of beings indifferently human, animal, and divine,—some of them derived from elemental forces personified, holding sway over the elements, and skilled in sorcery. Probably after the viking days came in the conceptions of the last war of gods, and the end of all, and the theory of Odin All-father as a kind of emperor in the heavenly world. The famous tree that lives through all the world is regarded as "foreign, Christian, and confined to few poems." There is, almost undoubtedly, a touch of the Christian dawn on the figure and myth of the pure and beloved and ill-fated god Balder, and his descent into hell. The whole subject is beset with critical difficulties, and we have chiefly noted features which can hardly be regarded as late, and which correspond with widely-distributed mythical ideas.[2]

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[1] See Tylor, *Prim. Cult.*, i. 326.

[2] Bleek, *Bushman Folk-Lore*, pp. 6-8. Mr Max Müller suggests another theory (*Selected Essays*, i. 460): "*Κρόνος* did not exist till long after *Ζεύς* in Greece." The name *Κρονίων*, or *Κρονίδης*, looks like a patronymic. Mr Müller, however, thinks it originally meant only "connected with time, existing through all time." Very much later the name was mistaken for a genuine patronymic, and "Zeus the ancient of days" became "Zeus the son of Cronus." Having thus got a Cronus, the Greeks—and "the misunderstanding could have happened in Greece only"—needed a myth of Cronus. They therefore invented or adapted the "swallow-myth" so familiar to Bushmen and Australians. This singular reversion to savagery itself needs some explanation. But the hypothesis that Cronus is a late derivation from *Κρονίδης* and *Κρονίων* is by no means universally accepted. Others derive *Κρόνος* from *κραίνω*, and connect it with *κρόνια*, a kind of harvest home festival. Schwartz (*Prähistorisch-anthropologische Studien*) readily proves Cronus to be the storm, swallowing the clouds. Perhaps we may say of Schwartz's view, as he says of Preller's—"das ist Gedankenspiel, aber nimmermehr Mythologie."

[3] Elton, *Origins of English History*, 298-301.

It is now necessary to cast a hasty glance over the chief divisions of myths. These correspond to the chief problems which the world presents to the curiosity of untutored men. They ask themselves (and the answers are given in myths) the following questions:—What is the Origin of the World? The Origin of Man? Whence came the Arts of Life? Whence the Stars? Whence the Sun and Moon? What is the Origin of Death? How was Fire procured by Man? The question of the origin of the marks and characteristics of various animals and plants has also produced a class of myths in which the marks are said to survive from some memorable adventure, or the plants and animals to be metamorphosed human beings. Examples of all these myths are found among savages and in the legends of the ancient civilizations. A few such examples may now be given.

Myths of the Origin of the World.—We have found it difficult to keep myths of the gods apart from myths of the origin of the world and of man, because gods are frequently regarded as creative powers. The origin of things is a problem which has everywhere exercised thought, and been rudely solved in myths. These vary in quality with the civilization of the races in which they are current, but the same ideas which we proceed to state pervade all cosmogonical myths, savage and civilized. All these legends waver between the theory of creation, or rather of manufacture, and the theory of evolution. The earth, as a rule, is supposed to have grown out of some original matter, perhaps an animal, perhaps an egg which floated on the waters, perhaps a fragment of soil fished up out of the floods by a beast or a god. But this conception does not exclude the idea that many of the things in the world, minerals, plants, people, and what not, are fragments of the frame of an animal or non-natural magnified man, or are excretions from the body of a god. We proceed to state briefly the various forms of these ideas. The most backward races usually assume the prior existence of the earth.

The aborigines of the northern parts of Victoria (Australia) believe that the earth was made by Pund-jel, the bird-creator, who sliced the valleys with a knife. Another Australian theory is that the men of a previous race, the Nooralie (very old ones), made the earth.

The problem of the origin of the world seems scarcely to have troubled the Bushmen. They know about "men who brought the sun," but their doctrines are revealed in mysteries, and Qing, the informant of Mr Orpen (*Cape Monthly Magazine*, July 1874), "did not dance that dance," that is, had not been initiated into all the secret doctrines of his tribe. According to Qing, creation was the work of Cagn (the mantis insect), "he gave orders and caused all things to appear." Elsewhere in the myth Cagn made or manufactured things by his skill.

As a rule the most backward races, while rich in myths of the origin of men, animals, plants, stones, and stars, do not say much about the making of the world. Among people a little more advanced, the earth is presumed to have grown out of the waters. In the Iroquois myth (Lafitau, *Mœurs des Sauvages*, 1724), a heavenly woman was tossed out of heaven, and fell on a turtle, which developed into the world. Another North-American myth assumes a single island in the midst of the waters, and this island grew into the world. The Navajos and the Digger Indians take earth for granted as a starting-point in their myths. The Winnebagos, not untouched by Christian doctrine, do not go farther back. The Great Manitou awoke and found himself alone. He took a piece of his body and a piece of earth and made a man. Here the existence of earth is assumed (Bancroft, iv. 228). Even in Guatemala, though the younger sons of a divine race succeed in making the earth where the elder son (as usual) failed, they all had a supply of clay as first material. The Pimas, a Central-American tribe, say the earth was made by a powerful being, and at first appeared "like a spider's web." This reminds one of the Ananzi or spider creator of West Africa. The more metaphysical Tacullies of British Columbia say that in the beginning nought existed but water and a musk-rat. The musk-rat sought his food at the bottom of the water, and his mouth was frequently filled with mud. This he kept spitting out, and so formed an island, which developed into the world. Among the Tinnehs, the frame of a dog (which could assume the form of a handsome young man) became the first material of most things. The dog, like Osiris, Dionysus, Purusha, and other gods, was torn to pieces by giants; the fragments became many of the things in the world (Bancroft, i. 106). Even here the existence of earth for the dog to live in is assumed.

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[1] Indra was a hawk when, "being well-winged, he carried to men the food tasted by the gods" (*R.-V.*, iv. 26, 4). Yehl, the Thlinkeet god-hero, was a raven or a crane when he stole the water (Bancroft, iii. 100-102). The prevalence of animals, or of god-animals, in myths of the stealing of water, soma, and fire, is very remarkable. Among the Andaman Islanders, a kingfisher steals fire for men from the god Pulugu (*Anthrop. Journal*, November 1882).

[2] Dasent's *Prose or Younger Edda* (Stockholm, 1842), the *Corpus Septentrionale* already referred to, Mr Keary's *Mythology of the Eddas*, Pigott's *Manual of Scandinavian Mythology* (1888), and Laing's *Early Kings of Norway* may be consulted by English students. For Germanic myths at large, Grimm's celebrated *German Mythology*, translated by Mr Stallybrass, may be studied, and Mr Keary's *Outlines of Primitive Belief*. German divine myths are necessarily scarce, owing to the early conversion of Germany before a pre-Christian literature, like the *Eddas*, was preserved. Obscure classical notices, and survivals in folk-lore, mediæval and modern, are the chief sources of information. The divine names, however, prove that the German was in form not alien to the Scandinavian mythology. The märchen in Grimm's and other collections belong rather to the heroic myths than to those concerned with gods.

Coming to races more advanced in civilization, we find the New Zealanders in possession of ancient hymns in which the origin of things is traced back to nothing, to darkness, and to a metaphysical process from nothing to something, from being to becoming. The hymns may be read in Sir George Grey's *Polynesian Mythology*, and in Taylor's *New Zealand*. It has been suggested that these hymns bear traces of Buddhist and Indian influence; in any case, they are rather metaphysical than mystical. Myth comes in when the Maoris represent Rangi and Papa, Heaven and Earth, as two vast beings, male and female, united in a secular embrace, and finally severed by their children, among whom Tane Mahuta takes the part of Cronus in the Greek myth. The gods were partly elemental, partly animal in character; the lists of their titles show that every human crime was freely attributed to them. In the South Sea Islands, generally, the fable of the union and separation of Heaven and Earth is current; other forms will be found in Gill's *Myths and Songs from the South Pacific*.

The Greek cosmogonic myths have already been alluded to in the passage on divine myths in Greece.

The cosmogonic myths of the Aryans of India are peculiarly interesting, as we find in the *Vedas* and *Brahmanas* and *Puranas* almost every fiction familiar to savages side by side with the most abstract metaphysical speculations. We have the theory that earth grew, as in the Iroquois story of the turtle, from a being named Uttanapad (Muir, v. 335). We find that Brahmanaspati "blew the gods forth from his mouth," and one of the gods, Tvashtri, the mechanic among the deities, is credited with having fashioned the earth and the heaven (Muir, v. 354). The "Purusha Sukta," the 90th hymn of the tenth book of the *Rig-Veda*, gives us the Indian version of the theory that all things were made out of the mangled limbs of Purusha, a magnified non-natural man, who was sacrificed by the gods. As this hymn gives an account of the origin of the castes (which elsewhere are scarcely recognized in the *Rig-Veda*), it is sometimes regarded as a late addition. But we can scarcely think the main conception late, as it is so widely scattered that it meets us in most mythologies, including those of Chaldæa and Egypt, and various North-American tribes. Not satisfied with this myth, the Aryans of India accounted for the origin of species in the following barbaric style. A being named Purusha was alone in the world. He differentiated himself into two beings, husband and wife. The wife, regarding union with her producer as incest, fled from his embraces as Nemesis did from those of Zeus, and Rhea from Cronus, assuming various animal disguises. The husband pursued in the form of the male of each animal, and from these unions sprang the various species of beasts (*Satapatha-Brahmana*, xiv. 4, 2; Muir, i. 25). The myth of the cosmic egg from which all things were produced is also current in the *Brahmanas*. In the *Puranas* we find the legend of many successive creations and destructions of the world a myth of world-wide distribution

As a rule, destruction by a deluge (see DELUGE) is the most favourite myth, but destructions by fire and wind and by the wrath of a god are common in Australian, Peruvian, and Egyptian tradition. The idea that a boar, or a god in the shape of a boar, fished up a bit of earth which subsequently became the world out of the waters, is very well known to the Aryans of India, and recalls the feats of American musk-rats and coyotes already described.[1] The tortoise from which all things sprang, in a myth of the *Satapatha-Brahmana*, reminds us of the Iroquois turtle. The Greek and Mangaian myth of the marriage of Heaven and Earth and its dissolution is found in the *Aitareya-Brahmana* (Haug's trans., ii. 308; *Rig-Veda*, i. lxii.).

So much for the Indian cosmogonic myths, which are a collection of ideas familiar to savages, blended with sacerdotal theories and ritual mummeries. The philosophical theory of the origin of things, a hymn of remarkable stateliness, is in *Rig-Veda*, x. 129. The Scandinavian cosmogonic myth starts from the abyss, Ginnungagap, a chaos of ice, from which, as it thawed, was produced the giant Ymir. Ymir is the Scandinavian Purusha. A man and woman sprang from his armpit, like Athene from the head of Zeus. A cow licked the hoar-frost, whence rose Bur, whose children, Odin, Vile, and Ve, slew the giant Ymir. "Of his flesh they formed the earth, of his blood seas and waters, of his bones mountains, of his teeth rocks and stones, of his hair all manner of plants." This is the story in the *Prose Edda*, derived from older songs, such as the *Grimnersmal*. However the distribution of this singular myth may be explained, its origin can scarcely be sought in the imagination of races higher in culture than the Tinnehs and Tacullies, among whom dogs and beavers are the theriomorphic form of Purusha or Ymir.

Myths of the Origin of Man.—These partake of the conceptions of evolution and of creation. Man was made out of clay by a supernatural being. *Australia*: man was made by Pund-jel. *New Zealand*: man was made by Tiki; "he took red clay, and kneaded it with his own blood." *Mangaia*: the woman of the abyss made a child from a piece of flesh plucked out of her own side. *Melanesia*: "man was made of clay, red from the marshy side of Vanua Levú;" woman was made by Qat of willow twigs. *Greece*: men were πλάσματα πηλοῦ, figures baked in clay by Prometheus.[2] *India*: men were made after many efforts, in which the experimental beings did not harmonize with their environment, by Prajapati. In another class of myths, man was evolved out of the lower animals,—lizards in Australia; coyotes, beavers, apes, and other beasts in America. The Greek myths of the descent of the Arcadians, Myrmidons, children of the swan, the cow, and so forth, may be compared. Yet again, men came out of trees or plants or rocks: as from the Australian wattle gum, the Zulu bed of reeds, the great tree of the Ovahereros, the rock of the tribes in Central Africa, the cave of Bushman and North-American and Peruvian myth, "from tree or stone" (*Odyssey*, xix. 163). This view was common among the Greeks, who boasted of being autochthonous. The Cephisian marsh was one scene of man's birth according to a fragment of Pindar, who mentions Egyptian and Libyan legends of the same description.

Myths of the Arts of Life.—These are almost unanimously attributed to "culture-heroes," beings theriomorphic or anthropomorphic, who, like Pund-jel, Qat, Quawteaht, Prometheus, Manabozho, Quetzalcoatl, Cagn, and the rest, taught men the use of the bow, the processes (where known) of pottery, agriculture (as Demetêr), the due course of the mysteries, divination, and everything else they knew. Commonly the teacher disappears mysteriously. He is often regarded by modern mythologists as the sun.

Star Myths.—"The stars came otherwise," says Mr Browning's Caliban. In savage and civilized myths they are usually metamorphosed men, women, and beasts. In Australia, the Pleiades, as in Greece, were girls. Castor and Pollux in Greece, as in Australia, were young men. Our Bear was a bear, according to Charlevoix and Lafitau, among the North-American Indians; the Eskimo, according to Egede, who settled the Danish colony in Greenland, regarded the stars "very nonsensically," as "so many of their ancestors;" the Egyptian priests showed Plutarch the stars that had been Isis and Osiris. Aristophanes, in the *Pax*, shows us that the belief in the change of men into stars survived in his own day in Greece. The Bushmen (Bleek) have the same opinion. The *Satapatha-Brahmana* (*Sacred Books of the East*, xii. 284) shows how Prajapati, in his incestuous love, turned himself into a roebuck, his daughter into a doe, and how both became constellations. This is a thoroughly good example of the savage myths (as in Peru, according to Acosta) by which beasts and anthropomorphic gods and stars are all jumbled together.[3] The *Rig-Veda* contains examples of the idea that the good become stars.

Solar and Lunar Myths.—These are universally found, and are too numerous to be examined here. The sun and moon, as in the Bulgarian ballad of the *Sun's Bride* (a mortal girl), are looked on as living beings. In Mexico they were two men, or gods of a human character who were burned. The Eskimo know the moon as a man who visits earth, and, again, as a girl who had her face spotted by ashes which the Sun threw at her. The Khasias make the sun a woman, who daubs the face of the moon, a man. The Homeric hymn to Helios, as Mr Max Müller observes, "looks on the sun as a half-god, almost a hero, who had once lived on earth." This is precisely the Bushman view; the sun was a man who irradiated light from his armpit. In New Zealand and in North America the sun is a beast, whom adventurers have trapped and beaten. Medicine has been made with his blood. In the Andaman Islands the Sun is the wife of the Moon (*Jour. of Anth. Soc.*, 1882). Among aboriginal tribes in India (Dalton, p. 186) the Moon is the Sun's bride; she was faithless and he cut her in two, but occasionally lets her shine in full beauty. The Andaman Islanders account for the white brilliance of the moon by saying that he is daubing himself with white clay, a custom common in savage and Greek mysteries. The Red Men accounted to the Jesuits for the spherical forms of sun and moon by saying that their appearance was caused by their bended bows. The Moon in Greek myths loved Endymion, and was bribed to be the mistress of Pan by the present of a fleece, like the Dawn in Australia, whose unchastity was rewarded by a gift of a red cloak of opossum skin. Solar and lunar myths usually account for the observed phenomena of eclipse, waning and waxing, sunset, spots on the moon, and so forth, by various mythical adventures of the animated heavenly beings. In modern folk-lore the moon is a place to which bad people are sent, rather than a woman or a man. The mark of the hare in the moon has struck the imagination of Germans, Mexicans, Hottentots, Cingalese, and produced myths among all these races.[1]

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[1] *Black Yajur-Veda* and *Satapatha-Brahmana*; Muir, i. 52.

[2] Aristophanes, *Aves*, 686; *Etym. Magn.*, s.v. Ἰκόνιον. Pausanias saw the clay (Paus. x. iv.). The story is also quoted by Lactantius from Hesiod.

[3] See also *Vishnu Purana*, i. 131.

Myths of Death.—Few savage races regard death as a natural event. All natural deaths are supernatural with them. Men are assumed to be naturally immortal, hence a series of myths to account for the origin of death. Usually some custom or "taboo" is represented as having been broken, when death has followed. In New Zealand, Maui was not properly baptised. In Australia, a woman was told not to go near a certain tree where a bat lived; she infringed the prohibition, the bat fluttered out, and men died. The Ningphoos were dismissed from paradise, and became mortal, because one of them bathed in water which had been tabooed (Dalton, p. 13). In the *Atharva-Veda*, Yama, like Maui in New Zealand, first "spied out the path to the other world," which all men after him have taken. In the *Rig-Veda* (x. 14), Yama "sought out a road for many." In the Solomon Islands (*Jour. Anth. Inst.*, Feb. 1881), "Koevari was the author of death, by resuming her cast-off skin." The same story is told in the Banks Islands. In the Greek myth (Hesiod, *Works and Days*, 90), men lived without "ill diseases that give death to men" till the cover was lifted from the forbidden box of Pandora. As to the myths of Hades, the place of the dead, they are far too many to be mentioned in detail. In almost all the gates of hell are guarded by fierce beasts, and in Ojibway, Finnish, Greek, Papuan, and Japanese myths no mortal visitor may escape from Hades who has once tasted the food of the dead.

Myths of Fire-stealing.—Those current in North America (where an animal is commonly the thief) will be found in Bancroft, vol. iv. The Australian version, singularly like one Greek legend, is given by Brough Smyth. Stories of the theft of Prometheus are recorded by Hesiod, Æschylus, and their commentators. Muir and Kuhn may be consulted for Vedic fire-stealing.

Heroic and Romantic Myths.—In addition to myths which are clearly intended to explain facts of the universe, most nations have their heroic and romantic myths. Familiar examples are the stories of Perseus, Odysseus, Sigurd, the Indian epic stories, the adventures of Ilmarinen and Wainamoinen in the *Kalewala*, and so forth. To discuss these myths as far as they can be considered apart from divine and explanatory tales would demand more space than we have at our disposal. It will become evident to any student of the romantic myths that they consist of different arrangements of a rather limited set of incidents. These incidents have been roughly classified by Von Hahn.[2] We may modify his arrangement as follows.

There is (1) the story of a bride or bridegroom who transgresses a commandment of a mystic nature, and disappears as a result of the sin. The bride sins as in Eros and Psyche, Freja and Oddur, Pururavas and Urvasi.[3] The sin of Urvasi and Psyche was seeing their husbands—naked in the latter case. The sin was against "the manner of women." Now the rule of etiquette which forbids seeing or naming the husband (especially the latter) is of the widest distribution. The offence in the Welsh form of the story is naming the partner—a thing forbidden among early Greeks and modern Zulus. Presumably the tale (with its example of the sanction) survives the rule in many cases. (2) "Penelope formula." The man leaves the wife and returns after many years. A good example occurs in Chinese legend. (3) Formula of the attempt to avoid fate or the prophecy of an oracle. This incident takes numerous shapes, as in the story of the fatal birth of Perseus, Paris, the Egyptian prince shut up in a tower, the birth of Œdipus. (4) Slaughter of a monster. This is best known in the case of Andromeda and Perseus. (5) Flight, by aid of an animal usually, from cannibalism, human sacrifice, or incest. The Greek example is Phrixus, Helle, and the ram of the golden fleece. (6) Flight of a lady and her lover from a giant father or wizard father. Jason and Medea furnish the Greek example. (7) The youngest brother the successful adventurer, and the head of the family. We have seen the example of Greek mythic illustrations of "jungsten-recht," or supremacy of the youngest, in the Hesiodic myth of Zeus, the youngest child of Cronus. (8) Bride given to whoever will accomplish difficult adventures, or vanquish girl in race. The custom of giving a bride without demanding bride-price, in reward for a great exploit, is several times alluded to in the *Iliad*. In Greek heroic myth Jason thus wins Medea, and (in the race) Milanion wins Atalanta. In the *Kalewala* much of the Jason cycle, including this part, recurs. The rider through the fire wins Brunhild but this may belong to another cycle of ideas. (9) The grateful beasts, who, having been aided by the hero, aid him in his adventures. Melampus and the snakes is a Greek example. This story is but one specimen of the personal human character of animals in myths, already referred to the intellectual condition of savages. (10) Story of the strong man and his adventures, and stories of the comrades Keen-eye, Quick-ear, and the rest. Jason has comrades like these, as had Ilmarinen and Heracles, the Greek "strong man." (11) Adventure with an ogre, who is blinded and deceived by a pun of the hero's. Odysseus and Polyphemus is the Greek example. (12) Descent into Hades of the hero. Heracles, Odysseus, Wainamoinen in the *Kalewala*, are the best-known examples in epic literature. These are twelve specimens of the incidents, to which we may add (13) "the false bride," as in the poem of *Berte aus grans Piés*, and (14) the legend of the bride said to produce beast-children. The belief in the latter phenomenon is very common in Africa, and in the *Arabian Nights*, and we have seen it in America.

Of these formulæ (chosen because illustrated by Greek heroic legends)—(1) is a sanction of barbarous nuptial etiquette; (2) is an obvious ordinary incident; (3) is moral, and both (3) and (1) may pair off with all the myths of the origin of death from the infringement of a taboo or sacred command; (4) would naturally occur wherever, as on the west coast of Africa, human victims have been offered to sharks or other beasts; (5), the story of flight from a horrible crime, occurs in some stellar myths, and is an easy and natural invention; (6), flight from wizard father or husband, is found in Bushman and Namaqua myth, where the husband is an elephant; (7), success of youngest brother, may have been an explanation and sanction of "jüngsten-recht,"—Maui in New Zealand is an example, and Herodotus found the story among the Scythians; (8), the bride given to successful adventurer, is consonant with heroic manners as late as Homer; (9) is no less consonant with the belief that beasts have human sentiments and supernatural powers; (10), the "strong-man," is found among Eskimo and Zulus, and was an obvious invention when strength was the most admired of qualities; (11), the baffled ogre, is found among Basques and Irish, and turns on a form of punning which inspires an "ananzi" story in West Africa; (12), descent into Hades, is the natural result of the savage conception of Hades, and the tale is told of actual living people in the Solomon Islands and in New Caledonia; Eskimo Angekoks can and do descend into Hades,—it is the prerogative of the necromantic magician; (13), "the false bride", found among the Zulus, does not permit of such easy explanation,—naturally, in Zululand, the false bride is an animal; (14), the bride accused of bearing beast-children, has already been disposed of; the belief is inevitable where no distinction worth mentioning is taken between men and animals. English folk-lore has its woman who bore rabbits.

The formulæ here summarized, with others, are familiar in the märchen of Samoyeds, Zulus, Bushmen, Hottentots, and Red Indians.[4] For an argument intended to show that Greek heroic myths may be adorned and classified märchen, in themselves survivals of savage fancy, see *Fortnightly Review*, May 1872, "Myths and Fairy Tales." The usual explanation is that märchen are degenerate heroic myths. This does not explain the märchen of African, and perhaps not of Siberian races.

In this sketch of mythology that of Rome is not included, because its most picturesque parts are borrowed from or adapted into harmony with the mythology of Greece. Japanese, Chinese, and Persian matters are omitted from want of information, and because of the extreme obscurity of the subject. Greece, India, and Scandinavia will supply a fair example of Aryan mythology (without entering on the difficult Slavonic and Celtic fields).

There is perhaps no single work which contains a good comparative view of civilized and savage mythologies. Tylor's *Primitive Culture* comes nearest to what a reader interested in truly comparative mythology desires. As a rule, writers like Cox, Gubernatis, and other "elemental" mythologists lay little stress on non-Aryan stories. Gubernatis's *Zoological Mythology* and Cox's *Mythology of the Aryan People* must be consulted with caution. Schwartz, in his *Der Ursprung der Mythologie*, has got hold of a correct idea (the belief in meteoric animals), but he works his idea too hard. The writings of Max Müller, Muir's *Ancient Sanskrit Texts*, and other standard works have already been repeatedly quoted. The old writers, like Bryant, are useless, except for occasional references to ancient authorities. There are many useful references in Mr Brown's *Great Dionysiak Myth*, but the reasonings need not be adopted. As a rule the German treatises adopt various forms of the "meteorological" and "solar" hypotheses. (A. L.)

MYTILĒNE. See LESBOS.

MZENSK, another form of MTSENSK (*q.v.*).

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[1] See *Cornhill Magazine*, "How the Stars got their Names" (1882, p. 35); and "Some Solar and Lunar Myths" (1882, p. 440); Max Müller, *Selected Essays*, i. 609-611.

[2] *Griechische und Albanesische Märchen*, i. 45.

[3] Tenth Book of *Rig-Veda* and "Brahmana" of *Yajur-Veda*; Müller, *Selected Essays*, i. 410.

[4] See Castrén, Callaway, Theal, Bleek, Schoolcraft, whose *Algic Researches* must be read with caution.

N

N denotes the dental nasal in all the languages in which our alphabet is used. But the sound which we call the dental nasal varies slightly in different languages according to the position of the point of the tongue. This may be pressed against the back of the teeth; and then we have a true "dental" sound. But the point of the tongue may also be placed not against the teeth but against the front part of the palate immediately behind the gums; and it is in this way that our English dentals are formed.

But this same letter N, either alone or together with another letter, or distinguished by some diacritical mark, can be used for a much wider range of nasal sounds. It has been already pointed out (see letter M) that there are in every language as many nasals as there are clearly distinguished classes of sound produced at different parts of the mouth, *e.g.*, guttural or back-palatal, front-palatal, dental, labial, and others less easily apprehended. Each of these classes will have its nasal, which will vary from the sonant of the class only by the different position of the uvula: for the sonant (as, for example, *d*) the uvula is pressed up so as to cover the passage through the pharynx into the nostrils, and the voice therefore escapes wholly through the mouth; for the nasal (as for *n*) the uvula hangs down, so that the voice passes partly behind it through the nose, partly through the mouth; in all other respects the position of the vocal organs for *d* and for *n* is just the same, and the material of the sound is the same, *i.e.*, breath made sonant by the vibration of the glottis. In an improved alphabet, therefore, we ought in each language to have several symbols for the nasals, as in Sanskrit, which had five different symbols. But no European language has more than two simple symbols; and, of these two, *m* is confined to one class, viz., the labial; *n*, simple or modified, denotes the other sounds, and therefore often differs in different languages, and sometimes in the same language. It may also be employed to denote a wholly different class of sounds, as the nasalised vowels of the French, which will be described below.

The guttural nasal is heard in "anger," "finger," "hunger"; it is easy to note the difference of the *n* as heard in these words, and in "an," "fin," &c. In English, when the sound occurs at the end of a word, it is represented by *ng*, as "hang," "sing," &c., sometimes also when medial, as in the derivatives "hanger," "singer." It would be convenient if, as has often been proposed, the superfluous symbol *q* were employed for this nasal. The sound is heard in German as well as in English; but in French it is unknown. On the other hand, the front palatal nasal is heard in the French "Boulogne," Italian "Campagna," Spanish "año," "otoño," &c., the diacritical mark being always used in Spanish; it is not known with us; but its position in the mouth is shown by that of the corresponding closed consonants, English *ch* and *j*, and of the fricative consonant of the same class, which is *y*. The peculiar class of sounds called "cerebral" in Sanskrit was formed by turning the point of the tongue a little backward toward the top of the palate; of these the nasal was by far the most frequent. Our English "dental" lies between the cerebral and the true "dental," for which (as in India) the tongue actually touches the teeth,—our dental being of the kind already mentioned, in which the tongue does not come farther forward than the front palate.

From what has been said, it will appear that the nasals might be called nasalized consonants. The guttural nasal is *g* nasalized; the dental nasal is *d* nasalized: part of the voice in each case is diverted from the mouth through the nostrils, and some nasal sound is already heard while the passage through the mouth is closed by the tongue, or by the lips for the production of the labial nasal; but the complete nasal sound is not heard till the block of the tongue or of the lips is removed, exactly as in the production of *g*, or *d*, or *b*. But it is possible to nasalize vowels as well as to nasalize consonants. The position of the uvula can be altered when the mouth is set for sounding the vowel *a* just as well as when it is set for the sound of *g*; and then instead of the pure *a*-sound we get one of a nasal quality; as instead of the final consonant sound of "hag" we get the nasalized guttural in "hang." These nasalised vowels are unknown to us in England; and this is the reason why we find so much difficulty in pronouncing them in French. An Englishman learning French will always begin by pronouncing "en" as if it were "eng," and "on" as if it were "ong." But the French "en" is not the vowel *e* plus the guttural nasal *n*; it is the vowel *e* nasalized.

It is probable, though not provable, that nasal vowels were used in Latin. The evidence lies in the varying spelling of words like "censor" and "cesor," "consul" and "cosol," &c.; neither is right, but each seems to be an attempt to avoid an error; "censor" is a protest against sounding a nasal *e* as pure *e*; and "cesor" against sounding it as *e* + *n*. Again, the Latin has "con-ficere," but "com-ponere"; now *f* and *p* are both labials, and therefore we should expect the same treatment of the final *n* in "con" before each; probably the *n* marked a nasal vowel (used before a fricative consonant), whereas the *m* was a true nasal consonant before the closed consonant *p*. Cicero's doctrine (*Orat.* 159) that the vowel *i* is naturally long in "in-sanus," "in-felix," &c., but short in "in-doctus," points to the same conclusion—that the *n* before *s* and *f* marked a long nasalized vowel. Lastly, we have the spelling of Greek words like *θησαυρός* as "thensaurus" in Latin; it is improbable that the *n* here was the full consonant.

It is not unlikely that the appearance and non-appearance of the nasal in the dialects of the same language indicates an original nasalized vowel which has in one case disappeared, in the other has passed into a vowel followed by a nasal. Thus in German we find "sanft" corresponding to English "soft," "gans" to "goose," &c. But the vowel has been modified in such cases in compensation for the loss of its original nasal quality.

The phenomenon of the so-called "parasitic" nasal arises from careless pronunciation; before sounding a closed consonant (like *g*) the uvula is not sufficiently raised, and so a nasal of the same class is heard before the *g*, as in "nightingale" (compare German "nachtigal"). Yet more common is the development by the nasal itself of a parasitic closed consonant of its own class; many such have long been firmly established, as in the words "soun*d*" (Middle English "soun," like French "son," Latin "sonu-s"), "thun*d*er" (A.S. "thunor"), still rightly pronounced in the north of England as "thunner"; but "gown*d*," "sing-*g*ing," though familiar enough, have not yet made their way into polite speech. These parasitic sounds are also due to careless pronunciation; if the passage through the nostrils be not kept open till the articulating organs of the mouth have separated, the nasal quality at the end of the sound is lost, and the closed consonant must follow. There has been an odd loss of *n* at the beginning of several English words which has often been noted. It arises from our double form of the indefinite article "a" and "an." Sometimes the "a" has abstracted the "n" from the beginning of the noun: thus "a nadder" has turned into "an adder," "a napron" into "an apron," "a nauger" into "an auger." On the other hand the letter has had one compensatory gain: "an ewt" (eft) has turned into "a newt." (J. P.)

NABATÆANS, a famous people of ancient Arabia, whose settlements in the time of Josephus (*Ant.*, i. 12, § 4; comp. Jerome, *Qu. in Gen.* xxv.) gave the name of Nabatene to the border-land between Syria and Arabia from the Euphrates to the Red Sea. The language of Josephus suggests, and Jerome, apparently following him, directly affirms, that the name is identical with that of the Ishmaelite tribe of Nebaioth (נְבָיוֹת, Gen. xxv. 13; Isa. lx. 7), which in later Old Testament times had a leading place among the northern Arabs, and is associated with Kedar much as Pliny v. 11 (12) associates *Nabatæi* and *Cedrei*. The identification is still followed by many scholars, but is rendered uncertain by the fact that the name Nabatæan is properly spelled with *ṭ* not *t* (נבטו on the inscriptions, Arabic *Nabaṭ*, *Nabîṭ*, &c.). Thus the history of this remarkable people cannot with certainty be carried back beyond 312 B.C., at which date they were attacked without success by Antigonus in their mountain fortress of Petra. They are described by Diodorus (xix. 94 *sq.*) as being at this time a strong tribe of some 10,000 warriors, pre-eminent among the nomadic Arabs, eschewing agriculture, fixed houses, and the use of wine (which were forbidden on pain of death), living on flesh and milk, and drinking water sweetened with manna, but adding to pastoral pursuits a considerable and profitable trade with the seaports in myrrh and spices from Arabia Felix, as well as a trade with Egypt in bitumen from the Dead Sea used in the preparation of mummies. Their arid country was the best safeguard of their cherished liberty; for the bottle-shaped cisterns for rain-water which they excavated in the rocky or argillaceous soil were carefully concealed from invaders. Petra or Sela‘ was the ancient capital of Edom; the Nabatæans must have occupied the old Edomite country, and succeeded to its commerce, after the Edomites took advantage of the Babylonian captivity to press forward into southern Judæa. This migration, the date of which cannot be determined, also made them masters of the shores of the Gulf of ‘Aḳaba and the important harbour of Elath. Here, according to Agatharchides (*Geog. Gr. Min.*, i. 178), they were for a time very troublesome, as wreckers and pirates, to the reopened commerce between Egypt and the East, till they were chastised by the Greek sovereigns of Alexandria.

Tenacious as they were of the nomad usages of their ancestors, the Nabatæans had already some tincture of foreign culture when they first appear in history. That culture was naturally Aramaic; they wrote a letter to Antigonus "in Syriac letters," and Syriac continued to be the language of their coins and inscriptions when the tribe grew into a kingdom, and profited by the decay of the Seleucids to extend its borders northward over the more fertile country east of the Jordan. They occupied the Ḥaurán, and about 85 B.C. their king Aretas (Ḥáritha) became lord of Damascus and Cœle Syria. Allies of the first Hasmonæans in their struggles against the Greeks, they became the rivals of the Judæan dynasty in the period of its splendour, and a chief element in the disorders which invited Pompey's intervention in Palestine. The Roman arms were not very successful against the sons of the desert (expedition of Scaurus, 63 B.C.); King Aretas retained his whole possessions, including Damascus, as a Roman vassal.[1] As "allies" of the Romans the Nabatæans continued to flourish throughout the first Christian century. Their power extended far into Arabia, particularly along the coast of the Red Sea; and Petra was a meeting-place of many nations, though the importance of its commerce was diminished by the rise of the Eastern trade-route from Myoshormus to Coptus on the Nile. Under the Roman peace they lost their warlike habits, and were a sober, acquisitive, orderly people, wholly intent on trade. They had now agriculture and houses of stone, and were not unacquainted with foreign luxuries and arts (Strabo, xvi. 4). Such a people might have long been a valuable bulwark between Rome and the wild hordes of the desert but for the short-sighted cupidity of Trajan, who reduced Petra and broke up the Nabatæan nationality (105 A.D.). The new Arab invaders who soon pressed forward into their seats found the remnants of the Nabatæans transformed into *fellâḥîn*, and speaking Aramaic like their neighbours. Hence Nabatæans became the Arabic name for Aramæans, whether in Syria or ‘Iráḳ, a fact which was misinterpreted by Quatremère into a theory that the Nabatæans were originally Aramæan immigrants from Babylonia. More recent inquiry has shown this view to be quite false. The Nabatæans were true Arabs—as the proper names on their inscriptions show—who came under the influence of Aramæan civilization. See especially Nöldeke in *Z. D. M. G.*, xvii. 705 *sq.*, xxv. 122 *sq.*

For the inscriptions and coins of the Nabatæans consult De Luynes in *Revue Numism.*, 1858; Levy in *Z. D. M. G.*, xiv. 363 *sq.*; De Vogüé, *Mél. d'Arch. Or.*, 1868, *Syrie Centrale*, 1866–77, and *Inscr. Sémitiques*, 1868–77. The character of De Vogüé's inscriptions from the Haurán appears to be the parent of the Cufic Arabic. The so-called *Faláḥa Nabaṭíya*, or "Nabatæan agriculture," which professes to be an Arabic translation by Ibn-Waḥshíya from an ancient Nabatæan source (MSS. in Leyden and elsewhere), is a forgery of the 10th century. See Gutschmid in *Z. D. M. G.*, xv. 1 *sq.*; and Nöldeke, *Ibid.*, xxix. 445 *sq.*

NABHA, or Narbal, one of the Cis-Sutlej states in the Punjab, India, lying between 30° 17′ and 30° 40′ N. lat., and between 75° 50′ and 76° 20′ E. long., has an area of 863 square miles, with a population in 1881 of 261,824. The first relations of the state with the British were in 1807–8, when the rájá applied for and obtained protection against the threatened encroachments of Ranjit Sinh. During the mutiny in 1857 this chief showed distinguished loyalty, and was rewarded by grants of territory to the value of over £10,000. The rájá is a Sikh of the Sidhu Ját tribe; he has full powers of life and death over his subjects, and has an estimated annual revenue of £65,000. The chief products of the state are sugar, cereals, cotton, and tobacco.

NABULÚS, or Nablús. See Shechem.

NADÍM. Abulfaraj ibn Isḥáḳ of Baghdad, known as Ibn abí Ya‘ḳúb al-Nadím (*ob.* 995 A.D.), is the author of one of the most interesting works in Arabic literature, the *Fihrist*, or "list of the books of all nations that were to be found in Arabic," with notices of the authors and other particulars, carried down to the year 377 A.H. (987–88 A.D.). A note in the Leyden MS. places the death of the author eight years later. Of his life we know nothing; the name Nadím belonged to a distinguished family of Persian origin. The oldest Arabic scholars, of whose works comparatively little has been preserved to us, had a much wider range of interest than their successors. Even then Islám and the Korán were the centre of all study; but curiosity was not limited by religious scruples; men were eager to know the wisdom and the literature of all nations and sects; the free thought which was afterwards so sternly suppressed in the reaction of orthodoxy towards the close of the 9th century lifted men above narrow prejudices. The work of Al-Nadím gives us a complete picture of the most active intellectual period of the Arab empire. He traces the rise and growth of philology and belles-lettres, of theology, orthodox and heretical, of law and history, of mathematics and astronomy, of medicine and alchemy; he does not despise the histories of knights errant, the fables of Kalíla and Dimna, the facetiæ of the "boon companions," the works of magic and divination. But to us no part of his work is more interesting than his account of the beliefs of sects and peoples beyond Islám. Here, fortunately, still more than in other parts of his work, he goes beyond the functions of the mere cataloguer; he tells what he learned of China from a Christian missionary of Najrán, of India from a description of its religion compiled for the Barmecide Yaḥya; his full accounts of the Ṣabians of Ḥarrán and of the doctrines of Mani[1] are of the very first importance for the historian of Asiatic religions.

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[1] Compare 2 Cor. xi. 32. The Nabatæan Aretas or Æneas there mentioned reigned from 7 B.C. to 40 A.D. or thereby.

The *Fihrist* was much pillaged by later writers, but the author was sedulously ignored, and MSS. of his work are very scarce. Hottinger possessed one (now lost), and used it in his *Historia Orientalis*. There are others (all imperfect) at Paris, Leyden, and Vienna; a small part of the book is altogether lost. Flügel published an abstract of the work in *Z. D. M. G.*, xiii. (1859); his edition, with notes, appeared posthumously (vol. i., text, Leipsic, 1871; vol. ii., notes, 1872).

NADIR SHAH. See PERSIA.

NADIYÁ, or NUDDEA, a district in the lieutenant-governorship of Bengal, lying between 22° 52′ 33″ and 24° 11′ N. lat., and between 88° 11′ and 89° 24′ 41″ E. long., bounded on the N. by Rájsháhí, on the E. by Pabná and Jessor, on the S. by the 24 Parganás, and on the W. by Húglí, Bardwán, Bírbhúm, and Murshídábád districts, with an area of 3404 square miles. It is emphatically a district of great rivers. Standing at the head of the Gangetic delta, its alluvial surface, though still liable to periodical inundation, has been raised by ancient deposits of silt sufficiently high to be permanent dry land. Along the entire north-eastern boundary flows the wide stream of the Padmá or Ganges; and all the remaining rivers of the district are offshoots of the great river. The Bhágirathí on the eastern border, and the Jalangi and the Matabhanga meandering through the centre of the district, are the chief of these offshoots, and are called distinctively the "Nadiyá rivers." But the whole surface of the country is interlaced with a network of minor streams, communicating with one another by side channels. All the rivers are navigable in the rainy season for boats of the largest burthen, but during the rest of the year they dwindle down to shallow streams, with dangerous sandbanks and bars.

In former times the Nadiyá rivers afforded the regular means of communication between the upper valley of the Ganges and the seaboard; and much of the trade of the district still comes down to Calcutta by this route during the height of the rainy season. But the lines of the East Indian and Eastern Bengal Railways, with the main stream of the Ganges and the Sundarbans route, now carry by far the larger portion of the traffic.

The census of 1881 returned the population at 2,017,847, of whom 1,146,603 were Mohammedans and 864,773 Hindus. Of the 6439 Christians, 6304 were natives. Krishnagar had 24,477 inhabitants in 1881; and six others had in 1872 a population exceeding 5000:—Sántipur, 28,635; Kushtiá, 9245; Ránághát, 8871; Nadiyá, 8863; Mihrpur, 5562; and Kumárkhálí, 5251. Nadiyá, the ancient capital, was formerly situated on the east bank of the Bhágirathí (which has since changed its course). It has always been celebrated for the sanctity and learning of its pandits. The battlefield of Plassey was situated in this district, but the floods of the Bhágirathí have washed away the scene of that memorable engagement.

Rice is the staple crop, and there are four harvests in the year. Indigo is the chief export staple; but the district was the centre of the indigo riots in 1860, and the industry then received a blow from which it has never recovered. A large proportion of the cultivable area of the district is held on *utbandí* tenure—that is, for a single season only, the rents being assessed according to the out-turn of the crop. Floods are common, and frequently cause much damage.

The number of indigo factories is still considerable. Cotton-weaving is carried on, but is everywhere on the decline, especially at the town of Sántipur, where, in the beginning of the century, the Company used to purchase muslin to the annual value of £150,000. Sántipur muslin is still exported to a small extent. Raw date sugar is largely manufactured. The chief exports are indigo, jute, linseed, wheat, pulses and gram, rice, chillies, sugar, and tobacco.

The only institutions in the district worthy of note are the *tols* or indigenous Sanskrit schools. In these *smriti* (Hindu social and religious law) and *nyaya* (logic) are taught by learned pandits to eager pupils. The *tols* consist generally of a mere collection of mud hovels round a quadrangle, where the students live in the most primitive manner, each in his own hut, with his brass water-pot and mat, and seldom any other furniture. A student generally remains at the *tol* for eight or ten years. No fees are charged, and the pandits depend for their livelihood on the presents which their fame as teachers ensures them at religious ceremonies. Most of the *tols* are in Nadiyá town, but there are also a few in the surrounding villages. Their number is rapidly decreasing.

The district revenue in 1880–81 amounted to Rs. 1,654,818, Rs. 1,051,776 being derived from the land-tax. Education was afforded in 1877 by 897 schools, attended by 28,489 pupils. The principal educational institution is the Government college at Krishnagar. The average annual temperature is 77° Fahr.; the average annual rainfall about 65 inches. Besides remittent and intermittent fevers, which cause very great mortality, small-pox, diarrhœa, dysentery, and cholera are prevalent. Cattle disease is common.

NÆVIUS, GNÆUS, is the second in order of time among the creators of Latin literature. He had made his appearance as an author within five years after the first dramatic representation of Livius Andronicus; he was some ten or fifteen years older than Plautus, and preceded Ennius by a generation. As distinguished from Livius he was a native Italian, not a Greek; he was also a writer of original power, not a mere adapter or translator. If it was due to Livius that the forms of Latin literature were, from the first, moulded on those of Greek literature, it was due to Nævius that much of its spirit and substance was of native growth. Long before the formal recognition of literature in Rome, which dated from the year 240 B.C., there had existed various kinds of inartistic composition, written or spoken, in Saturnian verse. The most important of these were satiric and dramatic medleys, known by the name of *saturæ*, and commemorative verses in praise of eminent men, which were first sung at funeral banquets, and seem afterwards to have been preserved among family records. The fact that Nævius wrote his most important poem in Saturnian verse, the disparaging reference made to him by Ennius as the writer of verses like those of the old native "Fauni and Vates," the claim which he makes in his epitaph to be the last purely Latin poet, the political satire which he introduced into his comedies, the national and commemorative character of his epic poem, all point to him as a medium of connexion between the nameless authors of these satiric and commemorative verses and the recognized authors of Roman comedy, satire, and even epic poetry.

Though the fragments preserved from his numerous writings are few and inconsiderable, yet they corroborate the impression derived from ancient testimony that he was a man of originality and force of mind, and of a bold and vigorous character. The impulse which he sought to give to Latin literature was somewhat antagonistic to that actually given by Ennius; and either the greater genius and richer culture of the latter or his greater adaptation to his times determined that his influence should be predominant. Probably the genius of Ennius was the higher creative force; it was more in harmony with the serious Roman spirit, and with the grandeur of Roman institutions; it more naturally allied itself with the aristocratic influence which was predominant in the state for two generations after the death of Nævius; it was also more capable of assimilating the Greek culture, which was the formative element in the literary art of the Romans. Yet the racy popular spirit of Nævius gained for him admirers even in the Augustan age, and Cicero represents the great master of Latin oratory, Crassus, as the highest compliment he could pay to the pure idiomatic speech of his mother-in-law, Lælia, comparing it to the style of Nævius and Plautus. Though a richer vein of imaginative feeling was introduced into the Latin language and literature by Ennius, yet much was lost in their subsequent development by the partial suppression of the aggressive boldness and freedom of Nævius, as well as of the exuberant mirth and humour of Plautus.

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[1] The former translated in Chwolson's *Ssabier und Ssabismus*, vol. ii., the latter in Flügel's *Mani, seine Lehre und seine Schriften*, 1862.

There is great uncertainty in regard to the facts and dates of the life of Nævius. From the expression of Gellius characterizing his epitaph as written in a vein of "Campanian arrogance" it has been inferred that he was born in one of the Latin communities settled in Campania. But the phrase "Campanian arrogance" seems to have been used proverbially for "gasconade"; and, as there was a plebeian *Gens Nævia* in Rome, it is quite as probable that he was by birth a Roman citizen. The strong political partisanship which he displayed in his plays is favourable to this supposition, as is also the active interference of the tribunes on his behalf. On the other side weight must be given to the remark of Mommsen, viz., "the hypothesis that he was not a Roman citizen, but possibly a citizen of Cales or of some other Latin town in Campania, renders the fact that the Roman police treated him so unscrupulously the more easy of explanation." He served either in the Roman army or among the *socii* in the First Punic War, and thus must have reached manhood before the year 241 B.C. We learn from Cicero that he lived to a good old age, and that he died in exile about the end of the 3d century B.C. The date of his birth may be thus fixed with approximate probability about the year 265 B.C. No particulars of his military service are recorded. Sicily was the great battlefield of the combatants during the latter years of the war. No important Sicilian city was without its theatre, and it seems legitimate to connect the new taste for regular dramatic performances (and especially for tragedy, to which there was nothing corresponding among the Italian races) developed at Rome immediately after the conclusion of the First Punic War with the Sicilian experiences of the Roman and allied armies serving in the war. Another important influence in Roman literature and Roman belief which first appeared in the epic poem of Nævius also had its origin in Sicily, viz., the recognition of the mythical connexion of Æneas and his Trojans with the foundation of Rome. The origin of this belief may probably be attributed to the Sicilian historian Timæus; but the contact of the Romans and Carthaginians in the neighbourhood of Mount Eryx may have suggested that part of the legend which plays so large a part in the *Æneid*, which brings Æneas from Sicily to Carthage and back again to the neighbourhood of Mount Eryx. The actual collision of Phœnician and Roman on the western shores of Sicily, of which Nævius may well have been a witness, if it did not originate, gave a living interest to the mythical origin of that antagonism in the relations of Æneas and Dido.

The career of Nævius as a dramatic author began with the exhibition of a drama in or about the year 235 B.C., and was carried on energetically for thirty years afterwards. Towards the close of this career he incurred the hostility of some of the nobility, especially, it is said, of the family of the Metelli, by the attacks which he made upon them on the stage, and at their instance he was imprisoned,—a circumstance to which Plautus alludes in a passage of the *Miles Gloriosus* (211). After writing two plays during his imprisonment, in which he is said to have apologized for his former rudeness (Gellius, iii. 3, 15), he was liberated through the interference of the tribunes of the commons; but he had shortly afterwards to retire from Rome (in or about the year 204 B.C.) to Utica. The generally received accounts assigned his death to that year; but Cicero (*Brutus*, 15, 60) quotes Varro as an authority for the belief that his life was prolonged beyond that date. It may have been during his exile, when withdrawn from his active career as a dramatist, that he composed or completed his poem on the First Punic War.[1] Probably his latest composition was the epitaph already referred to, also written in Saturnian verse:—

> "Immortales mortales flere si foret fas,
> Flerent divæ Camenæ Nævium poetam;
> Itaque postquam est Orcino traditus thesauro
> Obliti sunt Romai loquier lingua Latina."[2]

If, as has been supposed, these lines were dictated by a jealousy of the growing ascendency of Ennius, the life of Nævius must have been prolonged considerably beyond the year 204 B.C., as it was only in that year that Ennius first settled, and began his career as an author, in Rome.

Like Livius, Nævius professed to adapt Greek tragedies and comedies to the Roman stage. Among the titles of his tragedies are *Ægisthus*, *Lycurgus*, *Andromache* or *Hector Proficiscens*, *Equus Trojanus*, &c. We find in the letters of Cicero a reference to a representation of the last-named play at the opening of the theatre of Pompey in 55 B.C.; but it seems to have retained its popularity so long not so much from its dramatic merits as from the scope it afforded for the gratification of the Roman taste for gorgeous spectacles. The few fragments preserved from the tragedies show the first rude beginnings of that artificial poetical phraseology and poetical word-formation which the impulse derived from Greek literature developed in the speech of Latium, and also the more native product of pithy sayings (such as the "laudari a laudato viro," "sero sapiunt Phryges") which had passed into proverbs in the age of Cicero. The national cast of his genius and temper was further shown by his deviating from his Greek originals, and producing at least two specimens of the *fabula prætexta*, one founded on the childhood of Romulus and Remus (*Romulus s. Alimonium Romuli et Remi*), the other called *Clastidium*, which celebrated the contemporary victory in which Marcellus carried off the *spolia opima*.

But it was as a writer of comedy that he was most famous, most productive, and most original. While he is never ranked as a writer of tragedy with Ennius, Pacuvius, or Accius, he is placed in the canon of the grammarian Volcatius Sedigitus third (immediately after Cæcilius and Plautus) in the rank of Roman comic authors. He is there characterized as "Nævius qui fervet," a phrase expressive of his ardent, impetuous character and style. He is also appealed to, along with Plautus and Ennius, as a master of his art in one of the prologues of Terence. His comedy, like that of Plautus, seems to have been rather a free adaptation of his originals than a rude copy of them, as those of Livius probably were, or an artistic copy like those of Terence. The titles of most of them, like those of Plautus, and unlike those of Cæcilius and Terence, are Latin not Greek. Among the few lines preserved from them we find in one the "Laurentines and Prænestines" spoken of, just as we find mention of provincial Italian towns frequently in Plautus. He drew from the writers of the old political comedy of Athens, as well as from the new comedy of manners, and he attempted to make the stage at Rome, as it had been at Athens, an arena of political and personal warfare. A strong spirit of partisanship is recognized in more than one of his fragments; and this spirit is thoroughly popular and adverse to the senatorian ascendency which became more and more confirmed with the progress of the Second Punic War. Besides his attack on the Metelli and other members of the aristocracy, the great Scipio (whose services and world-wide fame he acknowledges) is the object of a censorious criticism on account of a youthful escapade attributed to him. Among the few lines still remaining from his lost comedies, we seem to recognize the idiomatic force and rapidity of movement characteristic of the style of Plautus. There is also found that love of alliteration which is a marked feature in all the older Latin poets down even to Lucretius. In one considerable comic fragment attributed to him,—the description of a coquette,—there is great truth and shrewdness of observation. But we find no trace of the exuberant comic power and geniality of his great contemporary. His critical spirit and vehement temper declare his affinity rather to Lucilius than to Plautus.

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[1] Cicero (*De Sen.*, 14) speaks of it as the work of his old age.

[2] "If it were permitted that immortals should weep for mortals, the divine Camenæ would weep for Nævius the poet; for since he hath passed into the treasure-house of death men have forgotten at Rome how to speak in the Latin tongue."

He was not only the oldest native dramatist, but the first author of an epic poem,—which, by combining the representation of actual contemporary history with a mythical background, may be said to have created the Roman type of epic poetry. The poem as he gave it to the world was one continuous work, and was divided into seven books by a grammarian of a later age. The earlier part of it treated of the mythical adventures of Æneas in Sicily, Carthage, and Italy, and borrowed from the interview of Zeus and Thetis in the first book of the *Iliad* the idea of the interview of Jupiter and Venus, which Virgil has made one of the cardinal passages in the *Æneid*. The later part of the poem treated of the events of the First Punic War in the style of a metrical chronicle. The few remaining fragments produce the impression of vivid and rapid narrative, to which the flow of the native Saturnian verse, in contradistinction to the weighty and complex structure of the hexameter, was naturally adapted. Mommsen has noticed that in these fragments the story is told in the present tense. The disparaging criticism of Ennius—

> "Scripsere alii rem
> Versibu' quos olim Fauni vatesque canebant, &c."—

applies to the rudeness of the verse, not to the spirit or substance of the work. Cicero speaks of it as giving pleasure, like a statue of Myron, and the grudging admission of Horace—

> "Nævius in manibus non est et mentibus hæret
> Pæne recens"—

attests the fresh pleasure with which it still could be read in the Augustan age.

The impression we get of the man is that, whether or not he actually enjoyed the full rights of Roman citizenship, he was a vigorous representative of the bold combative spirit of the ancient Roman commons,—of the political not, like Plautus, of the bourgeois type of the Roman plebeian. Energy of character and vitality of temperament are shown by the prolonged continuation of his career as a writer, notwithstanding the discouragement of his imprisonment, and, what was a greater trial than temporary imprisonment, his exile. The chief service which he rendered to Roman letters was that he was one of those who made the Latin language into a great organ of literature, and that with the new formative energy which he applied to it he transmitted the force of the best popular speech of his time. The phrases still quoted from him have nothing of an antiquated sound, while they have a genuinely idiomatic ring. As a dramatist he worked more in the spirit of Plautus than of Ennius, Pacuvius, Accius, or Terence; but the great Umbrian humorist is separated from his older contemporary, not only by his breadth of comic power, but by his general attitude of moral and political indifference. The power of Nævius was the more genuine Italian gift—the power of satiric criticism—the "Italum acetum" which was employed in making men ridiculous, not, like that of Plautus, in extracting amusement from the humours, follies, and eccentricities of life. His more truly creative faculty seems to have shown itself, not only in rapid and animated narrative, but in pregnant invention which still lives in literature, owing to the recognition of its value by the receptive and reproductive genius of Virgil. Although our means of forming a fair estimate of Nævius are more scanty than in the case of the other makers of Roman literature whose work is only known to us in fragments, yet all that we do know of him leads to the conclusion that he was far from being the least among them, and that with the loss of his writings there was lost a vein of national feeling and genius which reappears rarely in the writings of the later republican and the imperial times—the vein which probably was predominant in Cato, which may still be traced in the fragments of Lucilius and in the personal and political lampoons of Catullus, and may be detected under the rhetorical invective of Juvenal.

Collections of the *Fragments* have been made and commented on by Klussmann (1843) and Vahlen (1852). A short study of the life and writings of Nævius (*De Cn. Nævii vita et scriptis*) has been written by M. Berchem. (W. Y. S.)

NÆVUS, a term in surgery signifying that form of tumour which is almost entirely composed of enlarged blood-vessels. There are three principal varieties:—(1) the capillary nævus, consisting of enlarged capillaries, frequently of a purplish colour, hence the term "port-wine stain"; (2) the venous nævus, in which the veins are enlarged, of a bluish colour; (3) the arterial nævus, in which there is distinct pulsation, it being composed of enlarged and tortuous arteries. The nævus can be lessened in size by pressure. It is generally met with in the skin or immediately under the skin; sometimes it lies in the mouth in connexion with the mucous membrane. It is often congenital, hence the term "mother's mark," or it may appear in early childhood. It often grows rapidly, sometimes slowly, and sometimes growth is checked, and it may gradually diminish in size, losing its vascularity and becoming fibrous and non-vascular. This natural cure is followed by less deformity than a cure by artificial means. It is a good rule not to interfere unless the tumour is growing rapidly and at a rate out of proportion to the growth of the child. Various methods are used by surgeons when an operation is called for:—(1) the tumour may be excised; (2) a ligature tightly tied may be applied to the base of the tumour; (3) inflammation may be set up in the growth by the injection of irritating agents,—in this way its vascularity may be checked and the formation of fibrous tissue encouraged; (4) the blood in the enlarged vessels may be coagulated by the injection of coagulating agents or by electrolysis. In large nævi the last method is very suitable, and the resulting cure most closely resembles the natural cure already described.

NÁGÁ HILLS, a district in the south-eastern corner of the chief-commissionership of Assam, India, lies between 25° 13′ and 26° 32′ N. lat., and between 93° and 94° 13′ E. long., being a mountainous borderland between Nowgong district and Manipur state, with an area of about 6400 square miles. It forms a wild expanse of forest, mountain, and stream. The valleys and hills are covered with dense jungle, dotted with small lakes and marshes. Coal is known to exist in many localities, as well as limestone, chalk, and slate. The chief rivers are the Dáyang, Dhaneswarí, and Jamuna, only navigable for small boats during the rainy season.

In 1870 the deputy-commissioner roughly estimated the strength of the different tribes as follows:—Assamese, 705; Aitaniyás, 355; Cácháris, 3505; Míkírs, 8820; Kukís, 2524; Nágás, 66,535; total, 82,444. The estimated population in 1881-82 was 93,000. Agriculture is conducted in a rude, nomadic fashion, the only implements of tillage being the *dáo* or hill knife, and a *kodáli* or hoe. Rice and millet are the main crops. In some places great skill is displayed in irrigation. The tea plant is indigenous, and a large number of natives are now employed in the tea-gardens. The manufactures embrace the production of the few rude articles required for domestic use or as clothing, and the forging of *dáos*, *kodális*, and spear-heads. Trade is generally conducted by means of barter, and has considerably increased of late years. The local products available for export comprise rice, cotton, cloth woven from nettle fibre, ivory, beeswax, and various dyes obtained from the jungle. Salt and iron are imported; but the one great desire of every Nágá is to have a gun. The revenue is nominal.

British administration was first introduced into the district in 1867; but it has not yet been surveyed, and it constitutes perhaps the least orderly portion of the Indian empire. It is inhabited by several wild aboriginal tribes, collectively known as the Nágás. Those within British territory are comparatively peaceful, but beyond the reach of British influence are several savage and predatory tribes, who are in the habit of raiding on the plains, and killing or carrying off inoffensive British subjects. Repeated expeditions have been despatched to chastise them in their native hills. In 1873 a survey party under Lieutenant Holcombe were treacherously massacred. In January 1875 a force escorting a survey party under Captain Butler was attacked by Nágás, but unsuccessfully; later in the same year, however, he was cut off and killed. In 1879-80 the Nágás murdered the deputy-commissioner, Mr Damant, and, after receiving a sharp punishment, made a foray on the Cáchár side, murdering a tea-planter and committing other ravages. For some time the district has been in a more settled condition. The construction of a road to Kohima, the principal town, and the settlement of a British governor there have produced a salutary effect. The eastern Nágás are becoming rapidly civilised.

NAGASAKI, or sometimes Nangasaki, the leading seaport on the western coasts of Japan, is situated in 32° 44′ N. lat. and 129° 52′ E. long., in the island of Kiu-shiu, and gives its name to a *ken* (province of Hizen or Hi-shiu). The harbour is formed by a beautiful inlet of the sea, stretching northward for a distance of about 4 miles, with an average width of about a mile, enclosed on both sides by a delightful framework of hills (1500 feet), and adorned by a number of the most picturesque-looking islands. The city lies near the upper end of the inlet on its eastern side, extending about a mile in length and ¾ of a mile in breadth. Immediately to the south, and connected with the mainland by a bridge, lies the half-artificial island of Desima (600 feet by 240), which, originally occupied by the Portuguese (1637–39), was for more than two hundred years (1641–1854) the trading post and prison-house of the Dutch traders. Southwards along the shore, on ground largely reclaimed from the sea, runs the foreign settlement, with the American, British, French, and Portuguese consulates on the hilly ground behind. The magnificent dock (460 feet long, 89 wide, and 28 deep), commenced by the prince of Hizen in 1865, and rebuilt in 1874–79, occupies a deep gorge between two hills at Tatagami, on the western side of the firth opposite the city; a few hundred yards to the north of the dock are the engine-works of Akaonura (with an area of 7 acres); and at Koski there is a fine patent slip constructed for the prince of Satsuma (the prince of Hizen's rival). Nagasaki is laid out with great regularity and neatness, the streets crossing each other at right angles; beginning to climb the hills, they not infrequently end in stairs. Among the public buildings may be mentioned the hospital established in 1861, the oldest in Japan, and the great Government school, with its department for European languages and sciences, attended by hundreds of Japanese of all ages and ranks. Population about 80,000.

In 1825 the trade of the Dutch monopolists, who were allowed to have only two vessels, amounted to upwards of £100,000 (£31,154 imports and £72,373 exports). By 1871,.twelve years after the opening of the port, this sum was multiplied more than sevenfold (£317,727 imports, £449,855 exports), and since then there has been a slight additional increase—£755,180 being the average of the four years 1878–81. The principal exports are coal (£228,000 in 1881), camphor, rice (now largely sent to Australia), tea, tobacco, dried fish, and vegetable wax. Most of the coal, which makes excellent coke, and is freely used by men-of-war and merchant steamers, is brought from the Takashima mines about 6 miles distant, which give employment to 4000 workmen. The export of camphor has steadily increased from 2880 piculs in 1877 to 11,640 piculs (worth £42,928) in 1881. Of the 833 vessels which entered the port in 1881, 280 were British. Nagasaki has regular steamship communication with Shanghai, and is the terminus of submarine telegraphs from that city and from Vladivostok.

NAGÍNA, a town in Bijnaur district, North-Western Provinces of India, is situated on the road from Hardwár to Muradábád, in 29° 27′ 5″ N. lat. and 78° 28′ 50″ E. long., with a population of 20,503 in 1881. The headquarters of the district were removed from it to Bijnaur town in 1824. It is celebrated for its ebony carvings. There are also manufactures of glassware, ropes, and matchlocks, and a large export of sugar.

NAGOYA, sometimes NOGOYA, one of the largest and most active of the cities of Japan, the chief town of Aichi *ken* (province of Owari), and formerly the seat of the princes of Owari (one of the "three august families" closely allied to the Tokugawa line of shoguns), lies at the head of the shallow Owari Bay, about 30 miles from Yokai-ichi, its port, with which it communicates by light-draught steamers. Nagoya is well known as one of the great seats of the pottery trade (though the master potters for the most part get their goods manufactured at Seto, about 13 miles distant, where the clay has been worked for wellnigh two thousand years); fans and enamels are also made in the city. The castle of Nagoya, occupying about 400 acres of ground at the north side of the city, erected in 1610, suffered comparatively little during the revolution of 1868, and is now the headquarters of the Nagoya military district, with extensive barracks and drill-grounds. The central keep of the citadel is a remarkable structure, covering close upon half an acre, but rapidly diminishing in each of its five stories till the top room is only about 12 yards square. Gabled roofs and hanging rafters break the almost pyramidal outline; and a pair of gold-plated dolphins 8 feet high form a striking finial. Both were removed in 1872, and one of them was at the Vienna Exhibition in 1873; but they have been restored to their proper site. Among the religious buildings perhaps the most interesting is the Kenchiu-ji, a monastery of the Jo-do sect, containing the burial-place of the princes of Owari. A superior court, a middle school, a girls' school, a normal school, the prefecture, the telegraph and post-office, and the hospital are the principal foreign-style buildings in Nagoya. The population is 325,000.

NÁGPUR, a district in the division of the same name, in the Central Provinces of India, lying between 20° 36′ and 21° 43′ N. lat., and between 78° 17′ and 79° 42′ E. long., bounded on the N. by Chhindwára and Seoni, E. by Bhandára, S. by Chánda and Wardhá, and W. by Wardhá and Ellichpur, with an area of 3786 square miles. Nágpur district lies immediately below the great table-land of the Sátpura range. A second line of hills shuts in the district on the south-west, and a third runs from north to south, parting the country into two plains of unequal size. These hills are all offshoots of the Sátpuras, and nowhere attain any great elevation. Their heights are rocky and sterile, but the valleys and lowlands at their feet are fertile, yielding rich crops of corn and garden produce. The western plain slopes down to the river Wardhá, is watered by the Jám and Madár rivers, tributaries of the Wardhá, and contains the most highly-tilled land in the district, abounding in fruit trees, and the richest garden cultivation. The eastern plain (six times the larger), stretching away to the confines of Bhandára and Chánda, consists of a rich undulating country, luxuriant with mango groves, and dotted towards the east with countless small tanks. It is watered by the Kanhán, with its tributaries, which flows into the Wainganga beyond the district.

The population in 1881 was 697,356 (British-born, 1068; other Europeans and Americans, 383; Eurasians, 630; aborigines, 42,750; Hindus, 606,228; Mohammedans, 39,765; Buddhists and Jains, 3569). The most numerous of the aboriginal tribes are the Gonds (43,885). The population of the nine principal towns was as follows:—Nágpur, 79,842; Kámthi, 36,364; Umrer, 12,784; Rámtek, 6978; Khápa, 6664; Narkher, 6498; Mohpa, 5256; Kalmeshwar, 4842; Saoner, 4739.

Of the area of 3786 square miles, 1868 were cultivated in 1882. Wheat in 1882 occupied 314,037 acres, rice 38,127, other food grains 489,111, oil-seeds 224,495, cotton 101,166, and sugar-cane 1545. During the last few years there has been a great increase in the manufacture of cotton in the Empress mills at Nágpur. There were 30,000 spindles in operation in 1882, the output of yarn and cloth being 1,804,530 and 149,995 ℔ respectively. The Nágpur branch of the Great Indian Peninsula Railway runs through the district for a distance of 26 miles. The gross revenue in 1876–77 was 1,460,168 rupees

NÁGPUR, the chief town of Nágpur district, and the administrative headquarters of the Central Provinces, India, is situated in the centre of the district, on the banks of a small stream, the Nág, in 21° 9′ 30″ N. lat., 79° 7′ E. long. The population was 79,842 in 1881. The municipal limits include, besides the city proper, the suburb of Sítábaldí, and the European station of Sítábaldí, with Táklí. In the centre stands Sítábaldí Hill, crowned with the fort, which commands a fine view of the country round. On the north and west lies the prettily wooded station of Sítábaldí; beyond, to the north, are the military lines and *bázárs*, and, again, beyond these the suburb of Táklí. Close under the southern side of the hill is the native suburb of Sítábaldí. Below the eastern glacis of the fort is the railway terminus. Beyond this lies the broad sheet of water known as the Jamá Taláo, and farther east is the city, completely hidden in a mass of foliage. Three great roads connect the city with the European station. Handsome tanks and gardens, constructed by the Mahratta princes, lie outside the city. Many Hindu temples, elaborately carved in the best style of Mahratta architecture, ornament the town; but the palace, built of black basalt, profusely ornamented with wood carving, was burnt down in 1864, and only the great gateway now remains. The tombs of the Bhonslá kings lie to the south of the city.

Nágpur does a large and increasing trade, the chief imports being wheat and other grain, salt, country cloth, European piece goods, silk, and spices. Cloth forms the chief article of manufacture and export. The finer fabrics of Nágpur have long been famous, and are still, in spite of the competition of English stuffs, in great request. Most of the public offices are in the station of Sítábaldi.

NAGY-KÖRÖS (*i.e.*, Great Körös) is a town, or rather an overgrown village, in Hungary, in the district and 50 miles to the south-west of Pesth. It lies in the midst of a sandy plain, and is a station on the railway from Pesth to Temesvar. In 1880 it contained 22,769 inhabitants, chiefly Protestants, who are engaged in wine-culture and the rearing of cattle and sheep. Its gymnasium is esteemed one of the best schools in Hungary.

NAGY-VÁRAD. See GROSSWARDEIN.

NAHARRO, BARTOLOMÉ DE TORRES, a Spanish dramatist of the period immediately preceding that of Cervantes and Lope de Vega, born at Torres in the neighbourhood of Badajoz, was for some time a captive in Algiers, and after receiving his freedom visited the court of Leo X. at Rome. Here his satirical pen excited such hostility that he was compelled to fly to Naples, where he lived for some time under the protection of Fabricio Colonna, and where he published his *Propaladia* in 1517. He died in poverty and obscurity; the time and place are unknown. See DRAMA, vol. vii. p. 420.

NAHUM. "The book of the vision of Nahum the Elkoshite" (נחום, "compassionate"), which stands seventh among the minor prophets, is entirely directed against Nineveh, and predicts the utter destruction of the bloody and rapacious city, its empire, and its gods by the tardy but sure and irresistible vengeance of Jehovah. The fall of Nineveh is the deliverance of Judah; Jehovah, so terrible to His adversaries, so unfailing in His righteous judgments, is a sure and gracious defender to them that take refuge with Him. It appears therefore that, when the prophet wrote, the Judæans were still suffering from Assyrian oppression, perhaps even from present or recent invasion, for in i. 15 [ii. 1] he speaks of the annual feasts and the sacrifices of the sanctuary as disturbed by the "wicked one" passing through the land. It is not, however, from a merely patriotic standpoint that Nahum regards the Assyrian harlot as Jehovah's enemy: she is the enemy of mankind, who sells all nations through her witchcrafts and whoredoms—that is, in the strength of her heathenish religion (iii. 4),—and she shall perish with none to pity her, for all have suffered continually from the wickedness of the ruthless empire. The exordium in chap. i., which depicts Jehovah as the jealous and avenging God, is a noble utterance of faith in the righteousness which rules in the world's history. The other two chapters are entirely occupied with the catastrophe of Nineveh; the battle without and within the walls is described with great poetic force, not in finished pictures but with broad effective strokes and daring imagery, and apparently with some local knowledge, though the latter is hardly so detailed as to justify the conclusion that the prophet had himself seen the imperial city. It might be argued on the same principle that he had also seen No-Ammon or Thebes, a description of the sack of which forms an episode in chap. iii. 8 *sq.* The reference here seems to be to the taking of No by Assurbanipal (G. Smith, *Hist. of Assurbanipal*, 55, 70; Schrader, *K. A. T.*, 2d ed., p. 450) about 660 B.C. —an event only known from the Assyrian monuments. Nahum must have prophesied after this date, probably not long after, that is, in the troublous times of Manasseh, which agrees well with i. 15. To suppose that his prophecy was occasioned by the actual approach of the Medes to destroy Nineveh, or by one of the earlier campaigns which preceded their final success, is arbitrary; for the judgment is predicted on general principles of divine justice, and there is no indication that the prophet knew what nation was to execute it. His descriptions, though pictorially vivid, are historically quite vague. The details of the decadence of the Assyrian empire are in truth so obscure that to search for the immediate occasion of the prophecy is mere guesswork.

The name Elkoshite (אֶלְקשִׁי, in the LXX. Ἐλκεσαῖος—the pronunciation therefore is uncertain) denotes the prophet's home or birthplace. Jerome's mention of a ruined "viculus Elcosi" in Galilee stands quite alone; Hitzig supports the idea that the prophet was a Galilæan by the name Capernaum, which probably means "village of Nahum," but of what Nahum we do not know. The confused account by R. Jos. Schwarz (*D. Heil. Land*, p. 149) of a grave shown as that of the prophet Nahum an hour north of Tiberias lacks confirmation. Internal evidence leads us rather to conclude that Nahum was a man of Judah, and John vii. 52 appears to show that he was not held to be a Galilæan in the time of Christ, when the fashion of localizing tombs of prophets was already in full force (Matt. xxiii. 29). Later tradition associated Nahum with the region against which he prophesied, and in the 12th century Benjamin of Tudela visited his synagogue at Mosul and his tomb in Babylonia. It was probably under Christian influence that the site of this tomb was ultimately fixed at Alḳôsh, the seat of the later Nestorian patriarchs, near the convent of Rabban Hormizd, a few miles north of Mosul, where it is now reverenced by Christians, Moslems, and Jews. The sepulchre is a simple plaster box without signs of antiquity (Layard, *Nineveh*, i. 233). The history of this identification of Elkosh is obscure; it is mentioned in the 16th century by Masius (ap. Assemani, *B. O.*, i. 525), as also in two Nestorian MSS. written at Alḳôsh by the same scribe in 1709 (Wright, *Cat.*, 1068) and 1713 (Assem., iii. i. 352); it seems, moreover, to be implied in a gloss of Bar Ali, given by Payne Smith (*Thes. Syr.*, 221), but not in Hoffmann's edition. On the other hand no very early notice either of the tomb or of the place has yet been found. Alḳôsh, but not the Nahum legend, is mentioned in a poem of the 11th century in Cardahi, *Liber Thesauri* (Rome, 1875); the same author places one Israel of Alḳôsh in the 8th century, but the date is questionable (see Nöldeke in *Z. D. M. G.*, xxxi. 165). The grave is undoubtedly a fabrication, and the evidence is not favourable to Ewald's conjecture that the name is ancient and the place really the city of Nahum. His further conjecture that some difficult words in Nahum may be Assyrian has not been confirmed by students of the inscriptions.

Literature.—The commentaries on the minor prophets; O. Strauss, *Nahumi de Nino vaticinium*, 1853. For a list of other books see Reuss, *Gesch. d. A. T.*, p. 369. (W. R. S.)

NAIADS. See NYMPHS.

NAILS. A nail is a headed pin or spike of metal, commonly of iron. The primary and principal use of nails is in wood work (joinery and carpentery), but they are also employed in upholstery, shoemaking, saddlery, slating, sheet-metal working, horse-shoeing, and numerous other trades. The consumption in all civilized communities is enormous, but it is exceptionally great where timber houses and wooden erections generally prevail, as in the United States of America, and in many British colonies. Size, form of head, nature of point, and special uses all give names to different classes of nails. Thus we have the names tacks, sprigs, and brads for very small nails; rose, clasp, and clout, according to the form of head; and flat points or sharp points according to the taper of the spike. Arranged according to the manner in which they are manufactured, nails may fall into four principal classes:—(1) ordinary or hand-wrought nails; (2) machine-wrought and cut nails; (3) wire or French nails; and (4) cast nails. The nailer handicraft was at one time a great industry in the country around Birmingham, and to this day in conjunction with chain-making it constitutes an important though declining trade. It is essentially a family industry, carried on in the meanest of workshops, with a very few simple blacksmith's tools and appliances. The nails are forged from nail-rods heated in a small smith's hearth, hammered on a low anvil, the nail length cut off on a chisel attached to the anvil, and the head formed by dropping the spike into a hole in a "bolster" of steel, from which enough of the spike is left projecting to form the head, which is variously flattened out. The head, in the case of clasp nails, is formed with two strokes of the hammer, while rose nails require four blows. The heads of the larger-sized nails are made with the aid of an "oliver" or mechanical hammer, and for ornamental or stamped heads "swages" or dies are employed. The conditions of life and labour among the hand nailers in England are exceedingly unsatisfactory: married women and young children of both sexes are set to work long hours in small filthy sheds attached to their dwellings, and their employment is controlled by middlemen or nail-masters, who supply them with the nail-rods and pay for work done, sometimes in money and sometimes in kind on the truck system. The handicraft is, however, an expiring industry, as machine-wrought and cut nails are rapidly supplanting most corresponding kinds of hand-made nails. Horse nails alone continue to be made in large measure by hand labour (at St Ninians near Stirling, as well as in the Birmingham district). These are made from the finest Swedish charcoal iron, hammered out to a fine sharp point. They must be tough and homogeneous throughout, so that there may be no danger of their breaking over and leaving portions sunk in the hoof. The credit of perfecting machinery for the making of nails belongs to American inventors, and by numerous stages the nail-making machines have arrived at a high degree of efficiency. Of late years mild steel, such as the plates employed for shipbuilding, has been largely used for machine-made nails. Without much detail it would be impossible to convey an idea of how the machine, fed with heated (to black heat only) strips of metal having a breadth and thickness sufficient for the nail to be made, shears off by means of its slicer the "nail blank," which, falling down, is firmly clutched at the neck till a heading die moving with sufficient force strikes against its upper end and forms the head, and the nail now completed is liberated, passing out through an inclined shoot. In the case of large nails the taper of the shank and point is secured by the sectional form to which the strips are rolled; brads, sprigs, and small nails, on the other hand, are cut from uniform strips in an angular direction from head to point, the strip being turned over after each blank is cut so that the points and heads are taken from opposite sides alternately, and a uniform taper on two opposite sides of the nail, from head to point, is secured. The machines turn out nails with wonderful rapidity, varying with the size of the nails produced from about 100 to 1000 per minute. Wire or French nails are made from round wire, which is unwound, straightened, cut into lengths, and headed by a machine the same in principle as the pin-making apparatus (see PINS), but the pointing is accomplished by the pressure of dies in the same manner as the head is formed. Cast nails, which are cast in sand moulds by the ordinary process, are used principally for horticultural purposes, and the hob-nails or tackets of shoemakers are also cast.

NAIN, LE. The three brothers Le Nain, who have of late attracted much attention, occupy a peculiar position in the history of French art. Although they figure amongst the original members of the French Academy, their works show no trace of the influences which prevailed when that body was founded. Their sober execution and choice of colour recall characteristics of the Spanish school, and when the world of Paris was busy with mythological allegories, and the "heroic deeds" of the king, the three Le Nain devoted themselves chiefly to subjects of humble life such as Boys Playing Cards, The Forge, or The Peasants' Noonday Meal. These three paintings, together with others, amongst which is the noble Procession in the Interior of a Church (erroneously attributed to the Le Nain), are now in the Louvre; various others may be found in local collections, and some fine drawings may be seen in the British Museum and in the Albertina; but their signature is rare, and is never accompanied by initials which might enable us to distinguish the work of one or other of the brothers. Their lives are lost in obscurity; all that can be affirmed is that they were born at Laon in Picardy early in the 17th century. In 1633 Antoine, the eldest, was admitted painter at Paris; in 1648 he and his brothers Louis and Mathew were received into the Academy, and in the same year both Antoine and Louis died. Mathew lived on till 1677; he bore the title of chevalier, and painted many portraits. Mary of Medici and Mazarin were amongst his sitters, but these works (like his portrait of the unfortunate Cinq Mars, sold by auction at the Palais Royal in 1848) seem to have disappeared. Champfleury has written two works on the brothers Le Nain (1850 1865).

NAIRN, a small maritime county in the north-east of Scotland, is bounded W. and S. by Inverness, E. by Elgin, and N. by the Moray Firth. Its greatest length from north to south is about 20 miles, and its greatest breadth about 15 miles; the area is 114,400 acres, or about 179 square miles.

The coast is low and sandy, and is skirted by sandbanks which render navigation dangerous. The eastern part of the seaboard district is formed of low sand-hills which extend into Morayshire. Parallel with the coast-line there is a great deposit of sand and gravel, which forms a terraced bank rising to the height of about 90 feet, and extends from 4 to 5 miles inward; it rests on Old Red Sandstone, which sometimes protrudes on the surface. This undulating plain is bordered by a hilly region which occupies two-thirds of the county. Where it joins the plain it is skirted by a strip of Devonian associated with coarse conglomerate. The hills, some of which reach a height of about 1500 feet, are formed of granite and grey gneiss, with occasional beds of primitive limestone. Freestone is plentiful, and there is also a species of dark bluestone which is greatly valued for ornamental building. Shell-marl is obtained from several of the lochs. The only rivers are the Nairn and Findhorn, with their tributaries. The Nairn, after entering the county, flows north-east for a distance of about 30 miles, and falls into the Moray Firth at the town of Nairn. The Findhorn, which also rises in Inverness, flows north-east through the southern and hilly district of the county into Morayshire. The soil of the alluvial plain on the coast is light and porous, and has been rendered very fertile by careful cultivation. There is also some rich land on the Findhorn. The most advanced methods of agriculture are in operation, but only a small proportion of the surface is capable of tillage, scarcely more than a fifth of the total area being under crops. The hills are for the most part covered with heath or pasture suitable for sheep, intermixed with fir and larch plantations.

The number of holdings in 1880 was only 392, and of these 214 did not exceed 50 acres in extent, 92 were between 50 and 100 acres, and 86 above 100 acres. According to the agricultural returns of 1882 there were 26,468 acres under cultivation, of which 9359 were under corn crops, 4871 under green crops, 10,031 under rotation grasses, and 2124 permanent pasture; 12 acres were under orchards, and 13,241 under woods. Very little wheat is grown, the principal corn crops being barley or bere, 3156 acres, and oats, 5917 acres. Of the green crops 4201 acres were under turnips or swedes, and 617 under potatoes. Horses in 1882 numbered 1292, cattle 5992 (1801 being cows or heifers in milk or in calf), sheep 17,442, and pigs 981.

The valued rental of the county in 1674 was £15,162 Scots, or about £1263 sterling. Exclusive of railways, the valuation in 1881–82 was £36,217. According to the latest return the number of proprietors was 537, possessing lands of a gross annual value of £41,767. Of these 467 possessed less than 1 acre, and 5 more than 5000 acres, viz., earl of Cawdor, 46,176 acres; James C. G. Brodie, 22,378; N. J. M'Gillivray, 12,600; earl of Leven and Melville, 7805; and Hugh Davidson, 6368. There are several fine mansions in the county, in addition to a number of shooting lodges. The coast is skirted by the Highland Railway, and there is a good harbour at Nairn. The county possesses no special trade or manufacture, but there is a large distillery at a short distance from the county town.

Nairn includes three entire parishes, Ardclach, Auldearn, and Nairn, and portions of the parishes of Cawdor, Croy, Dyke, Moy, Petty, Daviot, and Urquhart,—the last two being detached portions, lying within Inverness and Ross respectively, at considerable distances from the rest of the county. Since 1801, when it was 8322, the population has been slowly but steadily increasing, and in 1881 numbered 10,455 (4979 males and 5476 females). There is one royal burgh, Nairn, and a burgh of barony, Auldearn. The county is under the same sheriffdom as Elgin and Banff, and unites with Elgin in returning a member to parliament. Anciently Nairn was included under the province of Moray, which was governed by a ri or mormaer. Roman coins have been found at a vitrified fort on the summit of a hill in the parish of Cawdor. There are numerous stone circles, including a very perfect one on the summit of Lethenbar Hill, one at Golford, and one at Moyness consisting of two concentric circles and a rocking stone. Cawdor Castle, a fine baronial structure, in a very picturesque situation, 5 miles south of Nairn, is associated in unauthentic legend with the murder of King Duncan by Macbeth; but no part of the building is really older than the 15th century.

Nairn, a royal and parliamentary burgh and county town, is pleasantly situated near the Moray Firth, on the left bank of the Nairn, and on the Highland Railway, 93 miles west-north-west of Aberdeen and 15 north-east of Inverness. The principal buildings are the town and county hall (1818) surmounted by a spire, the hospital (1846) in the Italian style, the new public hall erected at a cost of £12,000, and the academy. Nairn is much frequented in summer for sea-bathing, and possesses very complete artificial baths. There is a commodious harbour with breakwater and pier. The principal exports are corn, eggs, potatoes, herrings, haddocks, freestone, and timber, and the principal imports coal, lime, and provisions. There are freestone quarries in the neighbourhood, and the town possesses rope and twine factories. There is also a salmon fishery. The burgh unites with Fortrose, Forres, and Inverness in returning a member to parliament. The population of the parliamentary burgh in 1881 was 4161, and that of the royal burgh 4665.

The town, whose original name was Invernairn, stood at first at some distance from its present site. Its earliest extant charter, which bears, however, to be a renewal of one received from Alexander I. in the 12th century, was granted by James VI. in 1589. At that time the inhabitants of the western half of the town spoke only Gaelic, and until a late period the distinction between the two sections of the town inhabited by different races was very clearly marked.

NAIRNE, Caroline Oliphant, Baroness (1766–1845), the authoress of many fine Scotch songs, was born in the "auld hoose" of Gask, Perthshire, 16th August 1766. She was descended from an old family which had settled in Perthshire in the 13th century, and which could boast of kinship with the royal race of Scotland. Her father, Laurence Oliphant, was one of the foremost supporters of the Jacobite cause, and she was named Caroline in memory of Prince Charlie. In early childhood her health was extremely delicate, but a certain refined sensibility was the only trace of this which she retained in after years. In the schoolroom she was known as "pretty Miss Car," and afterwards her striking beauty and pleasing manners earned for her the name of the "Flower of Strathearn." Miss Oliphant was one of the earliest admirers of Robert Burns, and induced her brother Laurence to enter his name as subscriber to the first edition of his poems. It was the attempts of Burns in the *Scots Musical Museum* to adapt words of a more refined character to the old Scotch airs that suggested to her to undertake a similar enterprise. Her first effort was a new version of the "Pleughman," which her brother introduced at an entertainment to the Gask tenantry, and which soon met with great popularity throughout central Scotland. In June 1800 she married William Murray Nairne, whose rank as fifth Lord Nairne was in abeyance on account of attainder. He was then assistant inspector-general of barracks in Scotland. At the instigation of the Misses Hume, daughters of Baron Hume, she some time after her marriage undertook to bring out a collection of national airs set to appropriate words. To the collection she contributed a large number of original songs, adopting the signature "B.B."—"Mrs Bogan of Bogan." The music was edited by R. A. Smith, and the collection was published at Edinburgh under the name of the *Scottish Minstrel* (6 vols., 1821–24). Her husband was restored to his rank in 1824, but died 9th July 1830. After his death she took up her residence at Enniskerry, county Wicklow, but on account of the delicate health of her only son she went to the Continent, where she spent several years. The son died at Brussels in 1838. Lady Nairne returned to Gask in 1843, and died there 26th October 1845.

The songs of Lady Nairne may be classed under three heads:—(1) those illustrative of the characters and manners of the old Scotch gentry, such as "The Laird of Cockpen," "The Fife Laird," and "John Tod"; (2) Jacobite songs, composed for the most part to gratify her kinsman the aged chief of Strowan, among the best-known of which are perhaps "Wha'll be King but Charlie," "Charlie is my Darling," "The Hundred Pipers," "He's owre the Hills," and "Bonnie Charlie's noo awa"; and (3) songs not included under the above heads, ranging over a variety of subjects from "Caller Herrin'" to the "Land o' the Leal." For vivacity, genuine pathos, and bright wit her songs are surpassed only by those of Burns, and, although their note is less full and strong than his, it is perhaps in some respects more mellow and tender.

Lays from Strathearn, by Caroline, Baroness Nairne, arranged with Symphonies and Accompaniments for the Pianoforte by Finlay Dun, appeared without date some time after her death. Her poems were published in vol. i. of the *Modern Scottish Minstrel*, 1857; but the most complete collection is that contained in *Life and Songs of the Baroness Nairne, with a Memoir and Poems of Caroline Oliphant the Younger*, edited by Rev. Charles Rogers, LL.D., 2d ed., 1869.

NAKHICHEVAN, or Nakhjevan, a city of Russian Armenia, the chief town of a circle in the government of Erivan, is situated in 39° 12′ N. lat. and 45° 25′ E. long., 100 miles south-east of Erivan and 267 miles from Tiflis. It occupies the brow of one of the last spurs of the Karabakh Mountains (Anti-Caucasus), 3015 feet above the sea, and looks out over the wide and beautiful valley of the Araxes. Built and rebuilt again and again, Nakhichevan is full of half-obliterated evidence of former periods of prosperity. The present houses have for the most part been quarried from ancient ruins; of the palace of the Atabeks of Azerbijan there still remains a gateway with a Persian inscription, flanked by two brick towers; and at a little distance stands the so-called Tower of the Khans, a richly decorated twelve-sided structure about 102 feet in circumference and 75 feet in height, dating, to judge by the marvellously executed inscription which runs round the cornice, from the 12th century. There are also ruins of a large mosque. Situated on the highroad to Tabriz and Teheran, Nakhichevan is the seat of a considerable transit trade. In the Persian period the city is said to have had 40,000 inhabitants; in 1863 there were only 6251, and in 1873 6877 (2157 Armenians, 4697 Tartars). At the latter date there were 1200 houses, one Russian Greek church, three Armenian churches, four mosques, and two caravanserais.

The origin of Nakhichevan (the Naxuana of Ptolemy) is unknown. Armenian tradition claims Noah as its founder, and a mean mound of earth in the city is still visited by many pilgrims as his grave. Laid waste by the Persians in the 4th century, Nakhichevan sank into comparative insignificance, but by the 10th century had recovered its prosperity. In 1064 it was taken by Alp Arslan, and in the 13th century it fell a prey to the followers of Jenghiz Khan. It afterwards suffered frequently during the wars between the Persians, Armenians, and Turks, and it finally passed into Russian possession by the peace of Turkmen-Chai in 1828.

NAKHICHEVAN-ON-THE-DON, a town of southern Russia, situated in the government of Ekaterinoslaff, district of Rostoff, 6 miles by rail to the north-east of the latter town, on the right bank of the Don. It was founded in 1780 by Armenians who emigrated from the Crimea and were allowed to settle on the banks of the Don, forming there an independent district between Azoff and the fort of St Demetrius, now Rostoff; they gave to the chief town of their new settlement the name of the older city in Caucasus. Owing to the fertility of the region, its advantageous situation for trade, and the privileges granted to the settlers, Nakhichevan soon became a wealthy place, and it still is the administrative centre of the "Armenian district," which extends as a narrow strip along the banks of the Don, with a population of upwards of 25,000, of whom 16,500—principally Armenians, with some 2000 Russians—are settled at Nakhichevan. The town has several tobacco and wadding factories, tallow-melting houses, soap-works, brick-works, and tanneries, with an aggregate annual production of about £100,000. The chief occupation of the Armenians, however, is trade, which they carry on throughout southern Russia, while the less wealthy of them are renowned as innkeepers on the Caucasus. The rural population depend mainly on cattle-breeding, and to some extent also on fishing.

NAMAQUALAND, a vast region of south-western Africa, extending along the west coast for a distance of 600 miles from the south of Damaraland (22° 43′ S. lat.) to the north of the county of Clanwilliam (30° 35′ S. lat.), and stretching inland from 80 to 350 miles. It is divided by the lower course of the Orange River into two portions —Little Namaqualand to the south, and Great Namaqualand to the north. Little Namaqualand, incorporated with Cape Colony since 1865, has an area of 20,635 square miles, and in 1875 had a population of 12,233, of whom 2675 were whites. The seat of magistracy is at Springbokfontein, on a branch of the Buffels River, about 60 miles from the coast, with which it communicates by a mule-railway (96 miles long) ending at Port Nolloth on Robbe or Seal Bay. Ookiep, 6 miles to the north of Springbokfontein, is, next to the diamond fields of Kimberley, the most important mining place in South Africa, its copper mines (worked by the Cape Copper Mining Company) giving employment to about 1500 people; the output in 1882 was 16,311 tons of extremely rich ore. The European miners are mainly from Cornwall and Mansfield. Copper is also worked at Concordia, Spektakel, and (since 1853) Kodas. Great Namaqualand has an area of 987,000 square miles, about sixteen times the size of England; but its population does not exceed 20,000, mostly Namaquas and other Hottentots (see HOTTENTOTS). For 30, 40, or even 100 miles inland the country is a sandy waste, and on the eastern side it passes off into the great Kalahari desert. The central portion is traversed from north to south by the Fish River or Oub and its tributaries, which ultimately reach the Orange River about 70 miles above its mouth; but, except after rain, they are mere dry beds. And the rains are periodical and partial,—the result almost always of thunderstorms. In a few minutes after the thunder-clouds have burst the country is flooded; turbid currents half a mile wide roar through a ravine which has not shown a drop of water for years previously; rivulets flow where one would think water had never run before (J. F. Wilson). The surface of the interior part of the country is covered with hills, irregularly distributed, but with a general tendency to run in lines parallel to the coast. Towards the south-east the Gei Kharas mountains reach a height of 6570 feet, and the smaller Khari Kharas group about 5200. The Nuaibeb mountains on the borders of Damaraland are a little higher (6700 feet). The only Europeans as yet settled in Great Namaqualand are the Basel and the Wesleyan missionaries; but it has been decided to establish a regular German colony at Angra Pequeña, the only important bay on the whole coast. The country, like Little Namaqualand, has long been known to be rich in minerals. The proposal made about 1876 to annex it and Damaraland to Cape Colony fell through.

See Andersson, *Lake Ngami*, &c., London, 1856; Tindall, *Lecture on Namaqualand*, Cape Town; Carl Zerrenner, *Reise des Ingenieurs A. Thies nach den Kupferbergwerken Namaqualands*, Freiberg, 1860; *Petermann's Mittheilungen*, 1865, p. 389–91; W. C. Palgrave's *Report of Mission to Damaraland and Great Namaqualand in* 1876, Cape Town, 1877; *Cape Monthly Magazine*, 1871 and 1880; Rev. Benjamin Ridsdale, *Scenes and Adventures in Great Namaqualand*, 1883.

NAMES. Names, and the study of proper names of persons and places, are not without scientific and historical importance, but, on the whole, are perhaps rather matter of curious interest. It stands to reason that, even in the earliest societies of "articulate speaking men," all known persons, places, and groups of human beings must have had names by which they could be spoken of and by which they were recognized. The study of these names and of their survival in civilization enables us in some cases to ascertain what peoples inhabited districts now tenanted by persons of far different speech. Thus the names of mountains and rivers in many parts of England are Celtic, —for example, to take familiar instances, Usk, Esk, and Avon. There are also local names (such as Mona, Monmouth, Mynwy, and others) which seem to be relics of tribes even older than the Celtic stocks, and "vestiges of non-Aryan people, whom the Celts found in possession both on the Continent and in the British Isles."[1] These are affairs of somewhat dubious conjecture, but it is certain enough that the Celtic names, with their mysterious and romantic sounds, do linger in English valleys like the last echoes of Arthur's horn among the hollows of the hills. And it is no less certain that the English name is sometimes the mere translation, perhaps unconscious, of the earlier Celtic appellation, often added to the more ancient word. Penpole Point in Somerset is an obvious example of this redoubling of names. As to the meaning and nature of ancient local names, they are as a rule purely descriptive. A river is called by some word which merely signifies "the water"; a hill has a name which means no more than "the point," "the peak," "the castle." Celtic names are often of a more romantic tone, as Ardnamurchan, "the promontory by the great ocean," an admirable description of the bold and steep headland which breasts the wash of the Atlantic. As a general rule the surviving Celtic names, chiefly in Ireland, Wales, and Scotland, all contain some wide meaning of poetic appropriateness. The English names, on the other hand, commonly state some very simple fact, and very frequently do no more than denote property, such and such a town or hamlet, "ton" or "ham," is the property of the Billings, Uffings, Tootings, or whoever the early English settlers in the district may have been. The same attachment to the idea of property is exhibited in even the local names of petty fields in English parishes. Occasionally one finds a bit of half humorous description, as when a sour, starved, and weedy plot is named "starvacre"; but more usually fields are known as "Thompson's great field," "Smith's small field," "the fouracre," or the like. The name of some farmer or peasant owner or squatter of ancient date survives for centuries, attached to what was once his property. Thus the science of local names has a double historical value. The names indicate the various races

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[1] Elton, *Origins of English History*, p. 165; Rhys, *Lectures on Celtic Philology*, 181, 182.

(Celtic, Roman, and English in Great Britain) who have set in the form of names the seal of their possession on the soil. Again, the meanings of the names illustrate the characters of the various races. The Romans have left us names connected with camps (castra, chesters) and military roads: the English have used simple descriptions of the baldest kind, or have exhibited their attachment to the idea of property; the Celtic names (like those which the red men have left in America, or the blacks in Australia) are musical with poetic fancy, and filled with interest in the aspects and the sentiment of nature. Our race carries with it the ancient names of an older people into every continent, and titles perhaps originally given to places in the British Isles by men who had not yet learned to polish their weapons of flint may now be found in Australia, America, Africa, and the islands of the furthest seas.

Local names were originally imposed in a handy local manner. The settler or the group of cave-men styled the neighbouring river "the water," the neighbouring hill "the peak," and these terms often still survive in relics of tongues which can only be construed by the learned. The history of personal names is longer and more complex, but proceeds from beginnings almost as simple. But in personal names the complexity of human character, and the gradual processes of tangling and disentangling the threads of varied human interest, soon come in, and personal names are not imposed once and for all. Each man in very early societies may have many names, in different characters and at different periods of his life. The oldest personal names which we need examine here are the names which indicate, not an individual, but a group, held together by the conscious sense or less conscious sentiment of kindred, or banded together for reasons of convenience. An examination of customs prevalent among the most widely separated races of Asia, Africa, Australia, and America proves that groups conceiving themselves to be originally of the same kin are generally styled by the name of some animal or other object (animate or inanimate) from which they claim descent. This object is known as the "totem," from the Red-Indian word *dodhaim*. Of this topic it must here suffice to say that the earliest and most widely spread class and family names among uncivilized people are totemistic. The groups of supposed kin, however widely scattered in local distribution, are known as wolves, bears, turtles, suns, moons, cockatoos, reeds, and what not, according as each group claims descent from this or that stock, and wears a badge representing this or that animal, plant, or natural object. Unmistakable traces of the same habit of naming exist among Semitic and Teutonic races, and even among Greeks and Romans. The origin of this class of names cannot well be investigated in this place, but it may be observed that the names chosen are commonly those of objects which can be easily drawn in a rude yet recognizable way, and easily expressed in the language of gesture. In addition to the totem names (which indicate, in each example, supposed blood-kindred), *local* aggregates of men received local names. We hear of the "hill-men," "the cave-men," "the bush-men," "the coast-men," the "men of the plain," precisely as in the old Attic divisions of Aktaioi, Pediaioi, and so forth. When a tribe comes to recognize its own unity, as a rule it calls itself by some term meaning simply "the men," all other tribes being regarded as barbarous or inferior. Probably other neighbouring tribes also call themselves "the men" in another dialect or language, while the people in the neighbourhood are known by an opprobrious epithet, as *Rakshasas* among the early Aryan dwellers in India, or *Eskimo* (raw-eaters) in the far north of the American continent.

Leaving tribal for personal names, we find that, among most uncivilized races, a name (derived from some incident or natural object) is given at the time of birth by the parents of each new-born infant. Occasionally the name is imposed before the child is born, and the proud parents call themselves father and mother of such an one before the expected infant sees the light. In most cases the name (the earliest name) denotes some phenomenon of nature; thus Dobrizhofer met in the forests a young man styled "Gold flower of day," that is, "Dawn," his father having been named "Sun." Similar names are commonly given by the natives of Australia, while no names are more common among North-American Indians than those derived from sun, moon, cloud, and wind. This simple historical fact is very damaging to the mythological theories which resolve into solar or elemental myths all legends where the names of the characters can be philologically twisted into descriptions of natural phenomena. It is concluded that these myths originally described incidents in the life of clouds, winds, and tides, whereas names like those on which the theory depends are commonly applied by savage peoples to ordinary human beings. Marchal Saxe was not the sun because his mistress was named "Aurore," and Cephalus and Procris were real persons to those who heard their story, although by a series of logical jumps their names may be interpreted as synonyms of the sun and the dew.

The names of savage persons are not permanent. The name first given is ordinarily changed (at the ceremony answering to confirmation in church) for some more appropriate and descriptive nickname, and that, again, is apt to be superseded by various "honour-giving names" derived from various exploits. The common superstition against being "named" has probably produced the custom by which each individual is addressed, when possible, by some wide term of kinship—"brother," "father," and the like. The bad luck which in Zulu customs as in Vedic myths attends the utterance of the real name is evaded by this system of addresses. Could we get a savage—an Iroquois, for example—to explain his titles, we would find that he is, say, "Morning Cloud" (by birth-name), "Hungry Wolf" (by confirmation name), "He that raises the white fellow's scalp" (by honour-giving name), of the Crane totem (by family and hereditary name, as understood by ourselves). When society grows so permanent that male kinship and paternity are recognized, the custom of patronymics is introduced. The totem name gives place to a gentile name, itself probably a patronymic in form; or, as in Greece, the gentile name gives place to a local name, derived from the deme. Thus a Roman is called Caius; Julius is his gentile name (of the Julian clan); Cæsar is a kind of hereditary nickname. A Greek is Thucydides (the name usually derived from the grandfather), the son of Olorus, of the deme of Halimusia.

This system of names answered the purposes of Greek and Roman civilization. In Europe, among the Teutonic races, the stock-names (probably totemistic in origin) survive in English local names, which speak of the "ton" or "ham" of the Billings or Tootings. An examination of these names, as collected in Kemble's *Anglo-Saxons*, proves that they were originally derived, as a rule, from animals and plants. Our English ancestors had for personal names compound words, as "Noble Wolf" (Ethelwulf), "Wolf of War," and so forth, and these names certainly testify to a somewhat primitive and fierce stage of society. Then came more vulgar nicknames and personal descriptions, as "Long," "Brown," "White," and so forth. Other names are directly derived from the occupation or craft (Smith, Fowler, Sadler) of the man to whom they were given, and yet other names were derived from places. The noble and landowner was called "of" such and such a place (the German *von*, and French *de*), while the humbler man was called not "of" but "at" such a place, as in the name "Attewell," or merely by the local name without the particle. If we add to these patronymics formed by the addition of "son," and terms derived from Biblical characters (the latter adopted after the Reformation as a reaction against the names of saints in the calendar), we have almost exhausted the sources of modern English and European names. A continual development of custom can be traced, and the analysis of any man's family and Christian names will lead us beyond history into the manners of races devoid of literary records. (A. L.)

NAMUR, a province of Belgium, is bounded on the N. by South Brabant, on the E. by Liége and Luxemburg, on the S. by France, and on the W. by Hainault, having a maximum length from north to south of 55 miles; its greatest breadth is 45 miles, and the area 1413 square miles. The surface is much varied by hill and dale, being traversed by the forest of Ardennes, which here attains a height of about 2100 feet; in some parts, especially in the valley of the Meuse between Dinant and Liége, the scenery is beautiful and romantic. The principal rivers are the Meuse and its tributary the Sambre, which joins it at Namur. Geologically the province belongs to the Carboniferous system; the iron mines are very rich, and along with the coal-pits employ a considerable proportion of the industry of the province. Lead mines are also worked to some extent; and building-stone, slate, and excellent marble are quarried. The soil in the arrondissement of Namur is a rich marl, fertile and well-cultivated; about one-third of the entire province is occupied by wood, and in the arrondissement of Dinant there are considerable stretches of heath. The climate is, generally speaking, moist and cold. Wheat, rye, oats, barley, hemp, flax, and hops are the principal crops raised, but the vine is also grown. As regards live stock, sheep are preferred to horned cattle; large numbers of horses, strong and of a good breed, are also reared. The special manufacture of Namur is cutlery, for which the province is famed. Among the other industries may be mentioned porcelain and glass-making, paper-making, cotton-spinning, and tanning. At the census of 1876 the population was 315,796. There are three arrondissements,—Dinant, Namur, and Philippeville.

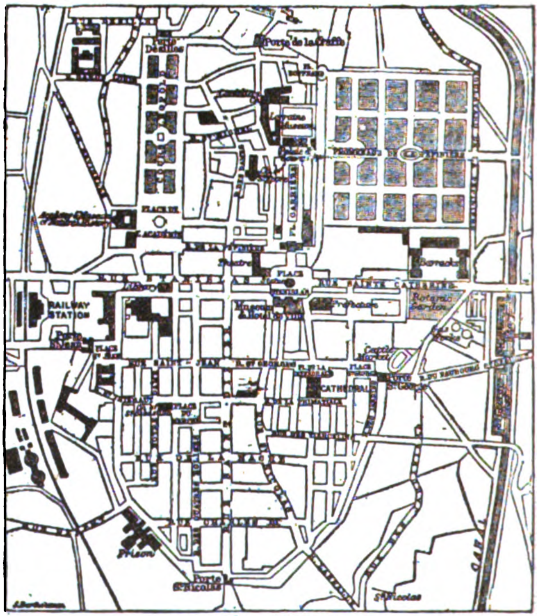
Namur (Flem., *Namen*), capital of the above province, is picturesquely situated on both banks of the Sambre, at the point of its junction with the Meuse, 35 miles south-east from Brussels. The rivers are crossed by several stone bridges. The streets are broad and clean, and there are two or three good squares. There are almost no buildings of any considerable antiquity now standing, if the 11th-century belfry and the palace of justice, dating from 1464 as the monastery of St Albinus, be excepted. The cathedral church of St Aubain or St Albin is a modern building (1751–72) in the Renaissance style, adorned in front with several statues in white marble. The interior has statues by Delvaux and Parmentier, a fine carved oak pulpit by Geerts, and the tomb of Don John of Austria, who died at his camp at Bouges, about a mile to the north-east of the town, in 1578. The church of St Loup is also a fine building, richly adorned in the interior with marble and stone carving. Besides several other churches, the town has a town-hall, a theatre, a seminary, a picture gallery, library, and archæological museum, various charitable institutions, barracks, &c. The manufactures are considerable, cutlery being the specialty. Tanning is also extensively carried on, and a great number of the inhabitants are employed in the mines and quarries of the neighbourhood. The situation of Namur gives it great advantages as a centre for trade. The population in 1875 was 27,068.

In Cæsar's time Namur was the capital of the Aduatuci, who, he tells us (*B. G.*, ii. 29), after his defeat of the Nervii, leaving all their other strongholds betook themselves to this one town "egregie natura munitum." Defended by walls of considerable thickness, by well-constructed outworks on both sides of the rivers, and by the citadel on a rocky eminence at their junction, it was long a place of great strength in modern times also. It was taken by Louis XIV. in 1692, an event which was recorded by Racine and celebrated in verse by Boileau, but it was recovered in 1695 by the British and Dutch under William III., after a siege of ten months. The fortifications were destroyed in 1784 by Joseph II. of Austria, restored and strengthened in 1817 under the inspection of Wellington, and finally razed in 1866.

NANAK. See India, vol. xii. p. 808.

NANA SAHIB is the common designation of Dandhu Panth, adopted son of the ex-peshwa of the Mahrattas, Báji Ráo, who took a leading part in the great Indian mutiny, and was proclaimed peshwa by the mutineers. See India, vol. xii. p. 810. Nana Sahib was responsible for the massacres at Cawnpore, and was engaged in the protracted campaigns in Oudh. In the closing days of 1859, when the last remnants of the rebels disappeared over the Nepalese frontier, the Nana was among the fugitives. His death was reported some time afterwards, but his real fate remains obscure. Compare Nepal.

NANCY, the ancient capital of Lorraine, afterwards the chief town of the French department of Meurthe, and since 1872 that of the department of Meurthe-et-Moselle, is situated 219 miles east of Paris by railway, on the left bank of the Meurthe, 6 miles above its junction with the Moselle. It consists of two distinct portions: the old town in the north-west, between the citadel and the streets and square which bear the name of Stanislas, is composed of narrow and winding streets; the Stanislas town in the south-east has, on the other hand, wide straight streets which cross each other at right angles and allow views of the hills around the city. Beyond the gates (several of which are preserved on account of their antiquarian interest, and still indicate the line of the old civic boundaries) long suburbs stretch out into the country. The railway from Paris to Strasburg skirts the city on the south-west side, and to the east and north lie the Meurthe



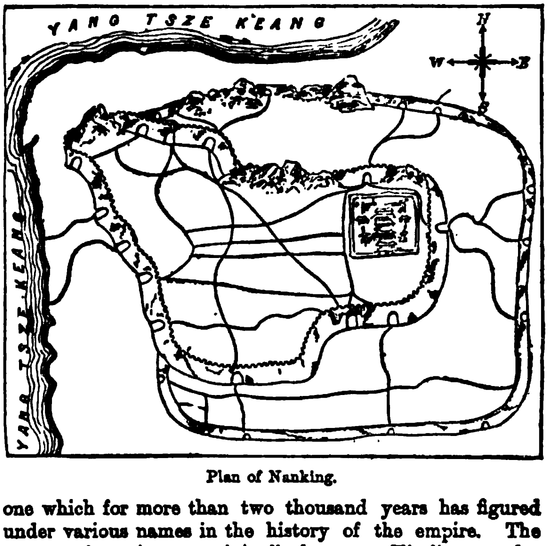
Plan of Nancy.

and the canal from the Marne to the Rhine. Other railways—to Metz, to Épinal by Mirecourt, to Château Salins—join the main line in the neighbourhood, and make the place an important junction. The Place Stanislas is worthy of a capital city: in the centre stands the statue of Stanislas Leczinski, ruler of Lorraine (who still remains the most popular personage in the town which he embellished), and on all sides rise imposing buildings in the 17th-century style—the town-hall, episcopal palace, theatre, &c. The streets opening into the square have railings of artistic workmanship. A fine triumphal arch known as the King's Gate leads from the Place Stanislas to the Place Carrière, which forms a beautiful tree-planted promenade, and at its further end contains the Government palace and the so-called Pepinière (nursery), with fine clumps of trees, grass, and flowers. Other open spaces in the city are the Place d'Alliance (formed by Stanislas, with a fountain in memory of the alliance between Louis XV. and Maria Theresa in 1756), the Place de l'Académie, the Cours Léopold, the Place St Epvre, the Place Dombasle, and the Place de la Gare. The town-hall contains a picture gallery. The cathedral, built in the 18th century, has a wide façade flanked by two dome-surmounted towers, and a somewhat frigid and sombre interior. Of particular interest is the church of the Franciscans (Cordeliers), in the old town, built by René II. to commemorate his victory over Charles the Bold in 1476. Pillaged during the Revolution period, but restored to religious uses in 1825, it contains the tombs of Antony of Lorraine and his wife Marie d'Harcourt, Philippe of Gueldres, second wife of René II., the engraver Jacques Callot, Henry III., count of Vaudémont, and Isabella of Lorraine his wife, René II. (a curious monument raised by his widow in 1515), and Cardinal de Vaudémont. Here also is a chapel built in the beginning of the 17th century to receive the tombs of the princes of the house of Lorraine. The church of St Epvre, rebuilt between 1864 and 1874 on the site of an old church in the style of the 13th, 14th, and 15th centuries, has a fine spire and belfry and good stained glass windows. Bonsecours Church, at the end of the St Pierre Faubourg, contains the mausoleums of Stanislas (by whom it was built) and his wife Catherine, and the heart of their daughter Marie, queen of France. Of the old ducal palace, begun in the 15th century by Duke Raoul and completed by René II., there remains but a single wing, and of this a portion was destroyed by a great fire in 1871, and has been replaced by an upper primary school built in the same 15th-century style as the rest of the building. The entrance to this wing is a delightful specimen of the late Gothic of the beginning of the 16th century. From the ground-floor gallery a fine staircase ascends to the Galerie des Cerfs, which accommodates the archæological museum of Lorraine; one of the greatest treasures of the collection is a piece of tapestry 92 feet long and 13 feet broad, which was found in the tent of Charles the Bold after the battle of Nancy. At a short distance from the railway station a cross marks the spot where the duke's body was found. Of the old gates of Nancy the most remarkable is the Porte de la Craffe.

Nancy is the seat of a bishop and of a court of appeal, and the headquarters of a military division dependent on the Châlons corps d'armée. It is also a university town, with the four faculties of medicine, literature, science, and law, and as an educational centre has risen in importance since 1871. It possesses a large library, archives of antiquarian interest, a botanical garden, and a museum of natural history, an academy, a geographical society, and an important school of forestry (see vol. ix. p. 403). The first agricultural station founded in France (1822) is at Roville in the vicinity. Timber, grain, and hops (largely grown in the district), rags for the paper-mills of the Vosges, and the embroidery which was its earliest industry have long been the objects of an extensive trade at Nancy; during the last fifty years the commercial and industrial importance of the place has been greatly increased by the construction of the railway and the canal from the Marne to the Rhine, now supplemented by the new eastern canal between the Meuse, the Moselle, and the Saône; and since the Franco-German war the manufacturing class has been recruited by numerous immigrants from Alsace. Round about the city are now to be seen the chimneys of iron-works and foundries, cotton-mills, chemical-works, and glass-works; and large numbers of the inhabitants are also employed in making straw-hats, artificial flowers, boots and shoes, and hosiery. A printing and publishing establishment of some importance has been transferred from Strasburg. The population was about 23,000 in the close of the 18th century, 43,000 in 1856, 52,000 in 1871, and 66,000 (73,225 as a commune) in 1881.

At the close of the 11th century Odelric of Nancy, brother of Gerard of Alsace, possessed at Nancy a castle which enabled him to defy the united assaults of the bishops of Metz and Treves and the count of Bar. In the course of the next century the town was surrounded with walls, and became the capital of the dukes of Lorraine; but its real importance dates from the 15th century, when (in 1477) Charles the Bold and his schemes of conquest perished at its gates. Enlarged, embellished, and admirably refortified by Charles III., it was taken by the French in 1633 (Louis XIII. and Richelieu being personally present at the siege); and when in 1661 it was restored by Louis XIV. Charles was compelled to raze its fortifications. After the peace of Ryswick in 1697 Duke Leopold, at length in quiet possession of his duchy, set himself to repair the disasters of the past. He founded academies, established manufactures, and set about the construction of the new town. But it was reserved for Stanislas Leczynski, to whom Lorraine and Bar were assigned in 1736, to carry out the plans of improvement and embellishment in a style which made Nancy one of the palatial cities of Europe, and rendered himself the most popular as he was the last of the dukes of Lorraine. The city, which became French in 1766, was occupied by the allies in 1814 and 1815, and put to ransom by the Prussians in 1870.

NANKING, or "the southern capital," is the name by which Keang-ning, the chief city in the province of Keang-soo, in China, has been popularly known for several centuries. The present city, which stands in 32° 5′ N. lat. and 118° 47′ E. long., dates only from the beginning of the Ming dynasty (1368), although it is built on the site of one which for more than two thousand years has figured under various names in the history of the empire. The more ancient city was originally known as Kin-ling; under the Han dynasty (206 B.C. to 25 A.D.) its name was converted into Tan-yang; by the T'ang emperors (618–907



Plan of Nanking.

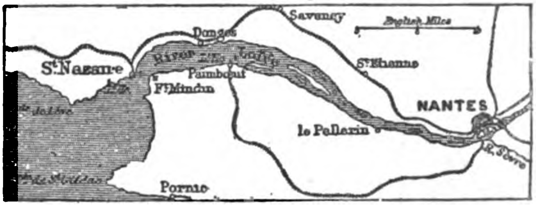
A.D.) it was styled Keang-nan and Shing Chow; by the first sovereign of the Ming dynasty (1368–1644 A.D.) it was created the "southern capital" (Nan-king), and was given the distinctive name of Ying-t'een; and since the accession to power of the present Manchu rulers it has been officially known as Keang-ning, though still popularly called Nan-king. As a matter of fact it was the seat of the imperial court only during the reigns of the first two emperors of the Ming dynasty, and was deserted for Shun-t'een (Peking) by Yung-lo, the third sovereign of that line, who in 1403 captured the town and usurped the crown of his nephew, the reigning emperor.

But even when speaking of the city rebuilt by the Ming emperors it is necessary to use the past tense. The Taiping rebels, who carried the town by assault in 1853, made a clean sweep of all the national monuments and most of the more conspicuous public buildings it contained, and destroyed or were the means of destroying the greater part of the magnificent wall which surrounded it. The following description, therefore, must be understood as referring to the town as it existed before it was invaded by those ruthless destroyers.

The city is said by Chinese topographers to have been surrounded by a wall measuring 96 le, or 32 miles, in circumference. This computation has, however, been shown by more accurate calculation to be a gross exaggeration, and it is probable that 60 le, or 20 miles, would be nearer the actual dimensions. The wall, of which only small portions now remain, was about 70 feet in height, measured 30 feet in thickness at the base, and was pierced by thirteen gates. Encircling the north, east, and south sides of the city proper was a second wall which enclosed about double the space of the inner enclosure. The public buildings were on a scale befitting one of the foremost cities in the empire, which was and still is the permanent seat of the provincial government, and which for a time was the abode of the imperial court. The inner city, which is nominally inhabited by the Manchu garrison only, is crossed from north to south by four main thoroughfares, which are intersected by roads connecting the gates in the eastern and western walls. In the north-east corner of the town stood the imperial palace reared by Hung-woo, the imperial founder of the modern city. After suffering mutilation at the time of the overthrow of the Ming dynasty, this magnificent building was finally burnt to the ground on the recapture of the city from the Taiping rebels in 1864. But beyond comparison the most conspicuous public building at Nanking was the famous porcelain tower, which was designed by the emperor Yung-lo (1403–28) to commemorate the virtues of his mother. Twelve centuries previously an Indian priest deposited on the spot where this monument afterwards stood a relic of Buddha, and raised over the sacred object a small pagoda of three stories in height. During the disturbed times which heralded the close of the Yuen dynasty (1368) this pagoda shared the fate of the surrounding buildings, and was utterly destroyed. It was doubtless out of respect to the relic which then perished that Yung-lo chose this site for the erection of his "token-of-gratitude" pagoda. At noon on the fifteenth day of the sixth month of the tenth year of the reign of this monarch (1413) the building was begun. But before it was finished Yung-lo had passed away, and it was reserved for his successor to see the final pinnacle fixed in its place, after nineteen years had been consumed in carrying out the designs of the imperial architect. In shape the pagoda was an octagon, and was about 260 feet in height, or, as the Chinese say, with that extraordinary love for inaccurate accuracy which is peculiar to them, 32 chang (a chang equals about 120 inches) 9 feet 4 inches and $\frac{2}{10}$ of an inch. The outer walls were cased with bricks of the finest white porcelain, and each of the nine stories into which the building was divided was marked by overhanging eaves composed of green glazed tiles of the same material. The summit was crowned with a gilt ball fixed on the top of an iron rod, which in its turn was encircled by nine iron rings. Hung on chains which stretched from this apex to the eaves of the roof were five large pearls of good augury for the safety of the city. One was supposed to avert floods, another to prevent fires, a third to keep dust-storms at a distance, a fourth to allay tempests, and a fifth to guard the city against disturbances. From the eaves of the several stories there hung one hundred and fifty-two bells, and countless lanterns adorned the same coignes of vantage. The strange form and beauty of the edifice, which might have been expected to have preserved it from destruction, were, however, no arguments in its favour in the eyes of the Taiping rebels, who razed it to the ground when they made themselves masters of Nanking.

Nanking is about 194 geographical miles to the west of Shanghai, and is nearly equidistant between Canton and Peking. It is situated on the south bank of the Yang-tsze Keang, and has a population of 400,000 souls. In bygone days it was one of the chief literary centres of the empire, besides being famous for its manufacturing industries. Satin, crape, nankeen cloth, paper, pottery, and artificial flowers were among its chief products. Of late years, however, these peaceful industries have been superseded by the production of all kinds of warlike material. As at Fuh-chow, the arsenal at Nanking is superintended by Europeans, under whose guidance steam ships of war and cannon of the newest and most approved type are there manufactured. In the history of the political relations of England with China, Nanking principally figures as the city where, after its capture by British ships in 1842, Sir Henry Pottinger signed the "Nanking treaty." (R. K. D.)

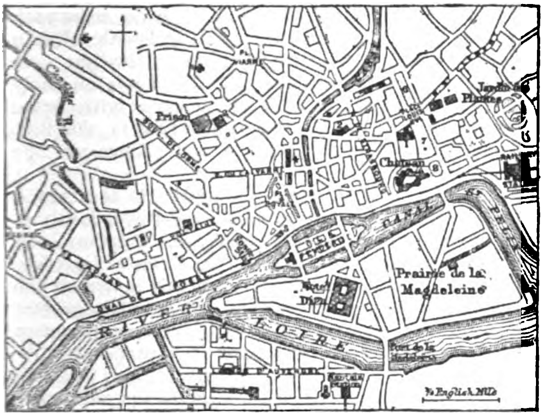
NANTES, a city of France, chief town of the department of Loire-Inférieure, is situated on the right bank of the Loire, 35 miles above its mouth, in 47° 13′ N. lat. and 1° 33′ W. long.. In population (117,555 inhabitants in 1881) it is the first city of Brittany. At Nantes the Loire receives on the left hand the Sèvre Nantaise, and on the right the Erdre, which forms the outlet of the canal between Nantes and Brest; and a large number of bridges spanning the various branches of the different streams join the several quarters of the city. Along the left bank of the Loire stretches an ever-extending line of factories and shipbuilding yards. In all there are 6 miles of quays, 2½ miles traversing the city in its greatest breadth from east to west along the main river. The largest vessels at present come no farther than St Nazaire, but a canal is being made on the left bank which will allow vessels drawing 16 feet to come up to the city. Nantes lies 264 miles west-south-west of Paris by the Angers and Le Mans Railway, and 40 miles from St Nazaire. Other lines connect it with Rennes *via* Châteaubriant, La Roche-sur-Yon, Paimbœuf, and Pornic.



Environs of Nantes.

The cathedral of Nantes, commenced in 1434 in the Gothic style, is still unfinished. Its length will be, when completed, 335 feet, and the nave is 85 feet wide and 123 feet in height. The towers are 205 feet high. There are two interesting monuments in the transept,—on the right Michel Colomb's tomb of Francis II., duke of Brittany, and his second wife Marguerite de Foix (1507), and on the left that of General Lamoricière by Paul Dubois. The former consists of a white marble base covered by a black marble slab on which rest the two effigies, the four corners being occupied by upright figures of Justice, Fortitude, Temperance, and Prudence. Of the other churches the more interesting are St Nicolas, a modern building in the style of the 13th century, Ste Croix, which occupies the site of an old pagan temple, and St Jacques on the left bank of the Loire.

Between the cathedral and the Loire, from which it is separated only by the breadth of the quay, stands the castle of Nantes, founded in the 9th or 10th century. Rebuilt by Francis II. and the duchess Anne, it was flanked by Mercœur in the time of the League with huge bastions decorated with the Lorraine cross. From being the residence of the dukes of Brittany it became a state prison (Cardinal de Retz, Fouquet, and the duchess of Berri were confined within its walls), and it is now occupied by the artillery headquarters. The chapel in which the marriage of Louis XII. with Anne of Brittany was celebrated was destroyed by an explosion in 1800. Nantes possesses a fine theatre, a court-house, a prefecture, and an exchange, which includes both the tribunal and the chamber of commerce. The town-hall possesses a curious casket in gold and enamel which once, it is said, contained the heart of Anne of Brittany. The public library is in the old corn-market, and the museum of painting and sculpture finds scanty accommodation in the old cloth-market. Apart from the beautiful collection presented to the town by the duke of Feltre, the catalogue includes 1000 pictures and 130 statues. An archæological museum has its quarters in the old church of the Convent of the Oratory, where Fouché, afterwards duke of Otranto, taught before the Revolution; part of the old mint is occupied by the school of science and arts; and not far off is the museum of natural history, comprising a complete collection of the minerals of the department. The botanic garden consists of a purely scientific portion and a landscape garden which forms one of the finest promenades of its kind. Between the Loire and the Erdre run Cours St Pierre and Cours St André, adorned at the two ends of the line by statues of Anne of Brittany and Arthur III., Du Guesclin and Olivier de Clisson, and separated by the Place Louis XVI., with a statue of that monarch on a column 92 feet high. The Place Royale, the great meeting-place of the principal thoroughfares of the city, contains a monumental fountain in blue Rennes granite, with a white marble statue of the town of Nantes and bronze statues of the Loire and four of its affluents—the Sèvre, the Erdre, the Cher, and the Loir. A flight of steps at the west end of the town leads up from the quay to the colossal cast-iron statue of St Anne, whence a splendid view may be obtained over the valley of the Loire. Several old houses of the 15th and 16th centuries, the fish market, the railway station, and the Salorges (a vast granite building now used as a bonded warehouse) are all of interest. Besides two great hospitals —St Jacques on the left bank of the Loire, with 1600 beds, and the Hôtel-Dieu, recently rebuilt in Gloriette island, with 1200 beds—Nantes contains a deaf-mute institute, a secondary school of medicine and pharmacy, a hydrographic school, a drawing school, a branch establishment of the conservatoire at Paris, and a lyceum. It is the see of a bishop, and the headquarters of the 11th corps d'armée. As a seat of the sugar manufacture Nantes stands next to Paris and Marseilles. In city or suburbs there are vast establishments for the manufacture of iron, copper, and lead, shipbuilding yards, factories for agricultural and similar implements, oil-works, soap-works, a national tobacco factory employing 1800 hands, a stained-glass factory, manure works, and granite yards. Food-preserving is a rapidly growing industry in all the three departments of meat, fish, and vegetables (the last largely grown in the neighbourhood). Commercially Nantes does not occupy so high a position as formerly, being now only eleventh in the list of French ports, though its custom-house still ranks second in amount of receipts. It imports coal from England (duty free), wood from Scandinavia, colonial wares from the Antilles. Its shipowners, whose vessels are rather more numerous than those of Havre, keep possession of the greater part of the trade of the lower Loire and the coast fisheries. In 1875 they had 745 vessels, of 150,000 tons aggregate burden. The commercial movement of the port was 235,000 tons; and the value of the exports and imports amounted to £5,000,000. In 1880 the movement was upwards of 400,000 tons.



Plan of Nantes

1. Cathedral.
2. Hôtel de Ville.
3. Palais de Justice.
4. Picture Gallery.
5. Bourse.
6. Cours St André.
7. Cours St Pierre.
8. Place de la Duchesse Anne.

Previous to the Roman occupation, Nantes (Condivicenum) was the chief town of the Nannetes, and under the conquerors it became a great commercial and administrative centre. In the middle of the 3d century Christianity was introduced by St Clair. Clotaire I. got possession of the city in 560, and placed it under the government of St Felix the bishop, who executed enormous works to cause the Loire to flow under the walls of the castle. After being several times subdued by Charlemagne, Brittany revolted under his successors, and Nominoé, proclaimed king in 842, ordered the fortifications of Nantes to be razed because it had sided with Charles the Bald. The Normans held the town from 843 to 936. About this time began the rivalry between Nantes and Rennes. Pierre de Dreux, declared duke of Brittany by Philip Augustus, made Nantes his capital, surrounded it with fortifications, and defended valiantly against John of England. During the Breton wars of succession Nantes took part first with Montfort, but afterwards with Charles of Blois, and did not open its gates to Montfort till his success was assured and his English allies had retired. In 1560 Francis II. granted Nantes a communal constitution. In the course of the 15th and 16th centuries the city suffered from several epidemics. Averse to Protestantism, it joined the League along with Mercœur, governor of Brittany, who helped to raise the country into an independent duchy; and it was not till 1598 that it opened its gates to Henry IV., who here signed on May 2d of that year the famous edict which until its revocation by Louis XIV. in 1685 was the charter of Huguenot liberties in France (see vol. ix. p. 564, 579, and vol. xii. p. 838–9). It was at Nantes that Count Chalais was punished for plotting against Richelieu, that Fouquet was arrested, and that the Cellamare conspirators were executed under the regent. Having warmly embraced the cause of the Revolution in 1789, the city was in 1793 treated with extremest rigour by Carrier, of *noyade* fame. Under the empire its foreign commerce was ruined. The duchess of Berri was arrested at Nantes in 1832 while trying to stir up La Vendée against Louis Philippe. Anne of Brittany, Charles Errard, founder of the French Academy at Rome, Generals Cambronne and Lamoricière, and Jules Verne were born in the city.

NANTEUIL, Robert (1623–1678), a crayonist, and one of the most eminent of French line engravers, was born about 1623, or, as other authorities state, in 1630, the son of a merchant of Rheims. Having received an excellent classical education, he studied engraving under his brother-in-law, Nicholas Regnesson; and, his crayon portraits having attracted attention, he was pensioned by Louis XIV., and appointed designer and engraver of the cabinet to that monarch. It was mainly due to his influence that the king granted the edict of 1660, dated from St Jean de Luz, by which engraving was pronounced free and distinct from the mechanical arts, and its practitioners were declared entitled to the privileges of other artists. The plates of Nanteuil, several of them approaching the scale of life, number about three hundred. In his early practice he imitated the technique of his predecessors, working with straight lines, strengthened, but not crossed, in the shadows, in the style of Claude Mellan, and in other prints cross-hatching like Regnesson, or stippling in the manner of Jean Boulanger; but he gradually asserted his full individuality, modelling the faces of his portraits with the utmost precision and completeness, and employing various methods of touch for the draperies and other parts of his plates. Much of the beauty and artistic character of his prints is due to the fact that he was himself a skilful portraitist, accustomed to work much from the life, and that he commonly engraved from his own designs. His subjects are quiet, tender, and silvern in effect, but, compared with those of his great contemporary Edelinck, they are less rich and varied in the rendering of the relative weights of colour. Among the finest works of his fully developed period may be named the portraits of Pomponne de Bellièvre, Gilles Ménage, Jean Loret, the Duc de la Meilleraye, and the Duchesse de Nemours. A list of his works will be found in Dumesnil's *Le Peintre Graveur Français*, vol. iv. He died at Paris in 1678.

NANTUCKET, an island, county, and town of the United States, forming (since 1693) part of Massachusetts. The island, with an area of about 50 square miles, lies within the 10-fathom line, but is separated from the mainland by Nantucket Sound, which measures from 25 to 30 miles in breadth, and has a general depth of from 5 to 8 fathoms. With the exception of a few inconsiderable hills, the surface for the most part consists of open, breezy, and now almost treeless downs. The soil is generally sandy, but affords in some places good pasture. On the north or landward side of the island there is a large lagoon-like harbour formed by a long narrow tongue of land—the Coatue Beach—which, curving north-west, runs out into Great Point, the end of which is marked by a white lighthouse tower in 41° 23′ 24″ N. lat. and 70° 2′ 24″ W. long. Within the harbour the depth at low water is about 12 or 14 feet, but on the bar it is only between 6 and 7. The western end of the island shelves out in a broad submarine platform (Tuckernuck Bank), which supports the two considerable islands of Tuckernuck and Muskeget, both included in the county. Nantucket post-village, the principal settlement, lies at the south-west end of the harbour, —a quiet place, but beginning to attract attention as a summer residence. A library and museum are maintained in the Athenæum building.

Nantucket (Natocko on the map of 1680) was visited by Gosnold (1602), who found it covered with oaks and other trees, and inhabited by about 1500 Indians. Governor Mayhew, in 1659, granted nine-tenths of the island to ten men for £30 and two beaver hats, and shortly afterwards the first settler, Thomas Macy, took possession. The town of Nantucket (known as Sherburne from 1673 to 1795) was incorporated in 1671; the original site was at Maddequet, 5 or 6 miles west of the present position, to which it was removed in the following year. About the same time whaling operations were commenced, and Nantucket gradually became the greatest whaling station in the world. In 1775 it had 150 vessels engaged in the business; but since the beginning of the century its prosperity has rapidly declined: in 1852 there were still 18,105 tons of its registered shipping employed in whale-fishing; in 1868 there were only 3739; and the number has gradually sunk to zero. The last full-blood Indian in Nantucket died in 1821; the last half-breed in 1854. The population of the county was 4500 in 1775, 9012 in 1840, 6094 in 1860, 4123 in 1870, and 3727 in 1880.

NANTWICH, a market-town of Cheshire, situated on two railway lines and on both sides of the Weaver, 20 miles south-east of Chester and 36 south-south-west of Manchester. There is water communication by the Grand Junction Canal, which near it joins the Ellesmere Canal. The town, which consists of three main streets, is somewhat irregularly built. The principal buildings are the church of SS. Mary and Nicholas, in the Decorated Gothic style, with octagonal tower; the grammar school, founded in 1611; the town-hall, in the Gothic style; and the new market-hall, which replaced the old one in 1867. There are several almshouses and other charities. The ancient castle, erected by the Normans, was in ruins before the time of Henry VII., and there are now no remains of it. The principal industry is the manufacture of boots and shoes; there are also several clothing factories. The population of the urban sanitary district in 1871 was 6673, and in 1881 it was 7495

Nantwich, which is said to have existed in the time of the Romans, was originally called Halen Gwyn, the white salt town. In Domesday it is entered as the part possession of the king and Earl Edwin, to whom its numerous salt springs supplied a considerable revenue. It was erected into a barony by Hugh Lupus, first Norman earl of Chester. The town suffered severely from fire in 1438 and in 1583, from a kind of mad ague in 1587, and from plague in 1604. In the reign of Henry VIII. it possessed three hundred salt-works, but, on account of the discovery of salt in 1624 at a district of the Vale of Weaver more convenient for water carriage, the industry rapidly declined, and is now wholly discontinued. Brine baths have been erected (1883) behind the town-hall.

NAPHTALI, the son of Jacob by Bilhah, Rachel's maid, and uterine brother of Dan. The narrator of Gen. xxx. 8 explains the name נַפְתָּלִי by the verb נִפְתַּל, "wrestle." The seats of the tribe lay in the eastern half of upper Galilee, a fertile mountainous country sloping down to the headwaters of Jordan and the Sea of Galilee (Josh. xix. 32–39). Within this country the Canaanites continued to hold Beth-shemesh and Beth-anath (Judg. i. 33). After the wars with Sisera, in which the tribe took a prominent part (Judg. iv.; v. 18), and with Midian (Judg. vii. 23), we hear little of Naphtali. Dwelling near the settlements of the Aramæans, the tribe was an early sufferer in the bloody conflicts of Damascus with Israel (1 Kings xv. 20), and it was depopulated in the first Assyrian captivity by Tiglath Pileser (2 Kings xv. 29; Isa. ix. 1 [viii. 23]).

NAPHTHA, a word originally applied to the limpid liquid portion of the petroleum which exudes abundantly at Baku, &c., on the shores of the Caspian Sea. It is the *νάφθα* of Dioscorides, and the *naphtha* or *bitumen liquidum candidum* of Pliny. Both in commerce and in science the term is now used somewhat vaguely, but more in a generic sense, to embrace several bodies having certain properties in common, than as a specific name for a particular substance. Naphtha indeed has no distinct place or meaning in modern chemistry. By the alchemists the word was used principally to distinguish various highly volatile, mobile, and inflammable liquids, such as the ethers,—sulphuric ether and acetic ether having been known respectively as *Naphtha sulphurici* and *Naphtha aceti*. In recent times naphtha has been employed to indicate the volatile, limpid, inflammable hydrocarbons obtained by destructive distillation of organic substances artificially conducted, as well as those produced by similar agencies acting within the earth. In commerce the application of the term is still more restricted, and in general it embraces no more than the more volatile portion of the fluid hydrocarbons separated in the distillation of tar.

Under the name naphtha we thus find the subjoined series of substances comprehended. (1) *Coal-tar naphtha* consists of the lightest and first separated portions of the hydrocarbons obtained in the distillation of gas-tar. It embraces the hydrocarbons having a specific gravity ranging from about 850° up to 950°, and is, especially in its lighter fractions, rich in benzole. (2) *Shale naphtha* is obtained in the purification of the crude oil got by the destructive distillation of shale and other carbonaceous minerals. The first fraction secured, having a specific gravity ranging from 640° to 680°, is termed gasoline; and coming between this and the ordinary burning oils is a light volatile and highly inflammable oil with a specific gravity of 700°–760°, known commonly as naphtha, but also more conveniently termed shale spirit. It is valuable as a solvent, and is also used to some extent for burning in open air. (See PARAFFIN.) (3) *Native naphtha* is the more fluid portion of the rock oil or petroleum found in many parts of the world. (4) *Wood naphtha*, or methyl alcohol, has been already described under METHYL, vol. xvi. p. 195. (5) *Caoutchouc naphtha*: a series of hydrocarbons can be prepared by the distillation of india-rubber, and may be separated by means of fractional distillation; together, under the name of caoutchine, they form a most efficient solvent for india-rubber itself. (6) *Bone naphtha*, or bone oil, known also as Dippel's animal oil, is a most offensively smelling product of the distillation of bones in the preparation of animal charcoal. The persistent and repulsive stench of this substance effectually precludes its industrial use among the naphthas.

NAPHTHALINE. See Tar.

NAPIER, a seaport and borough of New Zealand, on the south-east coast of North Island, is the chief town of the province of Hawke's Bay, and is built on a peninsula (known as Scinde Island) about 12 miles from the southern end of the bay, in 39° 29′ S. lat. and 176° 44′ E. long., about 200 miles by sea from Wellington. It is a thriving place, the centre of a large agricultural and pastoral district. The main portion of the town, with the banks, churches, hotels, &c., stretches along the flat shore-land, while the suburban dwelling-houses of the wealthier inhabitants scatter themselves over the hills to the north. The stagnant salt lagoons which formerly occupied the southern boundary have been reclaimed. In 1881 the population was 5756; and the municipality, with its area of 879 acres, now contains about 1300 dwellings, with rateable property valued in 1882 at £57,866. An athenæum, a small hospital, a lunatic asylum, a philosophical society, and an acclimatization society are among the public institutions. The town (named after Sir Charles James Napier) is the seat of the bishop of Waiapu, and returns a member to the New Zealand House of Representatives. A railway is now open as far as Makatuku (70 miles). The harbour (Port Ahuriri), 1½ miles to the west, is very unsatisfactory, and though there is good anchorage the roadstead is greatly exposed to easterly and southerly winds.

NAPIER, Sir Charles (1786–1860), British admiral, was the second son of Captain the Hon. Charles Napier, R.N., and grandson of Francis, fifth Lord Napier, and thus cousin to the three famous Napiers, Sir Charles, Sir George, and Sir William, and was born at Merchiston Hall, near Falkirk, on March 6, 1786. He became a midshipman in 1800, was promoted lieutenant in 1805 and commander in 1807, and distinguished himself in the West Indies, where he fought his famous action with three French ships of the line, and took the "Hautpoult," seventy-four guns, into which the admiral promoted him captain. On his return to England his rank was confirmed, but he was put on half-pay. He spent some time at the university of Edinburgh, and then went to Portugal to visit his cousins in Wellington's army. In 1811 he served in the Mediterranean, and in 1813 on the coast of America and in the expedition up the Potomac. The first years of his leisure he spent in Italy and in Paris, but speculated so much in a steamboat enterprise that by 1829 he was quite ruined. In that year he was appointed to the "Galatea," forty-two, and was at the Azores when they were held by the Count de Villa Flor for the queen of Portugal. He so much impressed the constitutional leaders that they begged him to take command of the fleet, which offer he accepted in February 1833. With it he destroyed the Miguelite fleet off Cape St Vincent on July 5, and on the demand of France was struck off the English navy list. Continuing his Portuguese services, he commanded the land forces in the successful defence of Lisbon in 1834, when he was made Grand Commander of the Tower and Sword, and Count Cape St Vincent in the peerage of Portugal. On his return to England he was restored to his former rank in the navy in 1836, and received command of the "Powerful," eighty-four, in 1838. When troubles broke out in Syria he was appointed second in command, and distinguished himself by leading the storming column at Sidon on September 26, 1840, and by other services, for which he was made a K.C.B. He went on half-pay in 1841, and was in 1842 elected M.P. for Marylebone in the Liberal interest, but lost his seat in 1846. He was promoted rear-admiral the same year, and commanded the Channel fleet from 1846 to 1848. On the outbreak of the Russian War he received the command of the fleet destined to act in the Baltic, and hoisted his flag in February 1854. He refused to attack Cronstadt, and a great outcry was raised against him for not obeying the orders of the Admiralty and attempting to storm the key of St Petersburg; but his inaction has been thoroughly justified by posterity. On his return in December 1854 he was not again offered a command. He was elected M.P. for Southwark in February 1855, and maintained his seat, though broken in health, until his death on November 6, 1860.

See Major-General E. Napier's *Life and Correspondence of Admiral Sir Charles Napier, K.C.B.*, 2 vols., London, 1862; Napier's own *War in Syria*, 2 vols., 1842; *The Navy, its past and present state, in a series of letters*, edited by Sir W. F. P. Napier, 1851; and *The History of the Baltic Campaign of* 1854, *from documents and other materials furnished by Vice-Admiral Sir C. Napier, K.C.B.*, 1857. See also *The Life and Exploits of Commodore Napier*, 1841; and *Life of Vice-Admiral Sir C. Napier*, 1854.

NAPIER, Sir Charles James (1782–1853), the acknowledged hero of a family of heroes, was born at Whitehall, London, in 1782, and was the eldest son of Colonel George Napier, of the Guards (a younger son of the fifth Lord Napier), and of his wife Lady Sarah Lennox—the Lady Sarah who had charmed King George III. After the custom of those times Charles Napier had been gazetted an ensign in the 33d regiment in 1794, and in 1797 his father secured for him the appointment of aide-de-camp to Sir James Duff, the general commanding the Limerick district. Longing for more active service, Napier obtained a commission as lieutenant in Manningham's rifles in 1800. This newly formed corps was designed to supply a body of light troops for the English army fit to cope with the French voltigeurs and tirailleurs, and was specially trained at first under the eye of Colonel Manningham, and then in the famous camp at Shorncliffe, under the immediate supervision of Sir John Moore. Moore speedily perceived the military qualities of the Napiers, and inspired the three elder brothers—Charles, George, and William—with an enthusiasm which lasted all their lives; but, though happy in his general, Charles Napier quarrelled bitterly with William Stewart, the lieutenant-colonel, and in 1803 left the regiment to accompany General Fox to Ireland as aide-de-camp. The great influence of his uncle, the duke of Richmond, procured him in 1804 a captaincy in the staff corps, and in the beginning of 1806 a majority in the Cape regiment. On his way to the Cape, however, he exchanged into the 50th regiment, with which he served in the short Danish campaign under Lord Cathcart in 1807. Shortly after his return from Denmark the 50th was ordered to Portugal, and shared all the glories of the famous retreat to Corunna. At the battle of Corunna, one of the last sights of Sir John Moore before he was struck was the advance of his own old regiment under the command of Charles Napier and Edward Stanhope, and almost his last words were "Well done, my majors!" Being badly supported from the right, the 50th were almost entirely cut to pieces, and both the majors left for dead upon the field. Napier's life was saved by a French drummer named Guibert, who brought him safely to the headquarters of Marshal Soult. Soult treated him with the greatest kindness, and he was allowed by Ney to return to England to his "old blind mother" instead of being interned. He had not been long in England when he heard that his exchange had been arranged, and, volunteering for the Peninsula, he joined the light division before Ciudad Rodrigo. As a volunteer he served in the actions on the

Coa, and again at Busaco, where he was badly wounded in the face. He was ordered to England, but refused to go, and was present with the light division in all the actions which took place during Wellington's pursuit of Masséna. His services were rewarded soon after by the lieutenant-colonelcy of the 102d regiment, which had been entirely demoralized at Botany Bay, and when he joined it at Guernsey was one of the worst regiments in the service; when he left it in 1813 it was one of the best. He accompanied it in June 1812 from Guernsey to Bermuda, where he wrought a wonderful change in the spirit both of officers and men. By treating his men as friends he won their love and admiration, and became in a peculiar degree the hero of the British soldiers. In September 1813 he exchanged back into the 50th regiment, and in December 1814, believing all chance of active service to be at an end, retired on half-pay. He was gazetted one of the first C.B.'s on the extension of the order in 1814, and was present as a volunteer at the capture of Cambray, though he just missed the great battle of Waterloo. Though an officer of some experience and more than thirty years of age, he now joined the military college at Farnham, and completed his military education. In 1819 he was appointed inspecting field officer at Corfu. From Corfu he was moved in 1822 to Cephalonia, where he remained for eight years as governor and military resident. What he did there he has described in a book of his own, and how he loved the place is shown by his wish to the very end of his life to return and die there. He was the model of a despotic colonial governor, and showed all the qualities of a benevolent despot. He made good roads and founded great institutions, but everything must be done by him, and he showed himself averse to interference whether from the lord high commissioner of the Ionian Islands or from the inhabitants of his own little colony. An interesting episode in his command was his communication with Lord Byron when he touched at Cephalonia on his way to his death at Missolonghi, and the insurrection of the Greeks, who would have called him to be their commander-in-chief had the Greek committee in London encouraged his pretensions. • But at last his struggle with the authorities of the colonies grew to such a pitch that in 1830 he was obliged to leave Cephalonia. He retired to Normandy, where he published his work on the colonies, and also an historical romance on William the Conqueror. In 1834 he refused the governorship of Australia, still hoping for military employment. In 1837 he was promoted major-general with his brother George, and in 1838 was made a K.C.B.; but he was to wait till 1839 before he received an offer of employment. In that year he was made commanding officer in the northern district, and found his command no sinecure, owing to the turbulent state of the Chartists in the towns of Yorkshire and Lancashire. His behaviour during the tenure of his command is described by William Napier in his life of his brother, and his inability to hold a command which did not carry supreme authority is plainly portrayed. In 1841, to the content of the Government, he resigned his command and went to India. He was stationed at Poona, and in September 1842, when troubles were expected there, was ordered to Sind.

His command in Sind from 1842 till August 1847 is the period of his life during which, according to his brother, he made good his title to fame, but his acts, more especially at first, have been most severely criticized. In fact there can be little doubt that from the moment he landed in the province he determined to conquer the ameers, and to seek the first opportunity of doing so. He was to be accompanied by Colonel Outram, who had been resident in Sind during the Afghan war, and who felt a great admiration for him, but who had also a warm affection for the ameers, and believed that he could put off the day of their destruction. On February 17, 1843, while Outram was still absent engaged in negotiation, Napier attacked the Baluch army 30,000 strong with but 2800 men. With these 2800 men, including the 22d regiment, which would do anything for him, he succeeded in winning the victory of Meanee. It was a battle of the olden type, in which generals had to fight like privates. Sir Charles was in his element, and himself engaged in the fray. In the March following he finally destroyed the army of the ameers at the battle of Hyderabad. His success was received with enthusiasm both by the governor-general, Lord Ellenborough, and by the English people, and he was at once made a G.C.B. The conqueror of Sind now had an opportunity to prove his administrative powers, and proceeded to apply the same material means of civilization to Sind which had formerly been successful in Cephalonia. Whether or not the conquest of Sind at that particular period can be justified, there can be no doubt that Charles Napier was the best administrator who could be found for the province when conquered. Sind, when it came under English rule, was in a state of utter anarchy, for the Baluches had formed a military government not unlike that of the Mamelukes in Egypt, which had been extremely tyrannical to the native population. This native population was particularly protected by Sir Charles Napier, who completed the work of the destruction of the Baluch supremacy which he had commenced with the victory of Meanee. The labour of administration was rendered more difficult by the necessity of repressing the hill tribes, which had been encouraged to acts of lawlessness by the licence which followed the Afghan war. The later years of his administration were made very stormy by the attacks on the policy of the conquest which had been made in England. He left Sind, after quarrelling with every authority of the presidency of Bombay, and nearly every authority of the whole of India, in August 1847, and received a perfect ovation on his return from all the hero-worshippers of the Napiers, of whom there were many in England. His short stay in England was occupied with incessant struggles with the directors of the East India Company; but, however much the directors hated him, it was not long before they had to beseech him in humble terms to become their commander-in-chief. The news of the indecisive victory of Chillianwalla created a panic in England, and the East India Company was obliged by the force of public opinion to summon the greatest general to take the command of its armies. Sir Charles started almost at a moment's notice, but on reaching India found that the victory of Gujrat had been won and the Sikh war was over. No taint of envy was in his nature, and he rejoiced that he had not to supersede Lord Gough in the moment of defeat. His restless and imperious spirit was met by one equally imperious in the governor-general, Lord Dalhousie. From the very beginning of his command the governor-general and the commander-in-chief disagreed, and in April 1850 Sir Charles was reprimanded on some trifling point of discipline. The reprimand was reiterated by the duke of Wellington, and in December 1850 Napier once more left for England. His constitution was undermined by the Indian climate, and especially by his fatiguing command in Sind, and on August 29, 1853, he died at Portsmouth.

Charles James Napier, recognized by his brothers as the greatest representative of the Napiers, though without the literary genius of his brother William, had all the restless energy which distinguished the whole family,—the same impatience of command and contradiction, the same power of inspiring the people with a reverential enthusiasm which impressed even the dullest. At Meanee he showed himself to be a gallant general; but he was also a great soldier, Possibly he had not the coolness which forms a Wellington, but he had the power of inspiring his soldiers with an enthusiastic love and admiration which Wellington could never inspire. Besides being a great soldier he was a very great administrator, and both in Cephalonia and in Sind proved what work a man never fatigued and never afraid of responsibility could do. The most discussed question in his life is the conquest of Sind. There can be no doubt that he hurried on that conquest. There can be no doubt that the conquest was disapproved by statesmen in England. Mr Gladstone's own testimony is to the effect that the conquest of Sind "was disapproved unanimously by the cabinet of Sir Robert Peel, of which I can speak, as I had just entered it at that time. But the ministry were powerless inasmuch as the mischief of retaining was less than the mischief of abandoning it, and it remains an accomplished fact" (*Contemporary Review*, November 1876). But that the mischief was not greater was due to Sir Charles's administrative power. Many men have been gallant generals, great soldiers, and even great administrators, but no man of the 19th century was a hero as well, and it is the heroic side of his character which it is most difficult to analyse, and most easy to perceive. It appears all through Sir William Napier's life of his brother, but it is most clearly and trenchantly brought out in a letter of Carlyle to the biographer. "The fine and noble qualities of the man are very recognizable to me: his subtle piercing intellect turned all to the practical, giving him just insight into men and into things; his inexhaustible adroit contrivances, his fiery valour, sharp promptitude to seize the good moment that will not return. A lynx-eyed fiery man, with the spirit of an old knight in him, more of a hero than any modern I have seen for a long time."

The chief authority for Sir Charles Napier's life is his *Life and Opinions*, by his brother, 1857; consult also MacCall, *Career and Character of C. J. Napier*, 1857; and M'Dougall, *General Sir C. J. Napier, Conqueror and Governor of Scinde*, 1860. His own works are *Memoir of the Roads of Cephalonia*, 1825; *The Colonies*, 1833; *Colonization*, 1835; *Remarks on Military Law and the Punishment of Flogging*, 1837; *A Letter on the Defence of England by Corps of Volunteers and Militia*, 1852; *A Letter to the Right Honourable Sir J. C. Hobhouse on the Baggage of the Indian Army*, 1849; *Defects, Civil and Military, of the Indian Government*, 1853; and *William the Conqueror, a Historical Romance*, edited by Sir W. Napier, 1858. On Sind, consult primarily Sir W. Napier, *The Conquest of Scinde*, 1845; *The Administration of Scinde*, 1851; *Compilation of General Orders issued by Sir C. Napier*, 1850; and Outram, *The Conquest of Scinde, a Commentary*, 1846. For his command-in-chief, and the controversy about his resignation, consult J. Mawson, *Records of the Indian Command of General Sir C. J. Napier*, Calcutta, 1851; *Minutes on the Resignation of the late General Sir C. Napier, by Field-Marshal the Duke of Wellington, &c.*, 1854; *Comments by Sir W. Napier on a Memorandum of the Duke of Wellington*, 1854; and Sir William Napier, *General Sir C. Napier and the Directors of the East India Company*, 1857. (H. M. S.)

NAPIER, John (1550–1617), the inventor of logarithms, was born at Merchiston near Edinburgh in 1550, and was the eighth Napier of Merchiston. The first Napier of Merchiston, "Alexander Napare," acquired the Merchiston estate before the year 1438, from James I. of Scotland. He was provost of Edinburgh in 1437, and was otherwise distinguished. His eldest son Alexander, who succeeded him in 1454, was provost of Edinburgh in 1455, 1457, and 1469; he was knighted and held various important court offices under successive monarchs; at the time of his death in 1473 he was master of the household to James III. His son, John Napier of Rusky, the third of Merchiston, belonged to the royal household in the lifetime of his father. He also was provost of Edinburgh at various times, and it is a remarkable instance of the esteem in which the lairds of Merchiston were held that three of them in immediate lineal succession repeatedly filled so important an office during perhaps the most memorable period in the history of the city. He married a great-granddaughter of Duncan, eighth earl of Levenax (or Lennox), and besides this relationship by marriage the Napiers claimed a lineal male cadency from the ancient family of Levenax. His eldest son, Archibald Napier of Edinbellie, the fourth of Merchiston, belonged to the household of James IV. He fought at Flodden and escaped with his life, but his eldest son Alexander (fifth of Merchiston) was killed. Alexander's eldest son (Alexander, sixth of Merchiston) was born in 1513, and fell at the battle of Pinkie in 1547. His eldest son was Archibald, seventh of Merchiston, and the father of John Napier, the subject of this article.

In 1549 Archibald Napier, at the early age of about fifteen, married Janet, daughter of Francis Bothwell, and in the following year John Napier was born. In the criminal court of Scotland, the earl of Argyll, hereditary justice-general of the kingdom, sometimes presided in person, but more frequently he delegated his functions; and it appears that in 1561 Archibald Napier was appointed one of the justice-deputes. In the register of the court, extending over 1563 and 1564, the justice-deputes named are "Archibald Naper of Merchistoune, Alexander Bannatyne, burgess of Edinburgh, James Stirling of Keir, and Mr Thomas Craig." About 1565 he was knighted at the same time as James Stirling, his colleague, whose daughter John Napier subsequently married. In 1582 Sir Archibald was appointed master of the mint in Scotland, with the sole charge of superintending the mines and minerals within the realm, and this office he held till his death in 1608. His first wife died in 1563, and in 1572 he married a cousin, Elizabeth Mowbray, by whom he had three sons, the eldest of whom was named Alexander.[1]

As stated above, John Napier was born in 1550, the year in which the Reformation in Scotland may be said to have commenced. In 1563, the year in which his mother died, he matriculated at St Salvator's College, St Andrews. He early became a Protestant champion, and the one solitary anecdote of his youth that is known to exist occurs in his address "to the Godly and Christian reader" prefixed to his *Plaine Discovery*. He writes:—

> "In my tender yeares, and barneage in Sanct-Androis at the Schooles, having, on the one parte, contracted a loving familiaritie with a certaine Gentleman, &c. a Papist; And on the other part, being attentive to the sermons of that worthie man of God, Maister Christopher Goodman, teaching upon the Apocalyps, I was so mooved in admiration, against the blindnes of Papists, that could not most evidently see their seven hilled citie Rome, painted out there so lively by Saint John, as the mother of all spiritual whoredoms, that not onely bursted I out in continual reasoning against my said familiar, but also from thenceforth, I determined with my selfe (by the assistance of Gods spirit) to employ my studie and diligence to search out the remanent mysteries of that holy Book: as to this houre (praised be the Lorde) I have bin doing at al such times as conveniently I might have occasion."

The names of nearly all Napier's classfellows can be traced as becoming *determinantes* in 1566 and masters of arts in 1568; but his own name does not appear in the lists. The necessary inference is that his stay at the university was short, and that only the groundwork of his education was laid there. Although there is no direct evidence of the fact, there can be no doubt that he left St Andrews to complete his education on the Continent, and that he probably studied at the university of Paris, and visited Italy and Germany. He did not, however, as has been supposed, spend the best years of his manhood abroad, for he was certainly at home in 1571, when, being just of age, the preliminaries of his marriage were arranged at Merchiston; and for many years after that event he took an earnest interest in the affairs of the church, the most engrossing element in the politics of the time.

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[1] The descent of the first Napier of Merchiston has been traced to "Johan le Naper del Counte de Dunbretan," who was one of those who swore fealty to Edward I. in 1296 and defended the castle of Stirling against him in 1304; but there is no authority for this genealogy. The legend with regard to the origin of the name Napier was given by Sir Alexander Napier, eldest son of John Napier, in 1625, in these words:—"One of the ancient earls of Lennox in Scotland had issue three sons: the eldest, that succeeded him to the earldom of Lennox; the second, whose name was Donald; and the third, named Gilchrist. The then king of Scotland having wars, did convocate his lieges to battle, amongst whom that was commanded was the earl of Lennox, who, keeping his eldest son at home, sent his two sons to serve for him with the forces that were under his command. This battle went hard with the Scots; for the enemy pressing furiously upon them forced them to lose ground until it came to flat running away, which being perceived by Donald, he pulled his father's standard from the bearer thereof, and valiantly encountering the foe, being well followed by the earl of Lennox's men, he repulsed the enemy and changed the fortune of the day, whereby a great victory was got. After the battle, as the manner is, every one drawing and setting forth his own acts, the king said unto them, ye have all done valiantly, but there is one amongst you who hath Na-Peer [*i.e.*, no equal]; and calling Donald into his presence commanded him, in regard to his worthy service, and in augmentation of his honour, to change his name from Lennox to Napier, and gave him the lands of Gosford, and lands in Fife, and made him his own servant, which discourse is confirmed by evidences of mine, wherein we are called Lennox *alias* Napier." Sir Archibald adds that this is "the origin of our name, as, by tradition from father to son we have generally and without any doubt received the same." The written statement of the legend was occasioned by the following circumstance. Robert Napier, a cousin of John Napier, had amassed riches abroad as a merchant; he was created a baronet in 1612, and in order to put his genealogy formally on record in the heralds' books, he applied for an authentic certificate to Sir Archibald, afterwards Lord Napier, who resided at Merchiston, as the head of the family; and Sir Archibald in reply wrote out in his own hand the document from which the preceding extract has been made.

In 1572 John Napier married Elizabeth, daughter of Sir James Stirling of Keir, mentioned above. This marriage took place almost immediately after his father's second marriage. About the end of the year 1579 John Napier's wife died, leaving him one son, Archibald, the first Lord Napier, and one daughter, Jane. A few years afterwards he married again, the name of his second wife being Agnes Chisholme, and by her he had ten children, five sons and five daughters.

On the 17th of October 1593 a convention of delegates was held at Edinburgh at which a committee was appointed to follow the king and lay before him in a personal interview certain instructions relating to the punishment of the rebellious Popish earls and the safety of the church. This committee consisted of six members, two barons, two ministers, and two burgesses—the two barons selected being John Napier of Merchiston and James Maxwell of Calderwood. The delegates found the king at Jedburgh, and the mission, which was a dangerous one, was successfully accomplished. Shortly afterwards another convention was held at Edinburgh, and it was resolved that the delegates sent to Jedburgh should again meet the king at Linlithgow and repeat their former instructions. This was done accordingly, the number of members of the committee being, however, doubled. These interviews took place in October 1593, and on the 29th of the following January Napier wrote to the king the letter which forms the dedication of the *Plaine Discovery*.

The full title of this first work of Napier's is given below.[1] It was written in English instead of Latin in order that "hereby the simple of this Iland may be instructed"; and the author states that he "was constrained of compassion, leaving the Latine, to haste out in English this present worke." He apologizes also for the language and his own mode of expression in the following sentences:—

> "Whatsoever therfore through hast, is here rudely and in base language set downe, I doubt not to be pardoned thereof by all good men, who, considering the necessitie of this time, will esteem it more meete to make hast to prevent the rising againe of Antichristian darknes within this Iland, then to prolong the time in painting of language"; and "I graunt indeede, and am sure, that in the style of wordes and utterance of language, we shall greatlie differ, for therein I do judge my selfe inferiour to all men: so that scarcely in these high matters could I with long deliberation finde wordes to expresse my minde."[2]

It is not to be supposed that Napier's *Plaine Discovery* was in any respect due to a visionary cloud passing over his mind, or to any temporary infatuation; on the contrary, it is a serious and laborious work, to which he had devoted years of care and thought, and which is closely connected with the history of the times. In one sense it may be said to stand to theological literature in Scotland in something of the same position as that occupied by the *Canon Mirificus* with respect to the scientific literature, for it is the first published original work relating to theological interpretation, and is quite without a predecessor in its own field. In judging of the book, the circumstances of the time and the state of the country have to be taken into account. Napier lived in the very midst of fiercely contending religious factions, and his home was situated in a district which was the scene of constant wars and disturbances; there was but little theological teaching of any kind, and the work related to what were then the leading political and religious questions of the day.

After the publication of the *Plaine Discovery*, Napier seems to have occupied himself with the invention of secret instruments of war, for in the Bacon collection at Lambeth Palace there is a document, dated June 7, 1596, and signed by Napier, giving a list of his inventions for the defence of the country against the anticipated invasion by Philip of Spain. The document is entitled "Secrett Inventionis, proffitabill and necessary in theis dayes for defence of this Iland, and withstanding of strangers, enemies of God's truth and religion,"[3] and the inventions consist of (1) a mirror for burning the enemies' ships at any distance, (2) a piece of artillery destroying everything round an arc of a circle, and (3) a round metal chariot, so constructed that its occupants could move it rapidly and easily, while firing out through small holes in it. It has been asserted (by Sir Thomas Urquhart) that the piece of artillery was actually tried upon a plain in Scotland with complete success, a number of sheep and cattle being destroyed.

In 1614 appeared the work which in the history of British science can be placed as second only to Newton's *Principia*. The full title is as follows:—*Mirifici Logarithmorum Canonis descriptio, Ejusque usus, in utraque Trigonometria; ut etiam in omni Logistica Mathematica, Amplissimi, Facillimi, & expeditissimi explicatio. Authore ac Inventore Ioanne Nepero, Barone Merchistonii, &c., Scoto. Edinburgi, ex officinâ Andreæ Hart Bibliopolæ, CIϽ.DC.XIV.* This is printed on an ornamental title-page. The work is a small-sized quarto, containing fifty-seven pages of explanatory matter and ninety pages of tables.

The nature of logarithms is explained by reference to the motion of points in a straight line, and the principle upon which they are based is that of the correspondence of a geometrical and an arithmetical series of numbers. The table gives the logarithms of sines for every minute to seven figures; it is arranged semi-quadrantally, so that the *differentiæ*, which are the differences of the two logarithms in the same line, are the logarithms of the tangents. Napier's logarithms are not the logarithms now termed

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[1] *A plaine discovery of the whole Revelation of Saint Iohn: set downe in two treatises: The one searching and proving the true interpretation thereof: The other applying the same paraphrastically and Historically to the text. Set foorth by John Napeir L. of Marchistoun younger. Whereunto are annexed certaine Oracles of Sibylla, agreeing with the Revelation and other places of Scripture. Edinburgh, printed by Robert Walde-grave, printer to the King's Majestie,* 1593. *Cum privilegio Regali.*

[2] The work was translated into French by George Thomson, a naturalized Scotsman residing in La Rochelle, and published by him at that town in 1602, under the title *Ouverture de tous les secrets de l'Apocalypse, &c. Par Jean Napier* (c. a. d.) *Nonpareil, Sieur de Merchiston, reveue par lui-meme, et mise en Francois par Georges Thomson, Escossois.* There was a second edition of the translation in 1605, and a third edition in 1607. There was also a German translation published at Frankfort, which reached its third edition in 1627. The second English edition appeared in 1611, and in the preface to it Napier states he intended to have published an edition in Latin soon after the original publication in 1598, but that, as the work had now been made public by the French and German translations, and as he was "advertised that our papistical adversaries wer to write larglie against the said editions that are alreadie set out," he defers the Latin edition "till having first seene the adversaries objections, I may insert in the Latin edition an apologie of that which is rightly done, and an amends of whatsoever is amisse." No criticism on the work was ever published, and there was no Latin edition. A third edition appeared in 1645.

[3] A facsimile of this document is given by Mr Mark Napier in his *Memoirs of John Napier*

Napierian, that is to say, logarithms to the base e where $e = 2{\cdot}7182818\ldots$; but they are closely related to this system, the connexion being expressed by the equation—

$$\log \text{Nap. } n = 10{,}000{,}000 \log_e (10{,}000{,}000) - 10{,}000{,}000 \log_e n\,;$$

or

$$\log \text{Nap. } n = 10^7 \log_e\left(\frac{10^7}{n}\right).$$

A translation of the *Canon Mirificus* into English was made by Edward Wright, and published after his death by his son Samuel Wright, at London, in 1618, under the title *A Description of the admirable Table of Logarithmes*. Edward Wright, who was a fellow of Caius College, Cambridge, occupies a conspicuous place in the history of navigation. In 1599 he published *Certaine errors in Navigation detected and corrected*, and he was the author of other works; to him also is chiefly due the invention of the method known as Mercator's sailing. He at once saw the value of logarithms as an aid to navigation, and lost no time in preparing a translation, which he submitted to Napier himself. The preface to Wright's edition consists of a translation of the preface to the *Canon Mirificus*, together with the addition of the following sentences written by Napier himself:—"But now some of our Countreymen in this Island well affected to these studies, and the more publique good, procured a most learned Mathematician to translate the same into our vulgar English tongue, who after he had finished it, sent the Coppy of it to me, to bee seene and considered on by myselfe. I having most willingly and gladly done the same, finde it to bee most exact and precisely conformable to my minde and the originall. Therefore it may please you who are inclined to these studies, to receive it from me and the Translator, with as much good will as we recommend it unto you." There is a short "preface to the reader" by Briggs, and a description of a triangular diagram invented by Wright for finding the proportional parts. The table is printed to one figure less than in the *Canon Mirificus*. Edward Wright died in 1615, and his son in the preface states that his father "gave much commendation of this work (and often in my hearing) as of very great use for mariners"; and with respect to the translation he says that "shortly after he had it returned out of Scotland, it pleased God to call him away afore he could publish it."

In 1617 Napier published his *Rabdologia*,[1] a duodecimo of one hundred and fifty-four pages; there is prefixed to it as preface a dedicatory epistle to the high chancellor of Scotland. The method which Napier terms "Rabdologia" consists in the use of certain numerating rods for the performance of multiplications and divisions. These rods, which were commonly called "Napier's bones," will be described further on. The second method, which he calls the "Promptuarium Multiplicationis" on account of its being the most expeditious of all for the performance of multiplications, involves the use of a number of lamellæ or little plates of metal disposed in a box. In an appendix of forty-one pages he gives his third method, "local arithmetic," which is performed on a chess-board, and depends, in principle, on the expression of numbers in the scale of radix 2. In the *Rabdologia* he gives the chronological order of his inventions. He speaks of the canon of logarithms as "a me longo tempore elaboratum." The other three methods he devised for the sake of those who would prefer to work with natural numbers; and he mentions that the promptuary was his latest invention. In the preface to the appendix containing the local arithmetic he states that, while devoting all his leisure to the invention of these abbreviations of calculation, and to examining by what methods the toil of calculation might be removed, in addition to the logarithms, rabdologia, and promptuary, he had hit upon a certain tabular arithmetic, whereby the more troublesome operations of common arithmetic are performed on an abacus or chess-board, and which may be regarded as an amusement rather than a labour, for, by means of it, addition, subtraction, multiplication, division, and even the extraction of roots are accomplished simply by the motion of counters. He adds that he has appended it to the *Rabdologia*, in addition to the promptuary, because he did not wish to bury it in silence, nor to publish so small a matter by itself. With respect to the calculating rods, Napier mentions in the dedication that they had already found so much favour as to be almost in common use, and even to have been carried to foreign countries; and that he has been advised to publish his little work relating to their mechanism and use, lest they should be put forth in some one else's name.

John Napier died on April 4, 1617, the same year as that in which the *Rabdologia* was published, so that his death must have taken place very soon after its appearance. His will, which is extant, was signed on the fourth day before his death. No particulars are known of his last illness, but it seems likely that death came upon him rather suddenly at last. In both the *Canon Mirificus* and the *Rabdologia*, however, he makes reference to his ill-health. In the dedication of the former he refers to himself as "mihi jam morbis penè confecto," and in the "Admonitio" at the end he speaks of his "infirma valetudo"; while in the latter he says he has been obliged to leave the calculation of the new canon of logarithms to others "ob infirmam corporis nostri valetudinem."

It is usually stated that John Napier was buried in St Giles's church, Edinburgh, and there can be no doubt that some of the family of Napier were buried there in the 16th or 17th century, but the late Professor Wallace, in a paper read before the Society of Antiquaries of Scotland in 1832, and quoted by Mr Mark Napier on pp. 425–427 of his *Memoirs of John Napier of Merchiston*, gives evidence for believing that he was buried in St Cuthbert's church. Professor Wallace's words are—

> "My authority for this belief is unquestionable. It is a Treatise on Trigonometry, by a Scotsman, James Hume of Godscroft, Berwickshire, a place still in possession of the family of Hume. The work in question, which is rare, was printed at Paris, and has the date 1636 on the title-page, but the royal privilege which secured it to the author is dated in October 1635, and it may have been written several years earlier. In his treatise (page 116) Hume says, speaking of logarithms, 'L'inuenteur estoit un Seigneur de grande condition, et duquel la posterité est aujourd'huy en possession de grandes dignitéz dans le royaume, qui estant sur l'age, et grandement trauaillé des gouttes ne pouvait faire autre chose que de s'adonner aux sciences, et principalment aux mathematiques et à la logistique, à quoy il se plaisoit infiniment, et auec estrange peine, a construict ses Tables des Logarymes, imprimees à Edinbourg en l'an 1614. . . . Il mourut l'an 1616, et fut enterré hors la Porte Occidentale d'Edinbourg, dans l'Eglise de Sainct Cudbert.'"

There can be no doubt that Napier's devotion to mathematics was not due to old age and the gout, and that he died in 1617 and not in 1616; still these sentences were written within eighteen years of Napier's death, and their author seems to have had some special sources of information. Additional probability is given to Hume's assertion by the fact that Merchiston is situated in St Cuthbert's parish. It is nowhere else recorded that Napier suffered from the gout.

The *Canon Mirificus* contains only an explanation of the use of the logarithms without any account of the manner in which the canon was constructed. In an "Admonitio" on the seventh page he states that, although in that place the mode of construction should be explained, he proceeds at once to the use of the logarithms, "ut prælibatis prius usu, et rei utilitate, cætera aut magis placeant posthac edenda, aut minus saltem displiceant silentio sepulta." He awaits therefore the judgment and censure of the learned "priusquam cætera in lucem temerè prolata lividorum detrectationi exponantur"; and in an "Admonitio" on the last page of the book he states that he will publish the mode of construction of the canon "si huius inventi usum eruditis gratum fore intellexero."

Napier, as we have seen, died in 1617, immediately after the appearance of the *Rabdologia*, and before he had published the promised account of the method of construction of the canon. This work was, however, issued by Robert Napier, his second son by his second marriage, in 1619.[1] The *Constructio* consists of a preface of two pages, followed by sixty-seven pages of text. In the preface Robert Napier says that he has been assured from undoubted authority that the new invention is much thought of by the ablest mathematicians, and that nothing would delight them more than the publication of the mode of construction of the canon. He therefore issues the work to satisfy their desires, although, he states, it is manifest that it would have seen the light in a far more perfect state if his father could have put the finishing touches to it; and he mentions that, in the opinion of the best judges, his father possessed, among other most excellent gifts, in the highest degree the power of explaining the most difficult matters by a certain and easy method in the fewest possible words.

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[1] *Rabdologiæ, seu Numerationis per virgulas Libri duo: Cum Appendice de expeditissimo Multiplicationis Promptuario. Quibus accessit & Arithmeticæ Localis Liber unus. Authore & Inventore Ioanne Nepero, Barone Merchistonii, &c., Scoto. Edinburgi, Excudebat Andreas Hart*, 1617.

It is important to notice that in the *Constructio* logarithms are called artificial numbers; and Robert Napier states that the work was composed several years (*aliquot annos*) before Napier had invented the name logarithm. The *Constructio* therefore may have been written a good many years previous to the publication of the *Descriptio* in 1614.[2]

The *Canon Mirificus*, on its appearance in 1614, at once attracted the attention of perhaps the two most eminent English mathematicians then living—Edward Wright and Henry Briggs. The former, as we have seen, translated the work into English, but died in 1615 before he could publish his translation. The latter was concerned with Napier in the change of the logarithms from those originally invented to decimal or common logarithms, and it is to him that the original calculation of the logarithmic tables now in use is mainly due (see BRIGGS). He died on January 26, 1631, aged about seventy-four years, so that at the time of the publication of the *Canon Mirificus* he was about fifty-seven years of age. In a letter to Archbishop Ussher, dated Gresham House, March 10, 1615, Briggs wrote, "Napper, lord of Markinston, hath set my head and hands a work with his new and admirable logarithms. I hope to see him this summer, if it please God, for I never saw book which pleased me better, or made me more wonder.[3] I purpose to discourse with him concerning eclipses, for what is there which we may not hope for at his hands"; and he also states "that he was wholly taken up and employed about the noble invention of logarithms, lately discovered." In the summer of 1615 he went to Merchiston and stayed with Napier a whole month; he repeated his visit in 1616, and, as he states, he "would have been glad to make him a third visit, if it had pleased God to spare him so long." William Lilly, the astrologer, in his *Life and Times*, 1721, gives the following account of the meeting between Napier and Briggs on the occasion of the first visit:—

> "I will acquaint you with one memorable story, related unto me by Mr John Marr, an excellent mathematician and geometrician, whom I conceive you remember: he was servant to King James and Charles I. At first, when the Lord Napier, or Marchiston, first made publick his logarithms, Mr Briggs, then reader of the Astronomy lecture at Gresham College in London, was so surprised with admiration of them that he could have no quietness in himself, until he had seen that noble person the Lord Marchiston whose only invention they were: he acquaints John Marr herewith, who went into Scotland before Mr Briggs, purposely to be there when these two so learned persons should meet. Mr Briggs appoints a certain day when to meet at Edinburgh: but failing thereof, the Lord Napier was doubtful he would not come. It happened one day as John Marr and the Lord Napier were speaking of Mr Briggs; 'Ah, John,' saith Marchiston, 'Mr Briggs will not now come'; at the very instant one knocks at the gate; John Marr hasted down and it proved Mr Briggs to his great contentment. He brings Mr Briggs up into my Lord's chamber, where almost one quarter of an hour was spent, each beholding the other almost with admiration, before one word was spoke. At last Mr Briggs began—'My Lord, I have undertaken this long journey purposely to see your person, and to know by what engine of wit or ingenuity you came first to think of this most excellent help unto Astronomy, viz., the Logarithms; but my Lord, being by you found out, I wonder nobody else found it out before, when now known it is so easy.' He was nobly entertained by the Lord Napier, and every summer after that, during the Lord's being alive, this venerable man, Mr Briggs went purposely into Scotland to visit him."

With respect to the change of the logarithms to decimal logarithms, the concluding paragraph of the "Admonitio" which appears on the last page of the *Canon* of 1614 is "Verùm si huius inventi usum eruditis gratum fore intellexero, dabo fortasse brevi (Deo aspirante) rationem ac methodum aut hunc canonem emendandi, aut emendatiorem de novo condendi, ut ita plurium Logistarum diligentia, limatior tandem et accuratior, quàm unius opera fieri potuit, in lucem prodeat. Nihil in ortu perfectum." In some copies, however, this "Admonitio" is absent. In Wright's translation of 1616 Napier has added the sentence—"But because the addition and subtraction of these former numbers may seeme somewhat painfull, I intend (if it shall please God) in a second Edition, to set out such Logarithmes as shall make these numbers above written to fall upon decimal numbers, such as 100,000,000, 200,000,000, 300,000,000, &c., which are easie to be added or abated to or from any other number" (p. 19); and in the dedication to the *Rabdologia* (1617) he wrote "Quorum quidem Logarithmorum speciem aliam multò præstantiorem nunc etiam invenimus, & creandi methodum, unà cum eorum usu (si Deus longiorem vitæ & valetudinis usuram concesserit) evulgare statuimus; ipsam autem novi canonis supputationem, ob infirmam corporis nostri valetudinem, viris in hoc studii genere versatis relinquimus: imprimis verò doctissimo viro D. Henrico Briggio Londini publico Geometriæ Professori, et amico mihi longè charissimo."

Briggs published in 1617, after Napier's death, his *Logarithmorum Chilias Prima*, containing the decimal logarithms of the first thousand numbers to 14 places of decimals. This is the first table of common (or Briggian) logarithms calculated or published. In 1624 he published his *Arithmetica Logarithmica*, containing the logarithms of the first 20,000 numbers and of the numbers from 90,000 to 100,000 to 14 places of decimals. In the short preface to the *Chilias* (1617) Briggs states that the reason why his logarithms are different from those introduced by Napier "sperandum, ejus librum posthumum, abunde nobis propediem satisfacturum." The "liber posthumus" was the *Constructio* (1619), in the preface to which Robert Napier states that he has added an appendix relating to another and more excellent species of logarithms referred to by the inventor himself in the *Rabdologia*, and in which the logarithm of unity is 0. . He also mentions that he has published some remarks upon the propositions in spherical trigonometry and upon the new species of logarithms by Henry Briggs, "qui novi hujus Canonis supputandi laborem gravissimum, pro singulari amicitiâ quæ illi cum Patre meo L. M. intercessit, animo libentissimo in se suscepit; creandi methodo, et usuum explanatione Inventori relictis. Nunc autem ipso ex hâc vitâ evocato, totius negotii onus doctissimi Briggii humeris incumbere, et Sparta hæc ornanda illi sorte quadam obtigisse videtur." In the address prefixed to the *Arithmetica Logarithmica* (1625) Briggs bids the reader not to be surprised that these logarithms are different from those published in the *Canon Mirificus*:—

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[1] The full title was—*Mirifici logarithmorum canonis constructio; Et eorum ad naturales ipsorum numeros habitudines; unà cum Appendice, de aliâ eâque præstantiore Logarithmorum specie condendâ. Quibus accessere Propositiones ad triangula sphærica faciliore calculo resolvenda: Unà cum Annotationibus aliquot doctissimi D. Henrici Briggii, in eas & memoratam appendicem. Authore & Inventore Ioanne Nepero, Barone Merchistonii, &c. Scoto. Edinburgi, Excudebat Andreas Hart, Anno Domini* 1619. There is also preceding this title-page an ornamental title-page, similar to that of the *Canon Mirificus* of 1614; the words are different, however, and run—*Mirifici logarithmorum canonis descriptio . . . Accesserunt Opera Posthuma: Primo, Mirifici ipsius canonis constructio, & Logarithmorum ad naturales ipsorum numeros habitudines. Secundò, Appendix de aliâ, eâque præstantiore Logarithmorum specie construenda. Tertiò, Propositiones quædam eminentissimæ, ad Triangula sphærica mirâ facilitate resolvenda.* . . . . It would thus appear that the *Canonis Descriptio* and the *Canonis Constructio* were issued together in 1619, or that at all events this was the intention.

[2] Both the *Descriptio* and *Constructio* were reprinted by Bartholomew Vincent at Lyons in 1620, and issued together under the title *Logarithmorum Canonis Descriptio, seu Arithmeticarum supputationum mirabilis abbreviatio. Ejusque usus in utraque Trigonometria ut etiam in omni Logistica Mathematica, amplissimi, facillimi & expeditissimi explicatio. Authore ac Inventore Joanne Nepero, Barone Merchistonii, &c. Scoto. Lugduni.* . . . It will be seen that the title of the translation is very different from that of Napier's work of 1614; very many writers have, however, erroneously given it as the title of Napier's original publication.

[3] Dr Thomas Smith thus describes the ardour with which Briggs studied the *Canon Mirificus*:—"Hunc in deliciis habuit, in sinu, in manibus, in pectore gestavit, oculisque avidissimis, et mente attentissima, iterum iterumque perlegit, . . ." *Vitæ quorundam eruditissimorum et illustrium virorum* (London, 1707).

> "Ego enim, cum meis auditoribus Londini, publice in Collegio Greshamensi horum doctrinam explicarem; animadverti multo futurum commodius, si Logarithmus sinus totius servaretur 0 (ut in Canone mirifico) Logarithmus autem partis decimæ ejusdem sinus totius, nempe sinus 5 graduum, 44, m. 21, s., esset 1000000000. atque ea de re scripsi statim ad ipsum authorem, et quamprimum per anni tempus, et vacationem a publico docendi munere licuit, profectus sum Edinburgum; ubi humanissime ab eo acceptus hæsi per integrum mensem. Cum autem inter nos de horum mutatione sermo haberetur; ille se idem dudum sensisse, et cupivisse dicebat: veruntamen istos, quos jam paraverat edendos curasse, donec alios, si per negotia et valetudinem liceret, magis commodos confecisset. Istam autem mutationem ita faciendam censebat, ut 0 esset Logarithmus unitatis, et 10000000000 sinus totius: quod ego longe commodissimum esse non potui non agnoscere. Cœpi igitur, ejus hortatu, rejectis illis quos anteà paraveram, de horum calculo serio cogitare; et sequenti æstate iterum profectus Edinburgum, horum quos hic exhibeo præcipuos, illi ostendi. idem etiam tertia æstate libentissime facturus, si Deus illum nobis tamdiu superstitem esse voluisset."

There is also a reference to the change of the logarithms on the title-page of the work.[1]

These extracts contain all the original statements made by Napier, Robert Napier, and Briggs which have reference to the origin of decimal logarithms. It will be seen that they are all in perfect agreement. Briggs pointed out in his lectures at Gresham College that it would be more convenient that 0 should stand for the logarithm of the whole sine as in the *Canon Mirificus*, but that the logarithm of the tenth part of the whole sine (that is to say, of the sine of 5° 44′ 21″) should be 10,000,000,000. He wrote also to Napier at once; and as soon as he could he went to Edinburgh to visit him, where, as he was most hospitably received by him, he remained for a whole month. When they conversed about the change of system, Napier said that he had felt and desired the same thing, but that he had published the tables which he had already prepared, so that they might be used until he could construct others more convenient. But he considered that the change ought to be so made that 0 should be the logarithm of unity and 10,000,000,000 that of the whole sine, which Briggs could not but admit was by far the most convenient of all. Rejecting therefore those which he had prepared already, Briggs began, at Napier's advice, to consider seriously the question of the calculation of new tables. In the following summer he went to Edinburgh and showed Napier the principal portion of the logarithms which he published in 1624. These probably included the logarithms of the first chiliad which he published in 1617.

Unfortunately Hutton in his history of logarithms, which was prefixed to the early editions of his *Mathematical Tables*, and was also published as one of his *Mathematical Tracts*, has charged Napier with want of candour in not telling the world of Briggs's share in the change of system, and he expresses the suspicion that "Napier was desirous that the world should ascribe to him alone the merit of this very useful improvement of the logarithms." According to Hutton's view, the words "*it is to be hoped* that his posthumous work" . . . . which occur in the preface to the *Chilias*, were a modest hint that the share Briggs had had in changing the logarithms should be mentioned, and that, as no attention was paid to it, he himself gave the account which appears in the *Arithmetica* of 1624. There seems, however, no ground whatever for supposing that Briggs meant to express anything beyond his hope that the reason for the alteration would be explained in the posthumous work; and in his own account, written seven years after Napier's death and five years after the appearance of the work itself, he shows no injured feeling whatever, but even goes out of his way to explain that he abandoned his own proposed alteration in favour of Napier's, and, rejecting the tables he had already constructed, began to consider the calculation of new ones. The facts, as stated by Napier and Briggs, are in complete accordance, and the friendship existing between them was perfect and unbroken to the last. Briggs assisted Robert Napier in the editing of the "posthumous work," the *Constructio*, and in the account he gives of the alteration of the logarithms in the *Arithmetica* of 1624 he seems to have been more anxious that justice should be done to Napier than to himself; while on the other hand Napier received Briggs most hospitably and refers to him as "amico mihi longè charissimo."

Hutton's unfair suggestions are all the more to be regretted as they occur in a history which is the result of a good deal of investigation, and which has been referred to as an authority by many English and foreign writers. He seems to have felt a strong prejudice against Napier for some reason, and all his statements with regard to the origin of logarithms and Napier's connexion with them are untrustworthy. While speaking of the change of the logarithms, it should be noticed that the "Admonitio" on the last page of the *Canon Mirificus*, containing the reference to the new logarithms, does not occur in all the copies. It is printed on the back of the last page of the table itself, and so cannot have been torn out from the copies that are without it. As there could have been no reason for omitting it after it had once appeared, we may assume that the copies which do not have it are those which were first issued. It is probable therefore that Briggs's copy contained no reference to the change, and it is even possible that the "Admonitio" may have been added after Briggs had communicated with Napier. As special attention has not been drawn to the fact that some copies have the "Admonitio" and some have not, different writers have assumed that Briggs did or did not know of the promise contained in the "Admonitio" according as it was present or absent in the copies they had themselves referred to, and this has given rise to some confusion. It ought also to be borne in mind that had Napier lived to publish the *Constructio* himself, he would probably have referred to Briggs in much warmer terms than those used by Robert Napier, who doubtless regarded it as due to his father's memory to simply state the facts as he knew them. The character of Briggs is very amiable and perfect; he states with modesty and simplicity his own share in the improvement; and with complete loyalty to his friend, and with great earnestness, he devoted the rest of his life to extend the utility of Napier's splendid invention.

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[1] The title runs as follows:—*Arithmetica Logarithmica, sive Logarithmorum chiliades triginta. . . . Hos numeros primus invenit clarissimus vir Iohannes Neperus Baro Merchistonij; eos autem ex eiusdem sententia mutavit, eorumque ortum et usum illustravit Henricus Briggius. . . .*

Napier's original canon is a table of logarithms of sines, and it was clearly Briggs's original intention to calculate logarithms of sines also; it does not appear from the account he gives who it was who first suggested the tabulation of the logarithms of numbers instead of sines.

Kepler received the invention of logarithms with great enthusiasm. His first mention of them occurs in a letter to Schikhart dated March 11, 1618, in which he writes —"Extitit Scotus Baro, cujus nomen mihi excidit, qui præclari quid præstitit, necessitate omni multiplicationum et divisionum in meras additiones et subtractiones commutata, nec sinibus utitur: at tamen opus est ipsi tangentium canone: et varietas, crebritas, difficultasque additionum subtractionumque alicubi laborem multiplicandi et dividendi superat." This erroneous estimate was formed when he had seen the *Canon Mirificus* but had not read it; and his opinion was very different when he became acquainted with the nature of logarithms. The dedication of his *Ephemeris* for 1620 consists of a letter to Napier dated July 28, 1619, and he there congratulates him warmly on his invention and on the benefit he has conferred upon astronomy generally and also upon his own Rudolphine tables. He says that, although Napier's book had been published five years, he first saw it at Prague two years before; he was then unable to read it, but last year he had met with a little work by Benjamin Ursinus[1] containing the substance of the method, and he at once recognized the importance of what had been effected. He then explains how he verified the canon, and so found that there were no essential errors in it, although there were a few inaccuracies near the beginning of the quadrant, and he proceeds, "Hæc te obiter scire volui, ut quibus tu methodis incesseris, quas non dubito et plurimas et ingeniosissimas tibi in promptu esse, eas publici juris fieri, mihi saltem (puto et cæteris) scires fore gratissimum; eoque percepto, tua promissa folio 57, in debitum cecidisse intelligeres." This letter was written two years after Napier's death, of which Kepler was ignorant, and in the same year as that in which the *Constructio* was published. In 1624 Kepler published a table of Napierian logarithms, with certain modifications and additions.

In a letter from Kepler to Petrus Cugerus there occurs the remarkable sentence—"Nihil autem supra Neperianam rationem esse puto: etsi quidem Scotus quidam literis ad Tychonem A. CIↃIↃXCIV. scriptis jam spem fecit Canonis illius Mirifici." It is here distinctly stated that some Scotsman in the year 1594, in a letter to Tycho Brahe, gave him some hope of the logarithms; and as Kepler joined Tycho after his expulsion from the island of Huen, and had been so closely associated with him in his work, he would be likely to be correct in any assertion of this kind. In connexion with Kepler's statement the following story, told by Anthony Wood in the *Athenæ Oxonienses*, should be noticed:—

> "It must be now known, that one Dr Craig, a Scotchman . . . coming out of Denmark into his own country, called upon Joh. Neper, Baron of Mercheston, near Edinburgh, and told him, among other discourses, of a new invention in Denmark (by Longomontanus, as 'tis said), to save the tedious multiplication and division in astronomical calculations. Neper being solicitous to know farther of him concerning this matter, he could give no other account of it than that it was by proportional numbers. Which hint Neper taking, he desired him at his return to call upon him again. Craig, after some weeks had passed, did so, and Neper then showed him a rude draught of what he called *Canon mirabilis Logarithmorum*. Which draught, with some alterations, he printing in 1614, it came forthwith into the hands of our author Briggs, and into those of Will. Oughtred, from whom the relation of this matter came."

Longomontanus was Tycho's assistant, and this story, though obviously untrue in its facts, is of importance, as it connects Dr Craig with Napier and Longomontanus. In the early part of this article Thomas Craig was mentioned as one of the colleagues of Sir Archibald Napier, John Napier's father, in the office of justice-depute. He is well known as the author of a celebrated legal work *De Feudis*, and between his third son John Craig and John Napier a friendship sprang up which may have been due to their common taste for mathematics. There are extant three letters from Dr John Craig to Tycho Brahe, which show that he was on the most friendly terms with him. In the first letter, of which the date is not given, Craig says that Sir William Stewart has safely delivered to him, "about the beginning of last winter," the book which he sent him. Now Mr Mark Napier found in the library of the university of Edinburgh a mathematical work bearing a sentence in Latin of which the translation is "To Doctor John Craig of Edinburgh, in Scotland, a most illustrious man, highly gifted with various and excellent learning, professor of medicine, and exceedingly skilled in the mathematics, Tycho Brahe hath sent this gift, and with his own hand written this at Uraniburg, 2d November 1588." As Sir William Stewart was sent to Denmark to arrange the preliminaries of King James's marriage, and returned to Edinburgh on November 15, 1588, there can be little doubt that this was the volume referred to by Craig. It appears from Craig's letter, to which we may therefore assign the date 1589, that, five years before, he had made an attempt to reach Uraniburg, but had been baffled by the storms and rocks of Norway, and that ever since then he had been longing to visit Tycho. Now John Craig was physician to the king, and in 1590 James VI. spent some days at Uraniburg before returning to Scotland from his matrimonial expedition. It seems not unlikely therefore that Craig may have accompanied the king in his visit to Uraniburg. In any case it is certain that Craig was a friend and correspondent of Tycho's, and there can be but little doubt that he was the "Scotus quidam."

It is therefore clear that as early as 1594 Napier must have communicated to Craig his hope of being able to effect the simplification of the processes of arithmetic. Everything tends to show that the invention of logarithms was the result of many years of labour and thought, undertaken with this special object, and it thus appears that Napier had seen some prospect of success nearly twenty years before the publication of the *Canon Mirificus*. It is very evident that no mere hint with regard to the use of proportional numbers could have been of any service to Napier, but it is possible that the news brought by Craig of the difficulties placed in the progress of astronomy by the labour of the calculations may have stimulated him to persevere in his efforts.

The "new invention in Denmark" to which Anthony Wood refers as having given the hint to Napier was probably the method of calculation called prosthaphæresis (often written in Greek letters προσθαφαίρεσις), which had its origin in the solution of spherical triangles.[2] The method consists in the use of the formula

$$\sin a \sin b = \tfrac{1}{2}\{\cos(a-b) - \cos(a+b)\},$$

by means of which the multiplication of two sines is reduced to the addition or subtraction of two tabular results taken from a table of sines; and, as such products occur in the solution of spherical triangles, the method affords the solution of spherical triangles in certain cases by addition and subtraction only. It seems to be due to Wittich of Breslau, who was assistant for a short time to Tycho Brahe; and it was used by them in their calculations in 1582. Wittich in 1584 made known at Cassel the calculation of one case by this prosthaphæresis; and Justus Byrgius proved it in such a manner that from his proof the extension to the solution of all triangles could be deduced. Clavius generalized the method in his treatise *De Astrolabio* (1593), lib. i. lemma liii. The lemma commences as follows:—

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[1] The title of this work is—*Benjaminis Ursini . . . Cursus Mathematici Practici volumen Primum continens Illustr. & Generosi Dn. Dn. Johannis Neperi Baronis Merchistonij &c. Scoti. Trigonometriam logarithmicam Usibus discentium accommodatam . . . Coloniæ . . CIↃ IↃC XIX.* At the end, Napier's table is reprinted, but to two figures less. As this work was published in 1619, and Vincent's reprint of the *Descriptio* and *Constructio* not till 1620, it forms the earliest publication of logarithms on the Continent.

[2] A careful examination of the history of the method is given by Scheibel in his *Einleitung zur mathematischen Bücherkenntniss*, Stück vii. (Breslau, 1775), pp. 13–20; and there is also an account in Kästner's *Geschichte der Mathematik*, vol. i. (1796), pp. 566–569; in Montucla's *Histoire des Mathématiques*, vol. i. pp. 583–585 and 617–619: and in Klügel's *Wörterbuch* (1808), article "Prosthaphæresis."

> "*Quæstiones omnes, quæ per sinus, tangentes, atque secantes absolvi solent, per solam prosthaphæresim, id est, per solam additionem, subtractionem, sine laboriosa numerorum multiplicatione divisioneque expedire.*
>
> "Edidit ante tres quatuorve annos Nicolaus Raymarus Ursus Dithmarsus libellum quendam, in quo præter alia proponit inventum sane acutum, et ingeniosum, quo per solam prosthaphæresim pleraque triangula sphærica solvit. Sed quoniam id solum putat fieri posse, quando sinus in regula proportionum assumuntur, et sinus totus primum locum obtinet, conabimur nos eam doctrinam magis generalem efficere, ita ut non solum locum habeat in sinibus, et quando sinus totus primum locum in regula proportionum obtinet, verum etiam in tangentibus, secantibus, sinibus versis et aliis numeris, et sive sinus totus sit in principio regulæ proportionum, sive in medio, sive denique nullo modo interveniat: quæ res nova omnino est, ac jucunditatis et voluptatis plena."

The work of Raymarus Ursus, referred to by Clavius, is his *Fundamentum Astronomicum* (1588). Longomontanus, in his *Astronomia Danica* (1622), gives an account of the method, stating that it is not to be found in the writings of the Arabs or Regiomontanus. As Longomontanus is mentioned in Anthony Wood's anecdote, and as Wittich as well as Longomontanus were assistants of Tycho, there seems little room for doubt that Wittich's prosthaphæresis is the method referred to by Wood.

In 1610 Herwart ab Hohenburg published at Munich a multiplication table extending to 1000 × 1000, huge folio volume of more than a thousand pages; and some writers, misled by the title,[1] have supposed that it contained logarithms. It appears from a correspondence between Kepler and Herwart,[2] which took place at the end of 1608, that Herwart used his table when in manuscript for the performance of multiplications in general, and that the occurrence of the word prosthaphæresis on the title is due to Kepler, who pointed out that by means of the table spherical triangles could be solved more easily than by Wittich's prosthaphæresis.

It is evident that Wittich's prosthaphæresis could not be a good method of practically effecting multiplications unless the quantities to be multiplied were sines, on account of the labour of the interpolations. It satisfies the condition, however, equally with logarithms, of enabling multiplication to be performed by the aid of a table of single entry; and, analytically considered, it is not so different in principle from the logarithmic method. In fact, if we put $xy = \phi(X+Y)$, X being a function of x only and Y a function of y only, we can show that we must have $X = Ae^{mx}$, $y = Be^{my}$; and if we put $xy = \phi(X+Y) - \phi(X-Y)$, the solutions are $\phi(X+Y) = \frac{1}{4}(x+y)^2$, and $x = \sin X$, $y = \sin Y$, $\phi(X+Y) = -\frac{1}{2}\cos(X+Y)$. The former solution gives a method known as that of quarter-squares; the latter gives the method of prosthaphæresis.

An account of the logarithmic table of Justus Byrgius is given in the article LOGARITHMS.

The more one considers the condition of science at the time, and the state of the country in which the discovery took place, the more wonderful does the invention of logarithms appear. When algebra had advanced to the point where exponents were introduced, nothing would be more natural than that their utility as a means of performing multiplications and divisions should be remarked; but it is one of the surprises in the history of science that logarithms were invented as an arithmetical improvement years before their connexion with exponents was known. It is to be noticed also that the invention was not the result of any happy accident. Napier deliberately set himself to abbreviate multiplications and divisions,—operations of so fundamental a character that it might well have been thought that they were *in rerum natura* incapable of abbreviation; and he succeeded in devising, by the help of arithmetic and geometry alone, the one great simplification of which they were susceptible,—a simplification to which the following two hundred and seventy years have added nothing.

When Napier published the *Canon Mirificus* England had taken no part in the advance of science, and there is no British author of the time except Napier whose name can be placed in the same rank as those of Copernicus, Tycho Brahe, Kepler, Galileo, or Stevinus. In England, Robert Recorde had indeed published his mathematical treatises, but they were of trifling importance and without influence on the history of science. Scotland had produced nothing, and was perhaps the last country in Europe from which a great mathematical discovery would have been expected. Napier lived, too, not only in a wild country, which was in a lawless and unsettled state during most of his life, but also in a credulous and superstitious age. Like Kepler and all his contemporaries he believed in astrology, and he certainly also had some faith in the power of magic, for there is extant a deed written in his own handwriting containing a contract between himself and Robert Logan of Restalrig, a turbulent baron of desperate character, by which Napier undertakes "to serche and sik out, and be al craft and ingyne that he dow, to tempt, trye, and find out" some buried treasure supposed to be hidden in Logan's fortress at Fastcastle, in consideration of receiving one-third part of the treasure found by his aid. In the deed Logan also agrees to conduct Napier from Edinburgh to Fastcastle and back again, without his being despoiled of his third part or otherwise harmed, when the deed is to be cancelled and destroyed as a discharge in full. "And incaiss the said Jhone sal find na poiss to be thair eftir all tryall and utter diligens tane; he referris the satisfactione of his trawell and painis to the discretione of the said Robert." Of this singular contract, which is signed "Robert Logano of Restalrige" and "Jhone Neper, Fear of Merchiston," and is dated July 1594, a facsimile is given in Mr Mark Napier's *Memoirs*.[3] As the deed was not destroyed, but is in existence now, it is to be presumed that the terms of it were not fulfilled; but the fact that such a contract should have been drawn up by Napier himself affords a singular illustration of the state of society and the kind of events in the midst of which logarithms had their birth. Considering the time in which he lived, Napier is singularly free from superstition: his *Plaine Discovery* relates to a method of interpretation which belongs to a later age; he shows no trace of the extravagances which occur everywhere in the works of Kepler; and none of his writings contain any allusion to astrology or magic.

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[1] *Tabulæ arithmeticæ προσθαφαιρεσεως universales, quarum subsidio numerus quilibet, ex multiplicatione producendus, per solam additionem; et quotiens quilibet, e divisione eliciendus, per solam subtractionem, sine tædiosâ & lubricâ Multiplicationis, atque Divisionis operatione, etiam ab eo, qui Arithmetices non admodum sit gnarus, exacte, celeriter & nullo negotio invenitur.*

[2] The correspondence is printed in Frisch's edition of Kepler's works, vol. iv. pp. 527–530. See also a paper "On Multiplication by a Table of Single Entry," in the *Philosophical Magazine* for November 1878.

[3] Of the contract itself Mr Mark Napier writes: "The singularity of his holding conference with one who had just been proclaimed an outlaw, and whose lawless violence is alluded to and provided against by Napier himself, must be accounted for by the rude state of society, and the simplicity of our philosopher's character. He took care to word the contract itself, however, and there is not an expression which indicates an idea beyond the most legitimate purpose; but, under the shield of his own innocence, he never dreamed of contamination from his company, was fond of the romance of science, and not averse (nothing derogatory in his times) to the prospect of gold."—*Memoirs*, p. 223.

After Napier's death his manuscripts and notes came into the possession, not of his eldest son Archibald, but of his second son by his second marriage, Robert, who edited the *Constructio*; and Colonel Milliken Napier, Robert's lineal male representative, was still in the possession of many of these private papers at the close of the last century. On one occasion when Colonel Napier was called from home on foreign service, these papers, together with a portrait of John Napier and a Bible with his autograph, were deposited for safety in a room of the house at Milliken, in Renfrewshire. During the owner's absence the house was burned to the ground, and all the papers and relics were destroyed. The manuscripts had not been arranged or examined, so that the extent of the loss is unknown. Fortunately, however, Robert Napier had transcribed his father's manuscript *De Arte Logistica*, and the copy escaped the fate of the originals in the manner explained in the following note, written in the volume containing them by Francis, seventh Lord Napier:—"John Napier of Merchiston, inventor of the logarithms, left his manuscripts to his son Robert, who appears to have caused the following pages to have been written out fair from his father's notes, for Mr Briggs, professor of geometry at Oxford. They were given to Francis, the fifth Lord Napier, by William Napier of Culcreugh, Esq., heir-male of the above-named Robert Finding them in a neglected state, amongst my family papers, I have bound them together, in order to preserve them entire.—NAPIER, 7th March 1801."

An account of the contents of these manuscripts was given by Mr Mark Napier in the appendix to his *Memoirs of John Napier*, and the manuscripts themselves were edited in their entirety by him in 1839 under the title *De Arte Logistica Joannis Naperi Merchistonii Baronis Libri qui supersunt. Impressum Edinburgi* M.DCCC.XXX.IX., as one of the publications of the Bannatyne Club. The treatise occupies one hundred and sixty-two pages, and there is an introduction by Mr Mark Napier of ninety-four pages. The *Arithmetic* consists of three books, entitled—(1) De Computationibus Quantitatum omnibus Logisticæ speciebus communium; (2) De Logistica Arithmetica; (3) De Logistica Geometrica. At the end of this book occurs the note—"I could find no more of this geometricall pairt amongst all his fragments." The *Algebra Joannis Naperi Merchistonii Baronis* consists of two books:—(1) "De nominata Algebræ parte; (2) De positiva sive cossica Algebræ parte," and concludes with the words, "There is no more of his algebra orderlie sett doun." The transcripts are entirely in the handwriting of Robert Napier himself, and the two notes that have been quoted prove that they were made from Napier's own papers. The title, which is written on the first leaf, and is also in Robert Napier's writing, runs thus:—"The Baron of Merchiston his booke of Arithmeticke and Algebra. For Mr Henrie Briggs, Professor of Geometrie at Oxforde."

These treatises were probably composed before Napier had invented the logarithms or any of the apparatuses described in the *Rabdologia*; for they contain no allusion to the principle of logarithms, even where we should expect to find such a reference, and the one solitary sentence where the *Rabdologia* is mentioned ("sive omnium facillime per ossa Rhabdologiæ nostræ") was no doubt added afterwards. It is worth while to notice that this reference occurs in a chapter "De Multiplicationis et Partitionis compendiis miscellaneis," which, supposing the treatise to have been written in Napier's younger days, may have been his earliest production on a subject over which his subsequent labours were to exert so enormous an influence.

Napier uses *abundantes* and *defectivæ* for positive and negative, defining them as meaning greater or less than nothing ("Abundantes sunt quantitates majores nihilo: defectivæ sunt quantitates minores nihilo"). The same definitions occur also in the *Canon Mirificus* (1614), p. 5:—"Logarithmos sinuum, qui semper majores nihilo sunt, abundantes vocamus, et hoc signo +, aut nullo prænotamus. Logarithmos autem minores nihilo defectivos vocamus, prænotantes eis hoc signum −." Napier may thus have been the first to use the expression "quantity *less than nothing*." He uses "radicatum" for power; for root, power, exponent, his words are radix, radicatum, index.

Apart from the interest attaching to these manuscripts as the work of Napier, they possess an independent value as affording evidence of the exact state of his algebraical knowledge at the time when logarithms were invented. There is nothing to show whether the transcripts were sent to Briggs as intended and returned by him, or whether they were not sent to him. Among the Merchiston papers is a thin quarto volume in Robert Napier's writing containing a digest of the principles of alchemy; it is addressed to his son, and on the first leaf there are directions that it is to remain in his charter-chest and be kept secret except from a few. This treatise and the transcripts seem to be the only manuscripts which have escaped destruction.

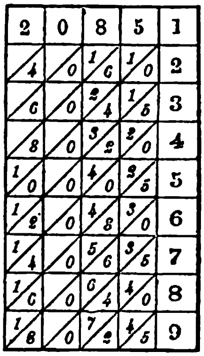


Fig. 1.

The principle of "Napier's bones" may be easily explained by imagining ten rectangular slips of cardboard, each divided into nine squares. In the top squares of the slips the ten digits are written, and each slip contains in its nine squares the first nine multiples of the digit which appears in the top square. With the exception of the top squares, every square is divided into two parts by a diagonal, the units being written on one side and the tens on the other, so that when a multiple consists of two figures they are separated by the diagonal. Fig. 1 shows the slips corresponding to the numbers 2, 0, 8, 5 placed side by side in contact with one another, and next to them is placed another slip containing, in squares without diagonals, the first nine digits. The slips thus placed in contact give the multiples of the number 2085, the digits in each parallelogram being added together; for example, corresponding to the number 6 on the right hand slip, we have 0, 8+3, 0+4, 2, 1; whence we find 0, 1, 5, 2, 1 as the digits, written backwards, of 6 × 2085. The use of the slips for the purpose of multiplication is now evident; thus to multiply 2085 by 736 we take out in this manner the multiples corresponding to 6, 3, 7, and set down the digits as they are obtained, from right to left, shifting them back one place and adding up the columns as in ordinary multiplication, viz., the figures as written down are—

$$\begin{array}{r} 12510 \\ 6255 \\ 14595 \\ \hline 1534560 \end{array}$$

Napier's rods or bones consist of ten oblong pieces of wood or other material with square ends. Each of the four faces of each rod contains multiples of one of the nine digits, and is similar to one of the slips just described, the first rod containing the multiples of 0, 1, 9, 8, the second of 0, 2, 9, 7, the third of 0, 3, 9, 6, the fourth of 0, 4, 9, 5, the fifth of 1, 2, 8, 7, the sixth of 1, 3, 8, 6, the seventh of 1, 4, 8, 5, the eighth of 2, 3, 7, 6, the ninth of 2, 4, 7, 5, and the tenth of 3, 4, 6, 5. Each rod therefore contains on two of its faces multiples of digits which are complementary to those on the other two faces; and the multiples of a digit and of its complement are reversed in position. The arrangement of the numbers on the rods will be evident from fig. 2, which represents the four faces of the fifth bar. The set of ten rods is thus equivalent to four sets of slips as described above, and by their means we may multiply every number less than 11,111, and also any number (consisting of course of not more than ten digits) which can be formed by the top digits of the bars when placed side by side. Of course two sets of rods may be used, and by their means we may multiply every number less than 111,111,111, and so on. It will be noticed that the rods only give the multiples of the number which is to be multiplied, or of the divisor, when they are used for division, and it is evident that they would be of little use to any one who knew the multiplication table as far as 9 × 9. In multiplications or divisions of any length it is generally convenient to begin by forming a table of the first nine multiples of the multiplicand or divisor, and Napier's bones at best merely provide such a table, and in an incomplete form, for the additions of the two figures in the same parallelogram have to be performed each time the rods are used. The *Rabdologia* attracted more general attention than the logarithms, and there were several editions on the Continent. An Italian translation was published by Locatello at Verona in 1623, and a Dutch translation by De Decker at Gouda in 1626. Ursinus published his *Rhabdologia Neperiana* at Berlin in 1623, and the *Rabdologia* itself was reprinted at Lyons in 1626. Nothing shows more clearly the rude state of arithmetical knowledge at the beginning of the 17th century than the universal satisfaction with which Napier's invention was welcomed by all classes and regarded as a real aid to calculation.

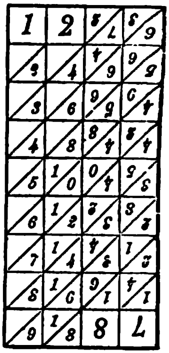


Fig. 2.

Napier also describes in the *Rabdologia* two other larger rods to facilitate the extraction of square and cube roots. In the *Rabdologia* the rods are called "virgulæ," but in the passage quoted above from the manuscript on arithmetic they are referred to as "bones" (ossa).

Besides the logarithms and the calculating rods or bones, Napier's name is attached to certain rules and formulæ in spherical trigonometry. "Napier's rules of circular parts," which include the complete system of formulæ for the solution of right-angled triangles, may be enunciated as follows. Leaving the right angle out of consideration, the sides including the right angle, the complement of the hypotenuse, and the complements of the other angles are called the circular parts of the triangle. Thus there are five circular parts, a, b, $90°-A$, $90°-c$, $90°-B$, and these are supposed to be arranged in this order (*i.e.*, the order in which they occur in the triangle) round a circle. Selecting any part and calling it the middle part, the two parts next it are called the adjacent parts, and the remaining two parts the opposite parts. The rules then are—

sine of the middle part = product of tangents of adjacent parts
= product of cosines of opposite parts.

These rules were published in the *Canon Mirificus* (1614), and Napier has there given a figure, and indicated a method, by means of which they may be proved directly. The rules are curious and interesting, but of very doubtful utility, as the formulæ are best remembered by the practical calculator in their unconnected form.

"Napier's analogies" are the four formulæ—

$$\tan\tfrac{1}{2}(A+B)=\frac{\cos\frac{1}{2}(a-b)}{\cos\frac{1}{2}(a+b)}\cot\tfrac{1}{2}C\,,$$

$$\tan\tfrac{1}{2}(A-B)=\frac{\sin\frac{1}{2}(a-b)}{\sin\frac{1}{2}(a+b)}\cot\tfrac{1}{2}C\,;$$

$$\tan\tfrac{1}{2}(a+b)=\frac{\cos\frac{1}{2}(A-B)}{\cos\frac{1}{2}(A+B)}\tan\tfrac{1}{2}c\,,$$

$$\tan\tfrac{1}{2}(a-b)=\frac{\sin\frac{1}{2}(A-B)}{\sin\frac{1}{2}(A+B)}\tan\tfrac{1}{2}c\,.$$

They were first published after his death in the *Constructio* among the formulæ in spherical trigonometry, which were the results of his latest work. Robert Napier says that these results would have been reduced to order and demonstrated consecutively but for his father's death. Only one of the four analogies is actually given by Napier, the other three being added by Briggs in the remarks which are appended to Napier's results. The work left by Napier is, however, rough and unfinished, and it is uncertain whether he knew of the other formulæ or not. They are, however, so simply deducible from the results he has given that all the four analogies may be properly called by his name. An analysis of the formulæ contained in the *Descriptio* and *Constructio* is given by Delambre in vol. i. of his *Histoire de l'Astronomie moderne.*

To Napier seems to be due the first use of the decimal point in arithmetic. Decimal fractions were first introduced by Stevinus in his tract *La Disme*, published in 1585, but he used cumbrous exponents (numbers enclosed in circles) to distinguish the different denominations, primes, seconds, thirds, &c. Thus, for example, he would have written 123·456 as 123⓪4①5②6③. In the *Rabdologia* Napier gives an "Admonitio pro Decimali Arithmetica," in which he commends the fractions of Stevinus and gives an example of their use, the division of 861094 by 432. The quotient is written 1993,273 in the work, and 1993,2′7″3‴ in the text. This single instance of the use of the decimal point in the midst of an arithmetical process, if it stood alone, would not suffice to establish a claim for its introduction, as the real introducer of the decimal point is the person who first saw that a point or line as separator was all that was required to distinguish between the integers and fractions, and used it as a permanent notation and not merely in the course of performing an arithmetical operation. The decimal point is, however, used systematically in the *Constructio* (1619), there being perhaps two hundred decimal points altogether in the book.

The decimal point is defined on p. 6 of the *Constructio* in the words :—"In numeris periodo sic in se distinctis, quicquid post periodum notatur fractio est, cujus denominator est unitas cum tot cyphris post se, quot sunt figuræ post periodum. Ut 10000000·04 valet idem, quod $10000000\frac{4}{100}$. Item 25·803, idem quod $25\frac{803}{1000}$. Item 9999998·0005021, idem valet quod $9999998\frac{5021}{10000000}$, & sic de cæteris." On p. 8, 10·502 is multiplied by 3·216, and the result found to be 33·774432; and on pp. 23 and 24 occur decimals not attached to integers, viz., ·4999712 and ·0004950. These examples show that Napier was in possession of all the conventions and attributes that enable the decimal point to complete so symmetrically our system of notation, viz., (1) he saw that a point or separatrix was quite enough to separate integers from decimals, and that no signs to indicate primes, seconds, &c., were required ; (2) he used ciphers after the decimal point and preceding the first significant figure ; and (3) he had no objection to a decimal standing by itself without any integer. Napier thus had complete command over decimal fractions, and understood perfectly the nature of the decimal point. Briggs also used decimals, but in a form not quite so convenient as Napier. Thus he prints 63·0957379 as $63\underline{0957379}$, viz., he prints a bar under the decimals ; this notation first appears without any explanation in his "Lucubrationes" appended to the *Constructio*. Briggs used the notation all his life, but in writing it, as appears from manuscripts of his, he added also a small vertical line just high enough to fix distinctly which two figures it was intended to separate : thus he might have written $63|\underline{0957379}$. The vertical line was printed by Oughtred and some of Briggs's successors. It was a long time before decimal arithmetic came into general use, and all through the 17th century exponential marks were in common use. There seems but little doubt that Napier was the first to make use of a decimal separator, and it is curious that the separator which he used, the point, should be that which has been ultimately adopted, and after a long period of partial disuse.

The hereditary office of king's poulterer (Pultrie Regis) was for many generations in the family of Merchiston, and descended to John Napier. The office, Mr Mark Napier states, is repeatedly mentioned in the family charters as appertaining to the "pultre landis" near the village of Dene in the shire of Linlithgow. The duties were to be performed by the possessor or his deputy ; and the king was entitled to demand the yearly homage of a present of poultry from the feudal holder. The pultrelands and the office were sold by John Napier in 1610 for 1700 marks. It has been erroneously asserted that Napier dissipated his means ; there is no truth in this statement. With the sole exception of the pultrelands all the estates he inherited descended undiminished to his posterity.

With regard to the spelling of the name, Mr Mark Napier states that among the family papers there exist a great many documents signed by John Napier. His usual signature was "Jhone Neper," but in a letter written in 1608, and in all deeds signed after that date, he wrote "Jhone Nepair." His letter to the king prefixed to the *Plaine Discovery* is signed "John Napeir." His own children, who sign deeds along with him, use every mode except Napier, the form now adopted by the family, and which is comparatively modern. In Latin he always wrote his name "Neperus." The form "Neper" is the oldest, as John, third Napier of Merchiston, so spelt it in the 15th century.

Napier frequently signed his name "Jhone Neper, Fear of Merchiston." He was "Fear of Merchiston" because, *more majorum*, he had been invested with the fee of his paternal barony during the lifetime of his father, who retained the liferent. He has been sometimes erroneously called "Peer of Merchiston," and in the 1645 edition of the *Plaine Discovery* he is so styled, probably by a misprint (see Mr Mark Napier's *Memoirs*, pp. 9 and 173, and *Libri qui supersunt*, p. xciv).

Napier's home at Merchiston is thus described by Sir Walter Scott in his *Provincial Antiquities of Scotland* :—"This fortalice is situated upon the ascent, and nearly upon the summit of the eminence called the Borough-moor-head, within a mile and a half of the city walls. In form it is a square tower of the 14th or 15th century, with a projection on one side. The top is battlemented, and within the battlements, by a fashion more common in Scotland than in England, arises a small building with a steep roof, like a stone cottage erected on the top of the tower. . . The celebrated John Napier of Merchiston was born in this weather-beaten tower ; and a small room in the summit is pointed out as the study in which he secluded himself while engaged in the mathematical researches which led to his great discovery. The battlements of Merchiston tower command an extensive view of great interest and beauty." There is a view of Merchiston tower in Mr Mark Napier's *Memoirs of John Napier*, and in the *Libri qui supersunt*.

One well-known character of the time, Dr Richard Napier, was cousin to John Napier. The eldest son of Alexander, sixth Napier of Merchiston, was Archibald, the father of John Napier ; his second son, named Alexander, settled at Exeter, and married an English lady by whom he had two sons, the eldest of whom, Robert, was the merchant, mentioned in the note near the beginning of this article as having been created a baronet. The second son was a fellow of Exeter College, Oxford, and became rector of Lynford, Buckinghamshire. He was a friend and pupil of Dr Simon Forman, a well-known Rosicrucian adept of the time, and at his death became the possessor of his secret manuscripts. Dr Richard Napier, who was more of a physician than a divine, was a great pretender to astrology, necromancy, and magical cures. There is a portrait of him in the Ashmolean Museum, Oxford (engraved in Mr Mark Napier's *Memoirs*), which is interesting on account of the similarity of some of the features to those of John Napier. It does not appear that there was ever any friendship or correspondence between John Napier and Richard Napier.

In 1787 *An Account of the Life, Writings, and Inventions of John Napier of Merchiston* was published at Perth by David Stewart, earl of Buchan, and Walter Minto, LL.D. It is a quarto work of one hundred and thirty-four pages, only twelve of which relate to the life of Napier, the rest being devoted to a careful explanation of the contents of his works. The particulars given of Napier's life are very scanty, but, such as they are, they form the source from which nearly all the notices of Napier which have appeared since have been drawn. The work has also given rise to the impression that there was but little chance of further information being obtained with respect to Napier's life. In 1834 Mr Mark Napier published his *Memoirs of John Napier of Merchiston, his Life, Lineage, and Times, with a History of the Invention of Logarithms*, a large quarto volume of five hundred and thirty-four pages. Mr Mark Napier, who had already devoted great attention to the history of Scotland with special reference to the families of Lennox and Napier, had full access to all the charters and papers in the possession of the family, and he spared no pains in examining every document and investigating every point which seemed likely to throw light upon the life of Napier and the circumstances amidst which his life was passed. The work contains a vast mass of general information relating to Napier and his relatives, and the people with whom he was brought into contact, besides much collateral matter which serves to illustrate the state of the country at the time. The facts relating to Napier's own life are so interwoven with the other contents of the volume, and the work is so large, that in the absence of an index it is very difficult to extract the comparatively small portion that relates to Napier himself. From this work, which is the sole authority upon the private events of Napier's life, all the facts given in this article with respect to his descent and personal history have been derived. In 1839 Mr Mark Napier completed his labours by editing Napier's unpublished manuscripts, of which he had only been able to give a résumé in the *Memoirs*, and to this he prefixed an introduction, the greater part of which, however, is included in the *Memoirs*. Three different portraits of Napier are known to be in existence; one was engraved as the frontispiece to the earl of Buchan's *Account*, and another forms the frontispiece to the *Memoirs*. There is also an engraving of Napier in Lilly's *Life and Times* (1823). For an account of the contents of Napier's mathematical works and their place in the history of science, the reader is referred to Delambre's *Histoire de l'Astronomie moderne*.

It may be useful to give, in conclusion, a list of Napier's works with a brief statement of the contents of each. The works published in his lifetime are—(1) *The Plaine Discovery* (1593), containing an interpretation of the Book of Revelation; (2) the *Canonis Mirifici Logarithmorum Descriptio*, containing the first announcement of the invention of logarithms and a table of log sines, also the rules of circular parts; (3) the *Rabdologia* (1617), containing the description of Napier's bones, the promptuary, and the method of local arithmetic,—all three designed for the simplification of multiplications and divisions. The posthumous works are—(1) the *Canonis Mirifici Logarithmorum Constructio* (1619), edited by his son Robert, containing an account of the mode of construction of the canon, and Napier's analogies; this book is the first in which the decimal point was systematically employed; (2) the treatise *De Arte Logistica*, edited by Mr Mark Napier in 1839, containing treatises on arithmetic and algebra, transcribed from Napier's notes by his son Robert. (J. W. L. G.)

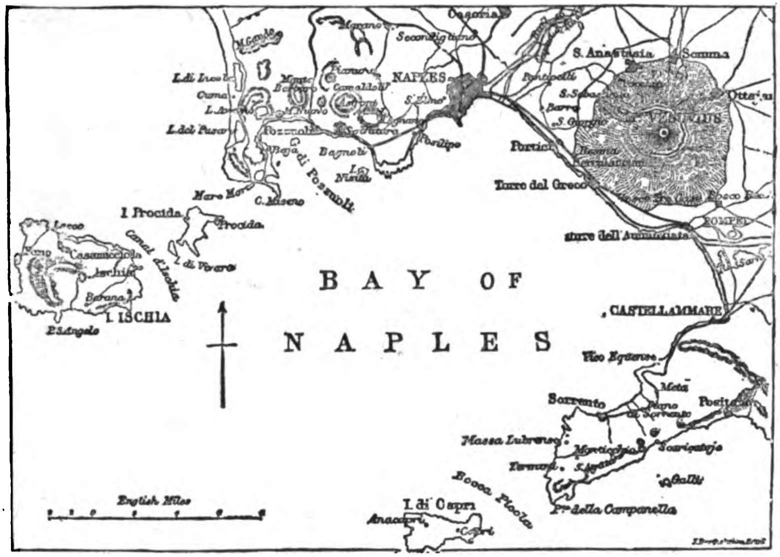
NAPIER, Sir William Francis Patrick (1785–1860), the third son of Colonel and Lady Sarah Napier, and brother of Sir Charles and Sir George Napier, was born at Cellbridge, near Dublin, on the 17th of December 1785. He became an ensign in the Royal Irish Artillery in 1800, but at once exchanged into the 62d, and was put on half-pay in 1802. He was afterwards made a cornet in the Blues by his uncle the duke of Richmond, and exchanged into the 52d regiment. He obtained a company in a West India regiment, but exchanged again into the 43d when it was being trained at Shorncliffe under Sir John Moore, who took Napier into special favour, and won his everlasting gratitude. He served in Denmark, and was present at the engagement of Kioge, and, his regiment being shortly afterwards sent to Spain, he bore himself nobly through the retreat to Corunna. In 1809 he became aide-de-camp to his uncle in Ireland, but joined the 43d when ordered again to Spain. With the light brigade (the 43d, 52d, and 95th), under the command of General Craufurd, he marched to Talavera in the famous forced march which he has described in his *History*, and had a violent attack of pleurisy on the way. He, however, refused to leave Spain, was wounded on the Coa, and shot near the spine at Cazal Nova. His conduct was so conspicuous during the pursuit of Masséna after he left the lines of Torres Vedras that he as well as his brother George was recommended for a brevet majority. He became brigade major, was present at Fuentes d'Onor, but had so bad an attack of ague that he was obliged to return to England. In England he fell in love with and married Caroline Fox, the daughter of General Henry Fox, with whom Moore had been in love in Sicily. Three days after his marriage he again started for Spain, and was present at the storming of Badajoz, where his great friend Colonel M'Leod was killed. In the absence of the new lieutenant-colonel he took command of the 43d regiment, and commanded it at the battle of Salamanca. After a short stay at home he again joined his regiment at the Pyrenees, and did his greatest military service at the battle of the Nivelle, where, with instinctive military insight, he secured the most strongly fortified part of Soult's position, practically without orders. He served with his regiment at the battles of the Nive, Orthes, and Toulouse. For his services he was made brevet lieutenant-colonel, and one of the first C.B.'s. Like his brother Charles he then entered the military college at Farnham. He commanded his regiment in the army of occupation in France until 1819, when he retired on half-pay. As it was impossible for him to live on his half-pay with a wife and family, he determined to become an artist, and took a house in Sloane Street, where he studied with George Jones, the academician. The years he had spent in France he had occupied in improving his general education, for it will hardly be believed that the author of the *History of the War in the Peninsula* could not spell or write respectable English till that time. But his career was to be great in literature, not in art. The tendency appeared in an able review of Jomini in 1821, and in 1823 Mr Bickersteth, afterwards Lord Langdale, suggested to him the expediency of writing a history of the Peninsular War. For some time he did not take kindly to the suggestion, but at last determined to become an author in order to defend the memory of Sir John Moore, and to prevent the glory of his old chief being overshadowed by that of Wellington. The duke of Wellington himself gave him much assistance, and handed over to him the whole of Joseph Bonaparte's correspondence which had been taken at the battle of Vittoria; this was all in cipher, but Mrs Napier, with great patience, discovered the keys. In 1828 the first volume of the *History* appeared, and it was at once seen that the great deeds of the Peninsular War were about to be fitly commemorated. The excitement which followed the publication of each volume is proved by the innumerable pamphlets issued by those who believed themselves to be attacked, and by personal altercations with many distinguished officers. But the success of the book was proved still more by the absence of competition than by these bitter controversies. The histories of Southey and Lord Londonderry fell still-born, and Sir George Murray, who had determined to produce *the* history, gave up the attempt in despair. This success was due to a combination of qualities which have justly secured for Napier the title of being the best military historian England has produced. The best military histories have always been written by eye-witnesses. It is impossible for a new generation to analyse the military combinations and understand the minute facts which account for the winning or losing of a battle, though it may often unravel political intrigues which were veiled to the eyes of contemporaries. Napier added to this qualification a wonderful insight into the nature of war, and was able to describe and understand the movements and feelings of the French as well as of the army in which he himself served. But neither contemporary knowledge nor military ability could have made his *History* memorable without a peculiarly appropriate literary style. He knew well how to mingle passages relating to individuals with descriptions of military movements, and how to relieve the dryness of details by an occasional glance at more extended subjects. He possessed an enthusiastic admiration for nearly all the heroes whose deeds he touched on. His admiration for Napoleon was only second to that for Moore, and he could feel for Soult in defeat as well as for Wellington in the hour of victory. When in 1840 the last volume of the *History* was published, his fame not only in England but in France and Germany was safely established. His life during these years had been chiefly absorbed in his *History*, but he had warmly sympathized with the movement for political reform which was agitating England. The Radicals of Bath pressed him to sit for their city, and it was commonly reported that if the reformers had found it necessary to resort to force Colonel Napier would have been their commander-in-chief. In 1842 he was promoted major-general, and had given him the lieutenant-governorship of Guernsey. Here he found plenty of occupation in controlling the relations between the soldiers and the inhabitants, and also found time to propound a complete scheme of reform for the government of the island. While he was at Guernsey his brother Charles had conquered Sind, and the attacks made on the policy of that conquest brought William Napier again into the field of literature. In 1845 he published his *History of the Conquest of Scinde*, and in 1851 the corresponding *History of the Administration of Scinde*—books which in style and vigour rivalled the great *History*, but which, being written for controversial purposes, are not likely to maintain such an enduring popularity. In 1847 he resigned his governorship, and in 1848 was made a K.C.B., and settled at Scinde House, Clapham Park. His time was fully occupied in defending his brother, in revising the numerous editions of his *History* which were being called for, and in writing letters to the *Times* on every conceivable subject, whether military or literary. His energy is the more astonishing when it is remembered that he never recovered from the effects of the wound he had received at Cazal Nova, and that he often had to lie on his back for months together. His domestic life was shadowed by the incurable affliction of his only son, and when his brother Charles died in 1853 the world seemed to be darkening round him. He devoted himself to writing the life of that brother, which appeared in 1857, and which is in many respects his most characteristic book. In the end of 1853 his younger brother, Captain Henry Napier, R.N., the historian of Florence, died, and in 1855 his brother Sir George. Inspired by his work, he lived on till the year 1860, when, broken by trouble, fatigue, and ill-health, he died (on February 12) at Clapham.

As a military historian Sir William Napier is incomparably superior to any other English writer, and his true compeers are Thucydides, Cæsar, and Davila. All four had been soldiers in the wars they describe; all four possessed a peculiar insight into the mainsprings of action both in war and peace; and all four possessed a peculiar and inimitable style. Napier always wrote as if he was burning with an inextinguishable desire to express what he was feeling, which gives his style a peculiar spontaneity, and yet he rewrote the first volume of his *History* no less than six times. His descriptions of sieges and of battles are admirable by themselves, and his analyses of the peculiarly intricate Spanish intrigues are even more remarkable, while the descriptions and analyses are both lit up with flashes of political wisdom and military insight. It is to be noted that he displays the spirit of the partisan, even when most impartial, and defends his opinions, even when most undoubtedly true, as if he were arguing some controverted question. If his style was modelled on anything, it was on Cæsar's commentaries, and a thorough knowledge of the writings of the Roman general will often explain allusions in Napier. The portraits of Sir John Moore and Colonel M'Leod, and the last paragraphs descriptive of the storming of Badajoz, may be taken as examples of the great natural eloquence which arose from the loving recollection of friends, or the deep impression made by a most terrible scene upon his vivid imagination.

For Sir William Napier's life, see his *Life and Letters*, edited by the Right Honourable H. A. Bruce (now Lord Aberdare), 2 vols., 1862. The dates of his books are given above. The edition of the *History* published in 1851 is the best, and contains the answers to various criticisms which sum up the controversies arising from statements in the work. The French translation is by Count Mathieu Dumas. (H. M. S.)

NAPLES (Ital. *Napoli*, Gr. and Lat. *Neapolis*), formerly the capital of the kingdom of the Two Sicilies, and since 1860 the chief town of a province in the kingdom of Italy, is the largest and most populous city in the country, and disputes with Constantinople the claim of occupying the most beautiful site in Europe. It is situated on the northern shore of the Bay of Naples (*Sinus Cumanus*), in 40° 52′ N. lat. and 14° 15′ 45″ E. long., as taken from the lighthouse on the mole. By rail it is distant 161 miles from Rome.

No other place in the world combines within the same compass so much natural beauty with so many objects of interest to the antiquary, the historian, and the geologist as the Bay of Naples. Its circuit is about 35 miles from the Capo di Miseno on the north-west to the Punta della Campanella on the south-east, or more than 52 miles if the islands of Ischia, at the north-west, and of Capri, at the south entrance, be included. At its opening between these two islands it is 14 miles broad; and from the opening to its head at Portici the distance is 15 miles. It affords good anchorage, with nearly 7 fathoms water, and is well sheltered, except from winds which blow from points between south-east and south-west. There is a perceptible tide of nearly 9 inches.

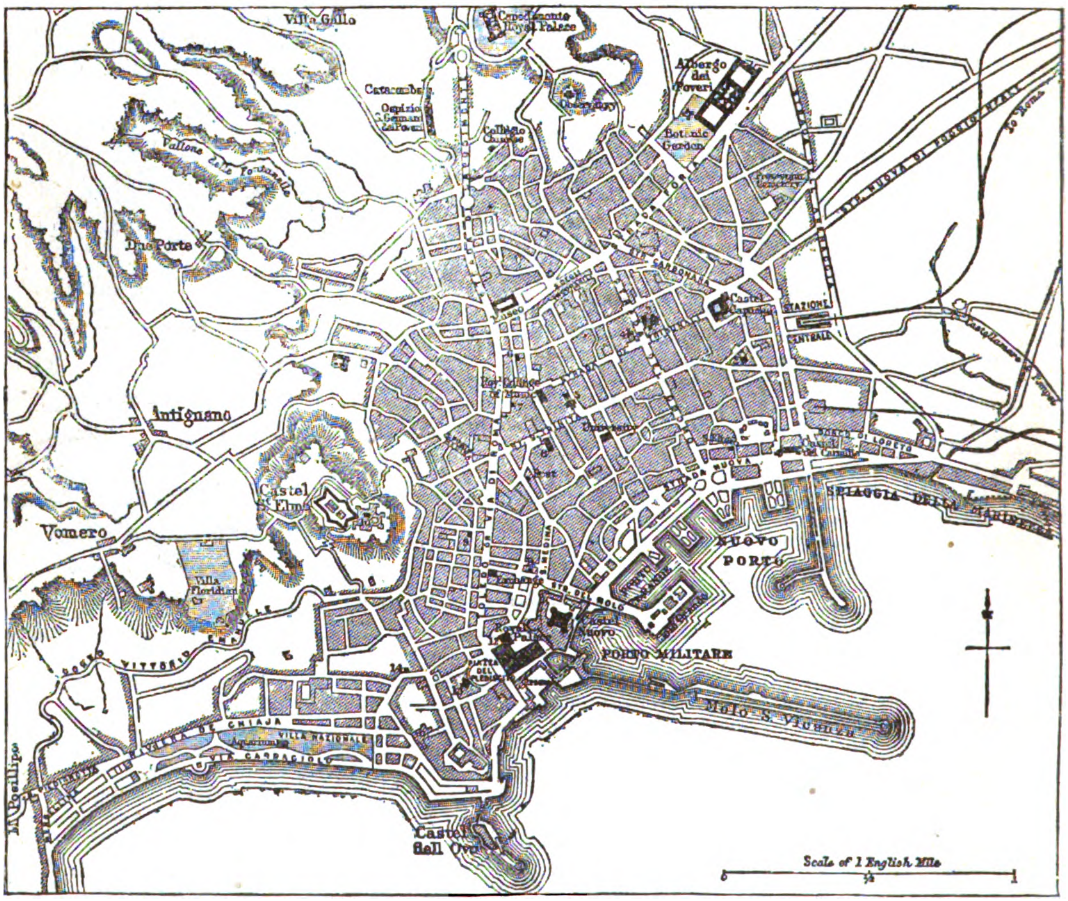


Environs of Naples.

On the north-east shore of the bay, east of Naples, is an extensive flat, forming part of the ancient *Campania Felix*, and watered by the small stream Sebeto and by the Sarno, which formerly flowed by Pompeii. From this flat, between the sea and the range of the Apennines, rises Vesuvius, at the base of which, on or near the sea-shore, are the town-like villages of San Giovanni Teduccio, Portici, Resina, Torre del Greco, Torre dell' Annunziata, &c., and the classic sites of Herculaneum and Pompeii. At the south-east extremity of the plain, 3 miles beyond the outlet of the Sarno, a great offshoot of the Apennines, branching from the main range near Cava, and projecting as a peninsula more than 12 miles west, divides the Bay of Naples from the Bay of Salerno (*Sinus Pæstanus*), and ends in the bold promontory of the Punta della Campanella (*Promontorium Minervæ*), which is separated by a strait of 4 miles from Capri. On the north slope of this peninsula, where the plain ends and the coast abruptly bends to the west, stands the town of Castellammare, near the site of *Stabiæ*, at the foot of Monte Sant' Angelo, which rises suddenly from the sea to a height of 4722 feet. Farther west, and nearly opposite to Naples across the bay, are Vico, Meta, Sorrento, Massa, and many villages.

The north-west shore of the bay, to the west of Naples, is more broken and irregular. The promontory of Posillipo, which projects due south, divides this part of the bay into two smaller bays—the eastern, with the city of Naples, and the western, or Bay of Baiæ, which is sheltered from all winds. A tunnel through the promontory, 2244 feet long, 21 feet broad, and in some places as much as 70 feet high, possibly constructed by Marcus Agrippa in 27 B.C., forms the so-called grotto of Posillipo; at the Naples end stands the reputed tomb of Virgil. Beyond Posillipo is the small island of Nisida (*Nesis*); and at a short distance inland are the extinct craters of Solfatara and Astroni, and the Lake of Agnano. Farther west, on a tongue of land, stands Pozzuoli (*Puteoli*); and beyond it, round the Bay of Baiæ, are Monte Nuovo, a hill thrown up in a single night in September 1538; the classic site of Baiæ; the Lucrine Lake; Lake Avernus; the Lake of Fusaro (*Acherusia Palus*); the Elysian Fields; and the port and promontory of Misenum. Still farther to the south-west lie the islands of Procida (*Prochyta*) and Ischia [1] (*Pithecusa*, *Ænaria*, or *Inarime*), which divide the Bay of Naples from the extensive Bay of Gaeta.

The city of Naples is built at the base and on the slopes of a range of volcanic hills, and, rising from the shore like an amphitheatre, is seen to best advantage from the water. From the summit occupied by the castle of St Elmo a transverse ridge runs south to form the promontory of Pizzofalcone, and divides the city into two natural crescents. The western crescent, known as the Chiaja ward, though merely a long and narrow strip between the sea and Vomero hill, is the fashionable quarter most affected by foreign residents and visitors. A fine broad street, the Riviera di Chiaja, commenced in the close of the 16th century by Count d'Olivares, and completed by the Duke de Medina Celi (1695–1700), runs for a mile and a half from east to west, ending in the quarter of Mergellina and Piedigrotta at the foot of the hill of Posillipo. In front lie the Villa Nazionale (Reale) public gardens, the chief promenade of the city, which were first laid out in 1780, and have been successively extended in 1807, in 1834, and under the new régime; and the whole edge of the bay from the Castel dell' Ovo to Posillipo is lined by a massive embankment and carriage-way, the Via Caracciolo, constructed in 1875–81. The eastern crescent includes by far the largest as well as the oldest portion of Naples—the ports, the arsenal, the principal churches, &c. The main thoroughfare is the Toledo (as it is still popularly called, though the official name is Via di Roma), which runs almost due north from the Piazza (Largo) del Plebiscito in front of the Palazzo Reale, till, as Strada Nuova di Capodimonte,



Plan of Naples.

Churches.
1. S. Maria del Carmine.
2. S. Annunziata.
3. Cathedral and S. Restituta.
4. S. Filippo Neri.
5. S. Domenico Maggiore.
8. S. Chiara.
10. S. Martino.
13. S. Francesco di Paola.

Theatres.
6. Teatro Bellini.
7. Teatro Mercadante.
9. „ Nuovo.
11. „ S. Carlino.
12. Teatro S. Carlo.
14. „ Sannazaro.

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[1] Since the article Ischia (*q.v.*) was written the island has been visited by another severe shock of earthquake (July 28, 1883), which completely ruined Casamicciola, Forio, Lacco Ameno, and Serrara Fontana, and destroyed about 2800 people.

crossing the Ponte della Sanità (constructed by Murat across the valley between Santa Teresa and Capodimonte), it reaches the gates of the Capodimonte palace. A new drive, Corso Vittorio Emmanuele, winds along the slopes behind the city from the Str. di Piedi (at the west end of the Riv. di Chiaja) towards the continuation of the Toledo. The character of the shore of the eastern crescent is being rapidly altered by the new harbour works: about the middle of the curve lies the new Villa del Popolo, or People's Park, constructed on land reclaimed from the bay.

The streets of Naples are generally well-paved with lava or volcanic basalt, which, however, renders them both noisy and slippery for horses. Side-pavements, where they exist, are usually narrow. In the older districts there is a countless variety of narrow gloomy streets, many of them steep. The houses throughout the city are more remarkable for their size and the solidity of their construction than for taste and elegance. They are mostly five or six stories high, are covered with stucco made of a kind of pozzuolana which hardens by exposure, and have large balconies and flat roofs frequently ornamented with flowers, shrubs, and small trees planted in boxes filled with earth. The castle of St Elmo (St Ermo, St Erasmus), which dominates the whole city, had its origin in a fort (Belforte) erected by King Robert the Wise in 1343. The present building, with its rock-hewn fosses and massive ramparts, was constructed by Don Pedro de Toledo at the command of Charles V. in 1535, and was long considered practically impregnable. Damaged by lightning in 1857, it was afterwards restored, but it is no longer used for defensive purposes. On a small island (I. del Salvatore, the *Megaris* of Pliny) now joined to the shore at the foot of the Pizzofalcone by an arch-supported causeway 800 feet long, stands the Castel dell' Ovo (so called from its shape, though mediæval legend associates the name with the enchanted egg on which the magician Virgil made the safety of the city to depend), which, dating from 1154, was for several centuries a place of great strength. The walls of its chapel were frescoed by Giotto; but the whole building was ruined by Ferdinand II. in 1495, and had to be restored in the 16th century. Castel Nuovo, a very picturesque building constructed near the harbour in 1283 by Charles I. of Anjou, contains between the round towers of its façade the triumphal arch erected in 1470 to Alphonso I., and numbers among its chambers the Gothic hall of Giovanni Pisano in which Celestine V. abdicated the papal dignity. Castel del Carmine, founded by Ferdinand I. in 1484, was occupied by the populace in Masaniello's insurrection, was used as a prison for the patriots of 1796, and became municipal property in 1878. The royal palace, begun in 1600 by the Count de Lemos, from designs by Domenico Fontana, partly burned in 1837, and since repaired and enlarged by Ferdinand II., is an enormous building with a sea frontage of 800 feet, and a main façade 554 feet long and 95 feet high, exhibiting the Doric, Ionic, and Composite orders in its three stories. On their visits to Naples, Kings Victor Emmanuel and Humbert have usually preferred the suburban palace of Capodimonte, begun by Charles III. and completed by Ferdinand II. Naples is the see of a Roman Catholic archbishop, always a cardinal. The cathedral has a chapter of thirty canons, and of the numerous religious houses formerly existing thirteen have in whole or in part survived the suppression in 1868. The city is divided into forty-seven parishes (the boundaries of which are administrative and not topographical, so that different stories of the same house are sometimes in different parishes), and there are 257 Roman Catholic churches and 57 chapels. Most of the churches are remarkable rather for richness of internal decoration than for architectural beauty. The cathedral of St Januarius, occupying the site of temples of Apollo and Neptune, and still containing some of their original granite columns, was designed by Nicola Pisano, and erected between 1272 and 1316. Owing to frequent restorations occasioned by earthquakes, it now presents an incongruous mixture of different styles. The general plan is that of a basilica with a nave and two (Gothic vaulted) aisles separated by pilasters. Beneath the high altar is a subterranean chapel containing the tomb of St Januarius (San Gennaro), the patron saint of the city; in the right aisle there is a chapel (Cappella del Tesoro) built between 1608 and 1637 in popular recognition of his having saved Naples in 1527 "from famine, war, plague, and the fire of Vesuvius"; and in a silver tabernacle behind the high altar of this chapel are preserved two phials partially filled with his blood, the periodical liquefaction of which forms a prominent feature in the religious life of the city (see JANUARIUS). Accessible by a door in the left aisle of the cathedral is the church of Sta Restituta, a basilica of the 7th century, and the original cathedral. Santa Chiara (14th century) is interesting for a fresco ascribed to Giotto (at one time there were many more), and monuments to Robert the Wise, his queen Mary of Valois, and his daughter Mary, empress of Constantinople. San Domenico Maggiore, founded by Charles II. in 1285, but completely restored after 1445, has an effective interior particularly rich in Renaissance sculpture. In the neighbouring monastery is shown the cell of Thomas Aquinas. San Filippo Neri or dei Gerolomini, erected in the close of the 16th century, has a white marble façade and two campaniles, and contains the tombstone of Giambattista Vico. Sta Maria del Parto, in the Chiaja, occupies the site of the house of Sannazaro, and is named after his poem *De Partu Virginis*. San Francesco di Paola, opposite the royal palace, is an imitation of the Pantheon at Rome by Pietro Bianchi di Lugano (1815–37), and its dome is one of the boldest in Europe. The church of the Certosa (Carthusian monastery) of San Martino, on the hill below St Elmo's castle, has now become in name, as so many of the churches are in reality, a museum. Dating from the 14th century, and restored by Fonsega in the 17th, it is a building of extraordinary richness of decoration, with paintings and sculpture by Guido Reni, Lanfranco, Caravaggio, D'Arpino, Solimene, Luca Giordano, and notably a Descent from the Cross by Ribera. One of the cloisters by Fonsega is particularly fine. A more ancient Christian monument than any of the convents or churches is the catacombs, which extend a great distance underground. The entrance is at the Ospizio dei Poveri di San Gennaro (see Schulze's monograph, Jena, 1877).

Of all the secular institutions in Naples none is more remarkable than the national museum, better known as the Museo Borbonico. The building, begun in 1586 for cavalry barracks, and remodelled in 1615 for the university, received its present destination in 1790. Enriched by the Farnese collection, by all that was most valuable in Naples, and by everything that would bear removal from Herculaneum, Pompeii, Stabiæ, Puteoli, Pæstum, &c., the museum is unique as a treasure-house of Roman and early Italian antiquities. The collection of Etruscan and Italo-Greek vases is unsurpassed. Nor is the variety of objects greater than the artistic value of some of the items—such as the Farnese Hercules, the Farnese Bull (Amphion and Zethus binding Dirce to its horns), the Dancing Faun (bronze), the statues of the Balbi (marble). For the rich libraries of Naples see vol. xiv. pp. 530, 548. The Club Alpino has a unique collection (25,000 volumes) of Vesuvian and seismographical literature.

The university of Naples is one of the oldest in Italy, having been founded by Frederick II. in the first half of the 13th century. It had fallen to insignificance under the Bourbons, but since 1860 it has rapidly recovered. It comprises five faculties (literature and philosophy, jurisprudence, mathematics, natural science, and medicine), and is well equipped with zoological, mineralogical, and geological museums, a physiological institute, a cabinet of anthropology, botanical gardens, and an observatory on Mount Vesuvius.

The students in 1882–3 numbered 3421. Originally erected in 1557 for the use of the Jesuits, the university buildings are regarded as the best work of Marco di Pino; the quadrangle, surrounded by a simple but effective peristyle, contains statues of Pietro della Vigna (Frederick's chancellor), Thomas Aquinas, Vico, and Giordano Bruno. The famous zoological station at Naples, whose aquarium is the principal building in the Villa Nazionale, is not connected with the university; it was founded in 1872 by Dr Dohrn, and has become one of the greatest centres of biological research in Europe. Its *Mittheilungen* began to be published in 1878, and a great work on the fauna and flora of the Gulf of Naples is in progress. The Royal Society of Naples, dating originally from 1756, was reconstituted in 1861, and now comprises three "academies" or departments, dealing respectively with the physical and mathematical sciences, the moral and political sciences, and literature, archæology, and the fine arts. The famous Accademia Pontaniana, founded in 1471 by Ant. Panormita and J. J. Pontanus, was restored in 1809, and still exists. The royal school of Oriental languages (35 pupils in 1880) owes its existence to Matteo Ripa, who in 1732 established a college for Chinese missionaries with money which he had collected by visiting various European courts in company with ten or twelve young Chinamen. Since 1857 Ludovico da Casoria, relying on public subscriptions, has carried on a special college for the education of Africans (Coll. dei Mori a Capodimonte). The royal college of music, practically founded by Charles III. in 1760, and thus one of the oldest as it is one of the most celebrated institutions of its class, was re-established in 1879. It has a teaching staff of nearly forty persons, takes in boarders (50 Italians gratuitously), and carries on a free day school for males and females. A large and beautiful building in Strada Fuori Porta Medina, erected in a Pompeian style by Francesco del Giudice, accommodates the royal institute for the encouragement of the natural and economical sciences, the royal technical institute (535 pupils), and the nautical institute (46 pupils); and in Str. del Salvatore there is a royal school of engineering with 250 pupils. Four technical schools are maintained by the municipality. The primary education of the people was so much neglected under the Bourbons that after twenty years of a better régime there were still 294,384 persons in Naples who could neither read nor write. That some progress had been made was shown in 1881 by the fact that the number of persons under thirty years of age who could both read and write had increased from 79,224 in 1871 to 101,277. In 1872 there were 14,461 children attending school; in 1879 there were 75,311. The educational expenditure of the commune was £64.972 in 1882 for the education of 30,000 children. About one-fourth of the children attending the infant schools are gratuitously supplied with soup at midday, and the children of the working classes are taught free of charge. Among the various private educational enterprises Mrs Salis Schwabe's Froebel Institute, founded in 1873, the Italian Protestant schools, and the institution established by the Marquis Casanova in 1869 to take charge of boys leaving school and bring them up to some special trade, deserve special mention. There are three schools for the blind—notably Lady Strachan's (1865) and the "Prince of Naples," founded by Martuscelli (1873)—and as many for the deaf and dumb.

Charitable institutions are unusually numerous in Naples. The oldest civil hospital is S. Eligio, dating from 1270; but the largest is the Casa Santa degli Incurabili, founded in 1521 by Francesca Maria Longo. It is open to patients of both sexes and any rank, contains upwards of 1000 beds, and has an annual income of about £32,000. In 1877 an international hospital was established by the foreign residents. The Albergo dei Poveri (poorhouse) occupies a magnificent range of buildings, commenced in 1761 by Charles III. at the suggestion of Padre Rocco. Starting with an income of about £3000, it now disposes yearly of £48,000; and it has successively absorbed various minor institutions such as the Conservatorio of St Francis of Sales (1816) and the deaf-mute school (1818). The great almshouse of St Januarius for old men (Ospiz. di S. Gennaro dei Poveri) dates from 1666. Besides the great provincial lunatic asylum (340 patients), now transferred to the convent of St Francis of Sales, there are three smaller asylums in the suburbs. Nothing perhaps is more characteristic of Naples than its so-called *Arci-confraternità*, associations similar to our friendly and burial societies, but entering more into the life of all classes of society. There are about one hundred and thirty of them. The oldest which has kept the date of its origin is that of the Bianchi della Carità, founded in 1382; seven belong to the 15th century and twenty-seven to the 16th. Mutual benefit societies are also numerous.

There are about a score of theatres in Naples. The San Carlo opera-house, with its area of 5157 square yards, and its pit capable of containing one thousand spectators, is one of the largest in Europe. It was originally erected in 1737 under Charles III. after the designs of Giovanni Medrano, but had to be almost completely rebuilt after the fire of 1816. Though closely associated with the names of Rossini, Bellini, Donizetti, Mercadante, &c., San Carlo has always had to be subsidized—first by the Bourbon princes, and since 1860 by the municipality, which also helps to support the Mercadante theatre. It is enough to mention the Teatro Nuovo, the Sannazaro, the Dei Fiorentini (devoted to the Italian drama), and the Bellini (dating from 1876, and second to none in the matter of decoration). The San Carlino, though mean and incommodious, is largely frequented by all classes from royalty downwards, its Pulcinella farces, always in the Neapolitan dialect, being a purely local institution, connected it may be with the Atellan plays.

At a very early date the original harbour at Naples, now known in its greatly reduced state as Porto Piccolo, and fit only for boats and lighters, became too small. In 1302 Charles II. of Anjou began the construction of the Porto Grande by forming the Molo Grande or San Gennaro, which stretched eastward into the bay, and was terminated by a lighthouse in the 15th century. By the addition of a new pier running north-east from the lighthouse, and protected by a heavily armed battery, Charles III. in 1740 added greatly to the safety of the harbour. In 1826 the open area to the south of the Porto Grande was formed into the Porto Militare by the construction of the Molo San Vincenzo, 1200 feet long. Shortly after the formation of the new kingdom of Italy attention was called to the insufficiency of the harbour for modern wants; and new works were commenced in 1862. Besides the lengthening of the Molo San Vincenzo to a total of more than 5000 feet, the scheme as authorized in 1879 includes the formation of a new pier, which is to extend from the Castel del Carmine a distance of about 2460 feet, the construction of quays along the shore between the fort and the Porto Grande, the deepening of the enclosed area to about 25 feet, and the establishment of new bonded warehouses and a floating dock on the Clark-Stanfield system. The contract provides for the completion of the works in 1885. The entrance to the harbour will then measure more than 2000 feet.

The port of Naples is second in the kingdom. The total tonnage of foreign and coasting trade (entrance and clearance) had increased from 1,812,138 register tons in 1863 to 4,128,057 in 1882. In the foreign trade the first place belongs to French shipping, 956,171 tons; the second to British, 374,608; and the third to Italian, 93,424. Cotton, cereals, sugar, coffee, tobacco, wool, &c., are the chief imports; pastes, coral (to the value of £1,500,000), and jewellers' work, dried fruit, hats, tartar and wine lees, wine, and olive oil are the chief exports. The total value of imports and exports was £9,374,940 in 1881 and £8,055,798 in 1882. Coral, kid gloves, and macaroni are manufactured in the city on an extensive scale.

Naples has several good local springs (notably the Acqua del Leone at Mergellina); a covered channel brings the waters of Monte Somma (Vesuvius) to the lower parts of the town; an aqueduct, constructed in the 17th century at the cost of Criminello and Carmignano, taps the Isclero at Sant' Agata dei Goti, 30 miles distant; and a number of artesian wells have proved successful as far as quantity is concerned. But in spite of all these resources the water supply has long been far below the demand; and a city which from its position might be one of the best-drained, cleanest, and healthiest in the world has had an unenviable reputation for dirtiness and unwholesomeness. At present extensive works are in progress by which good drinking water is to be brought from Serino (nearly 50 miles distant) and laid on at three different high levels at the rate of 22,000,000 gallons daily for the use of the inhabitants and 1,000,000 for public purposes.

Naples, the most densely peopled city in Europe, is slowly but steadily increasing. The commune—which includes not only the urban districts (*frazioni*) of S. Ferdinando, Chiaja, S. Giuseppe, Monte Calvario, Avvocata, Stella, San Carlo all' Arena, Vicaria, S. Lorenzo, Mercato, Pendino, and Porto, but also the suburban districts of Vomero, Posillipo, Fuorigrotta, Miano-Mianella, and Piscinola-Marianella—has advanced from 404,000 inhabitants in 1788 to 493,115 in 1881, and the city proper (the first twelve districts) from 326,130 in 1812 to 461,962 in 1881. In the condition of the lower classes considerable improvement has been effected since 1860; the lazzaroni, who bulked so largely in the experience of the tourist in the early part of the century, no longer exist, their place being taken by the dock-labourer, the fisherman, and the artisan.

History.—All ancient writers agree in representing Naples as a Greek settlement, though its foundation is obscurely and differently narrated. It seems that the oldest city on its site was founded by a colony from the neighbouring Greek town of Cumæ. They are said to have given it the name of *Parthenope*, from a legendary connection of the locality with the siren Parthenope, whose tomb was still shown at the time of Strabo. A number of Chalcidic and Athenian colonists are reported to have afterwards joined the original settlers, and to have built for themselves separate dwellings, which they called *Neapolis*, or the new city, in contradistinction to the old settlement, which in consequence was styled *Palæpolis*, or the old city. All modern attempts to define the respective extent and situation of Palæpolis and Neapolis have failed; but Livy's testimony leaves no doubt that they were close to each other, and identical in language and government.

In the year 328 B.C., the Palæpolitans having provoked the hostility of Rome by their incursions upon her Campanian allies, the consul Publilius Philo marched against them, and, having taken his position between the old and the new city, laid regular siege to Palæpolis. By the aid of a strong Samnite garrison which they received, the Palæpolitans were long able to withstand the attacks of the consul; but at length the city was betrayed into the hands of the Romans by two of her citizens. Neapolis possibly surrendered to the consul without any resistance, as it was received on favourable terms, had its liberties secured by a treaty, and obtained the chief authority, which previously seems to have been enjoyed by the older city. From that time Palæpolis totally disappeared from history, and Neapolis became as an allied city—*fœderata civitas*—a dependency of Rome, to whose alliance it remained constantly faithful, even under most trying circumstances. In 280 B.C. Pyrrhus unsuccessfully attacked its walls; and in the Second Punic War Hannibal was by their strength deterred from attempting to make himself master of the town. During the civil wars of Marius and Sulla, a body of partisans of the latter having entered it by treachery, 82 B.C., made a general massacre of the inhabitants; but Neapolis soon recovered the blow, as it was again a flourishing city in the time of Cicero. It became a *municipium* after the passing of the *lex Julia*; under the empire it is noticed as a *colonia*, but the time when it first obtained that rank is uncertain—possibly under Claudius.

Though a municipal town, Neapolis long retained its Greek culture and institutions; and even at the time of Strabo had gymnasia and quinquennial games, and was divided into *phratriæ*, after the Greek fashion. When the Romans became masters of the world, many of their upper classes, both before the close of the republic and under the empire, from a love of Greek manners and literature or from indolent and effeminate habits, resorted to Neapolis, either for education and the cultivation of gymnastic exercises or for the enjoyment of music and of a soft and luxurious climate. Hence we find Neapolis variously styled—by Horace as "otiosa Neapolis," by Martial as "docta Parthenope," by Ovid as "in otia natam Parthenopen." It was the favourite residence of many of the emperors: Nero made his first appearance on the stage in one of its theatres; Titus assumed the office of its archon; and Hadrian became its demarch. It was chiefly at Neapolis that Virgil composed his *Georgics*; and he was buried on the hill of Pausilypus, the modern Posillipo, in its neighbourhood. It was also the favourite residence of the poets Statius and Silius Italicus, the former of whom was a Neapolitan by birth.

After the fall of the Roman empire, Neapolis suffered severely during the Gothic wars. Having espoused the Gothic cause in the year 536, it was taken, after a protracted siege, by Belisarius, who turned aside an aqueduct, marched by surprise into the city through its channel, and put many of the inhabitants to the sword. In 542 Totila besieged it and compelled it to surrender; but, being soon after recovered by Narses, it remained long a dependency of the exarchate of Ravenna, under the immediate government of a duke, appointed by the Byzantine emperors. When the Lombards invaded Italy, and pushed their conquests in the southern provinces, the limits of the Neapolitan duchy were considerably narrowed. In the beginning of the 8th century, at the time of the Iconoclastic controversy, the emperor Leo the Isaurian having forced compliance to his edict against the worshipping of images, the Neapolitans, encouraged by Pope Gregory III., threw off their allegiance to the Eastern emperors, and established a republican form of government under a duke of their own appointment. Under this régime Neapolis retained her independence for nearly four hundred years, though constantly struggling against the powerful Lombard dukes of Benevento, who twice unsuccessfully besieged it. In 1027, however, Pandulf IV., a Lombard prince of Capua, succeeded in making himself master of it; but he was expelled in 1030 by Duke Sergius, chiefly through the aid of a few Norman adventurers. The Normans, in their turn, gradually superseded all powers, whether Greek, Lombard, or republican, which had previously divided the south of Italy, and furthermore checked the Saracens in the advances they were making through Apulia.

For the consolidation of the Norman authority over Sicily and Naples, the reader is referred to the article NORMANS. It is sufficient here to state that the leaders of the house of Hauteville in 1053 did homage to the pope for all conquests they had made or might make both in the island and upon the mainland, and that in 1130 Count Roger of that family assumed the style of king. In this way the south of Italy, together with the adjacent island of Sicily, was converted into one political body, which, owing to the peculiar temper of its Norman rulers and their powerful organization, assumed a more feudal character than any other part of the peninsula. The "regno," as it was called by the Italians, constituted a state apart, differing in social institutions, foreign relations, and type of home government from the commonwealths and tyrannies of upper Italy. It should furthermore be noticed that the indirect right acquired by the popes as lords paramount over this vast section of Italian territory gave occasion to all the most serious disturbances of Italy between the end of the 13th and the beginning of the 16th centuries, by the introduction of the house of Anjou into Naples and the disputed succession of Angevine and Aragonese princes. From the date at which the south of Italy and Sicily were subjugated by the Normans, the history of Naples ceases to be the history of a republic or a city, and merges itself, as the history of a kingdom, in that of the kingdom of the Two Sicilies. Naples henceforth formed the metropolis of the Italian portion of that kingdom, owing this pre-eminence to its advantageous position on the side of Italy towards Sicily, and to the favour of successive princes. Separated from Sicily between the years 1282 and 1442, reunited to Sicily between 1442 and 1458, again separated between 1458 and 1504, and finally reunited in the year 1504, the kingdom of Naples remained from that date forward, with short interruptions, under one crown, together with Sicily, until 1861. Then both Sicily and Naples were absorbed in the Italian kingdom through the cession by Garibaldi of his conquest to the popularly sanctioned sceptre of the house of Savoy.

It is impossible to write the history of Naples in modern times apart from that of Sicily, or to separate it from that of the several dynasties which have held royal or vice-royal state in Naples as their capital. But an epitome of the main vicissitudes which it has undergone during the last seven centuries and a half may be supplied. The Norman dynasty controlled both Sicily and Naples until the year 1194, when their rights were transmitted, by failure of legitimate male issue, to Henry VI., emperor, and husband of Constance de Hauteville. The popes, in pursuance of their Guelf policy, persecuted the great imperial house of Hohenstaufen to extinction, subdued the Ghibelline party in southern Italy, and conferred the kingdom of the Two Sicilies upon Charles of Anjou after his victory at Grandella, in the year 1265. As a consequence of the Sicilian Vespers, Charles had to relinquish Sicily in 1282; but he continued to be king of Naples. It was then shown that, though the Normans had welded Sicily and the southern provinces of Italy into one substantial political whole, the island and the mainland had no strong bond of national cohesion. The subsequent history of the sister kingdoms makes this even more apparent. Seven princes of the house of Anjou ruled Naples after the death of Charles until the year 1442. Meanwhile Sicily obeyed the house of Aragon, whose rights were derived from Constance, the daughter of Manfred, a bastard son of the emperor Frederick II. In 1442 Alphonso V. of Aragon and Sicily, surnamed the Magnanimous, expelled René of Anjou from the kingdom of Naples, and reunited the Two Sicilies under his own rule. Upon his death in 1458, his brother John became king of Aragon and Sicily; while his natural son Ferdinand assumed the crown of Naples, which was bequeathed to him by Alphonso as being his own property by right of conquest. The bastard Aragonese dynasty thus founded continued to hold sway in Naples, separate from Sicily, through four successive princes, until their line ended by the expulsion of Frederick, Alphonso's grandson, in 1501. Betrayed by his cousin Ferdinand of Spain, this prince surrendered to a French army and died in captivity in France three years later. The French and Spaniards were at this epoch disputing the possession of Italy. Charles VIII. of France had already, in 1494, reasserted the claims of the Angevine line, and had conquered the kingdom of Naples; but he proved unable or unwilling to maintain his conquest more than a few months. His successor Louis XII. covenanted in 1500 to partition Naples with Ferdinand the Catholic of Spain, who was already king of Sicily. Ferdinand, however, having no intention of fulfilling his engagements with his French ally, succeeded in possessing himself of the whole kingdom of Naples, which he now reunited to that of Sicily, and governed together with Castile and Aragon. From 1504 until 1707 Naples and Sicily owed immediate obedience to viceroys of the kings of Spain,—the only important episode in the history of the city throughout this period being the revolt of MASANIELLO (*q.v.*) in 1647. After 1707, during the wars of the Spanish succession, the Austrians made themselves masters of both Sicily and Naples; and, though Sicily was ceded by them in 1713 to the house of Savoy, and in 1718 conquered by Spain, they became again in 1720 possessors of both kingdoms. Naples was at this time of her history administered by Austrian, as previously by Spanish, viceroys. The war of the Polish succession gave monarchial independence once more to the Two Sicilies; for in 1735 Don Carlos, a younger son of Philip V., of the Bourbon dynasty in Spain, after a successful campaign against the Austrians, was crowned sovereign of both kingdoms at Palermo. He founded the Bourbon line, which reigned in Sicily and Naples until the year 1861, interrupted only by the disturbances of the French Revolution and by a brief French occupation (1806–15), during which Joseph Bonaparte bore the title of king of Naples for two years and Joachim Murat for seven years. Sicily throughout this period of French influence remained beneath the sway of her Bourbon princes. For the events which led to the expulsion of the Bourbons and the annexation of both Sicily and Naples to the crown of Italy, the reader is referred to the article ITALY; see also MASANIELLO, NORMANS, SICILY.

NAPOLEON I.

THE family Bonaparte (written by Napoleon's father and by himself down to 1796 Buonaparte, though the other spelling occurs in early Italian documents) was of Tuscan origin. A branch of it was settled in Corsica at least as early as the 16th century, from which time the Bonapartes appear as influential citizens of Ajaccio. They had an ancient title of nobility from the Genoese republic, and Napoleon's grandfather obtained letters of nobility also from the grand-duke of Tuscany. They had therefore the right to sign De Buonaparte, but ordinarily dropped the preposition of honour. Charles Marie de Buonaparte (born in 1746, studied law at the university of Pisa, where he took his doctor's degree in 1769) married at the age of eighteen Letitia Ramolino, who was not quite fifteen. The lady had beauty, but apparently neither rank nor wealth. In the children of this marriage the father, a somewhat indolent Italian gentleman with a certain taste for literature, seems traceable in Joseph, Jerome, and partly also in Lucien; the energy of which Lucien had a share, which Caroline also displayed, and which astonished the world in Napoleon, seems attributable to the Corsican blood of the mother. Thirteen children were born, of whom eight grew up. The list is as follows:—Joseph (king, first of Naples, then of Spain), *Napoleon*, Lucien, Eliza (Princess Bacciochi), Pauline (married, first to General Leclerc, afterwards to Prince Borghese), Caroline (married to Murat, became queen of Naples), Louis (king of Holland), Jerome (king of Westphalia). Of these the eldest was born in 1768, the youngest in 1784. See BONAPARTE.

Besides his brothers and sisters, Napoleon raised to importance Joseph Fesch, half-brother of his mother, a Swiss on the father's side, who was afterwards known to the world as Cardinal Fesch.

The accepted opinion is that Napoleon was born at Ajaccio on August 15, 1769. This opinion rests indeed on the positive statement of Joseph Bonaparte, but it is certain from documents that on January 7, 1768, Madame Letitia bore a son at Corte, who was baptized by the name of Nabulione. And even in legal documents we find contradictory statements about the time and place of birth, not only of Napoleon, but also of Joseph. All difficulties disappear at once if we suppose that Napoleon and Nabulione were one and the same, and that Joseph was really the second son, whom the parents found it convenient to pass off as the first-born. This they may have found convenient when, in 1779, they gained admission for a son to the military school of Brienne. A son born in 1768 would at that date be inadmissible, as being above ten years of age. Thus it is conceivable that Napoleon was introduced by a fraud to that military career which changed the face of the world. Nevertheless it is certain from Lucien's memoir that of such a fraud nothing was known to the younger members of the family, who regarded Joseph as without doubt the eldest.

After passing two or three months in a school at Autun for the purpose of learning French—he had hitherto been a thorough Italian—Napoleon entered Brienne on April 23, 1779, where he remained for more than five years, and then in September 1784 passed, as "cadet-gentilhomme," into the military school of Paris. In the next year, 1785, he obtained his commission of lieutenant in the regiment La Fère, stationed at Valence. He had already lost his father, who, undertaking a journey to France on business, was entertained at Montpellier in the house of an old Corsican friend Madame Permon, mother of the celebrated memoir-writer Madame Junot, and died there of the disease which was afterwards fatal to Napoleon, on February 25, 1785, at the age of thirty-eight years.

The fact principally to be noticed about Napoleon's extraction and boyhood is that he was by birth a noble, needy and provincial, and that from his tenth year his education was exclusively military. Of all the great rulers of the world none has been by breeding so purely a military specialist. He could scarcely remember the time when he was not a soldier living among soldiers. The effects of this training showed themselves too evidently when he had risen to the head of affairs. At the same time poverty in a society of luxurious noblemen, and the consciousness of foreign birth and of ignorance of the French language, made his school life at times very unhappy. At one time he demands passionately to be taken away, at another time he sends in a memorial, in which he argues the expediency of subjecting the cadets to a more Spartan diet. His character declared itself earlier than his talents. He was reported as "taciturn, fond of solitude, capricious, haughty, extremely disposed to egoism, seldom speaking, energetic in his answers, ready and sharp in repartee, full of self-love, ambitious, and of unbounded aspirations." So he appeared to his teachers, and an Englishman who remembered him at Brienne makes him a complete Timon, living as a hermit, and perpetually at war with his schoolfellows. His abilities do not seem to have excited wonder, but he was studious, and in mathematics and geography made great progress. He never, however, so Carnot tells us, became a truly scientific man. He had neither taste nor talent for grammatical studies, but was fond of books, and books of a solid kind. Of the writers of the day he seems to have been chiefly influenced by Raynal and Rousseau.

He is now a lieutenant of artillery in the service of Louis XVI. The next years are spent mainly with his regiment at Valence, Lyons, Douai, Paris, Auxonne, Seurre, Auxonne again. But he takes long holidays with his family at Ajaccio, obtaining permission on the ground of ill-health. Thus he was at Ajaccio in 1787 from February to October, again from December 1787 to May 1788, again from September 1789 to February 1791. During this period he is principally engaged in authorship, being consumed by the desire of distinction, and having as yet no other means of attaining it. He produces *Letters on the History of Corsica*, which he proposes to dedicate first to Paoli, afterwards to Raynal; he competes for a prize offered by the academy of Lyons for the best essay written "to determine the truths and feelings which it is most important to inculcate on men for their happiness." Among his smaller compositions is *The Narrative of the Masked Prophet*. Of all these writings, which are to be distinguished from the pamphlets written by him with a practical object, it may be said that they show more character than literary ability. As the compositions of a boy they are indeed remarkable for their precocious seriousness, but what strikes the reader most in them is a sort of suppressed passion that marks the style, a fierce impatience, as if the writer knew already how much he had to get through in a short life. But his sentiments, love of liberty, of virtue, of domestic happiness, are hollow, and his affectation of tenderness even ridiculous. The essay, as a composition, is positively bad, and was naturally unsuccessful.

Meanwhile his active life had begun with the Revolution of 1789. The first chapter of it is separate from the rest, and leads to nothing. That astonishing career which has all the unity of a most thrilling drama does not begin till 1795. The six years which preceded it may be called his Corsican period, because for the greater part of it he may be thought to have regarded Corsica as the destined scene of his future life. It must be very summarily treated here.

In 1789 the Italian island of Corsica had been for twenty years a dependency of France. But France had acquired it in a most unscrupulous manner by purchasing the rights of the republic of Genoa over it. She did this in 1768, that is, when Corsica had contested those rights in a war of nearly forty years, and had been practically independent and happy for about thirteen years under the dictatorship of Pasquale Paoli. It was an act similar to the partition of Poland, and seems to mark a design on the part of France—which had just lost its American colonies—to extend its power by way of the Mediterranean into the East. Paoli was compelled to take refuge in England, where he was still living when the French Revolution broke out. In the fall of Corsica a certain Matteo Buttafuoco played a disgraceful part. He had been sent by Paoli to treat as plenipotentiary with France, was won over by Choiseul, declared against the national cause, and appeared in the island as colonel of Louis XV.'s Corsican regiment. He too was still living when the states-general met, and represented there the noblesse of Corsica, while Salicetti, a name of no little prominence in the Revolution, was one of the representatives of the Corsican tiers état.

The Revolution was as dangerous an event to the relation between France and Corsica as to that between France and St Domingo. Would the island assert its independence, and, if so, could the assembly deny its right to do so? The islanders and the exiled Paoli at their head took a moderate view. France must guarantee a good deal of local freedom; on such conditions, they thought, the relation might continue, if only to prevent the republic of Genoa from reviving its pretensions. Accordingly, on November 30, 1789, Corsica was declared by the National Assembly to be a province of France on the motion of Salicetti himself, and the protest against this decree made by Genoa was treated with contempt. Paoli left London, was received in France with an ovation, appeared before the National Assembly on April 22, 1790, where he received the honours of the sitting, and landed in Corsica on July 14th, after an absence of twenty-one years. Thus was Corsica reconciled to France by the Revolution of 1789; but the good work was undone by the Second Revolution of 1792.

Since 1769 the French power in the island had rested mainly on the noblesse and clergy. The Bonaparte family, as noble, had been on the unpatriotic side; Napoleon's father appears always as a courtier of the French governor Marbœuf and as a mendicant at Versailles; Madame Letitia in soliciting a place for her son Louis styles herself "the widow of a man who always served the king in the administration of the affairs of the island of Corsica." It is therefore a remarkable fact that almost immediately after the taking of the Bastille Napoleon hurried to Ajaccio and placed himself at the head of the revolutionary party with all the decision characteristic of him. He devoted himself to the establishment of a National Guard, of which he might hope to be the La Fayette, and he published a letter to Buttafuoco which, properly understood, is a solemn desertion of the principles of his family, similar to that of Mirabeau. This letter has all the intensity of his other early writings, but far more effectiveness. It lashes Buttafuoco for his treason of 1768, describing him as a cynic, who had no belief in virtue, but supposed all men to be guided by selfish interest. The invective has lost its edge for us who know that Bonaparte soon after openly professed this very creed. In declaring for the Revolution he obeyed the real inclination of his feelings at the time, as we may see from his writings, which are in the revolutionary tone of Raynal. But had he not really, we may ask, an ulterior object, viz., to make Corsica independent of France, and to restore the old rule of Paoli, aiming himself at Paoli's succession? Probably he wished to see such a result, but he had always two strings to his bow. In his letter to Buttafuoco he carefully avoids separating Corsican liberty from the liberty offered by the French Revolution. Had the opportunity offered, he might no doubt have stood forth at this time as the liberator of Corsica; but circumstances did not prove favourable, and he drifted gradually in quite the opposite direction.

In October 1790 he met Paoli at Orezza, where Corsica constituted itself as a French department, Paoli being president, Salicetti procureur-général syndic, Arena and Pozzo di Borgo (also from Ajaccio) members of the Directorium. Paoli is said to have hailed Napoleon as "one of Plutarch's men." As the only Corsican officer trained at a royal military school, Napoleon might aspire to become commander of a paid native guard which it was proposed to create for the island. But France had misgivings about the use to which such a guard might be put, and the minister of war rejected the proposal. In the next year, however, he was successful in a second attempt to get the command of an armed force in Corsica, and betrayed in the course of this attempt how much more intent he was at this time upon Corsican than upon French affairs. It was decided to create four battalions of national volunteers for Corsica, and Napoleon became candidate for the post of lieutenant-colonel in the district of Ajaccio. The choice was in the hands of the volunteers themselves, and in pursuing his canvass Napoleon did not hesitate to outstay his furlough, and thus forfeit his French commission by wilful absence from a great review of the whole French army which was appointed for the opening day of 1792. He was, however, elected, having, it is said, executed the first of his many *coups d'état* by violently imprisoning a commissioner sent down to superintend the election. We can understand his eagerness when we remark that anarchy in Corsica was steadily increasing, so that he may have believed that the moment for some military stroke was at hand. He did not long delay. At the Easter festival of 1792 he tried to get possession of Ajaccio under cover of a tumult between the volunteers and the refractory clergy. The stroke failed, and he fled from the island. The European war was just breaking out, and at Paris everything was in confusion; otherwise he would probably have been tried by court-martial and shot.

A rebel in Corsica, a deserter in France, what was he to do? He went to Paris, where he arrived on May 21. The Second Revolution was at hand, and he could observe while no one had leisure to observe him. He witnessed the 10th of August and the downfall of the monarchy. To him this revolution was a fortunate event, for the new Government, attacked by all Europe, could not dispense with the few trained officers whom the emigration had left. On August 30th his name was restored to the army list with the rank of captain, a commission dated back to the 6th February, and arrears of pay. He was saved from the most desperate condition to which he was ever in his whole life reduced. On September 2d (terrible date!) he is engaged in withdrawing his sister Eliza from St Cyr (the House of St Louis having been suppressed). The next step he takes is remarkable. The great war which was to carry him to the pinnacle of fame was now in full progress. By undeserved good luck his military rank is restored to him. Will he not hurry to his regiment, eager to give proof of his military talents? No, his thoughts are still in Corsica. On the pretext of conducting his sister to her home he sets off without delay for Ajaccio, where he arrives on the 17th. The winter was spent in the unsuccessful expedition, which may be called Napoleon's first campaign, made from Corsica against the island of Sardinia. On his return he found a new scene opened. The Second Revolution was beginning to produce its effect in Corsica, which was no mere province of France, and in which everything was modified by the presence of Paoli. Elsewhere the Convention was able by its Representatives in Mission to crush opposition, but they could not so crush Corsica and Paoli. There was thus a natural opposition between the Convention and Paoli, and the islanders began to fall into opposite parties, as adherents of the former or of the latter. It might have been expected that Bonaparte, who all his life had glorified Paoli, and whose early letters are full of hatred to France, would have been an enthusiastic Paolist. But a breach seems to have taken place between them soon after Napoleon's return from Paris, perhaps in consequence of his escapade of Easter 1792. The crisis came on April 2d, when Paoli was denounced before the Convention, among others by Marat, and it was decreed that he and Pozzo di Borgo should come to Paris and render an account of their conduct to the Convention. Paoli refused, but with the remarkable, perhaps excessive, moderation which characterized him offered to leave Corsica if his presence there appeared to the Convention undesirable. But the islanders rallied round him almost as one man.

There could be no reason why the horrors of the Second Revolution should extend to Corsica, even if we consider them to have been inevitable in France. For a Corsican patriot no fairer opportunity could offer of dissolving with universal approbation the connexion with France which had begun in 1769. Napoleon took the opposite side. He stood out with Salicetti as the leading champion of the French connexion and the bitterest opponent of Paoli. Was his motive envy, or the bitterness caused by a recent personal quarrel with Paoli? We cannot positively say, but we can form an estimate of the depth of that insular patriotism which fills the *Letters on the History of Corsica.* Paoli summoned a national consulta at the end of May, and the dissolution of the French connexion now began. The consulta denounced the Bonaparte family by name. Napoleon answered by desperate attempts to execute his old plan of getting possession of the citadel of Ajaccio. But he failed, and the whole Bonaparte family, with Madame Letitia and Fesch, pursued by the fury of the people, took refuge in France. With this Hijra the first period of Napoleon comes to an end.

Up to this time Napoleon has regarded the French nation with dislike, French ways and habits are strange and foreign, and he has more than once turned aside from a French career when it seemed open to him. Henceforth he has no other career to look for, unless indeed it may be possible, as for some time he continued to hope, to make his way back to Corsica by means of French arms. A certain change seems now to pass over his character. Up to this time his writings, along with their intensity, have had a highly moral and sentimental tone. He seems sincerely to have thought himself not only stronger and greater but better than other men. At school he found himself among school-fellows who were a hundred "fathoms below the noble sentiments which animated himself," and again much later he pronounced that "the men among whom he lived had ways of thinking as different from his own as moonlight is from sunlight." Probably he still felt that he had more vivid thoughts than other men, but he ceases henceforth to be a moralist. His next pamphlet, *Le Souper de Beaucaire*, is entirely free from sentiment, and in a very short time he appears as a cynic, and even pushing cynicism to an extreme.

It was in June 1793 that the Bonaparte family found themselves at Toulon in the midst of the Corsican emigration. France was in a condition not less disturbed than Corsica, for it was the moment of the fall of the Girondins. Plunged into this new party strife, Bonaparte could hardly avoid taking the side of the Mountain. Paoli had been in a manner the Girondin of Corsica, and Bonaparte had headed the opposition to him. In *Le Souper de Beaucaire* (published in August 1793), which is the manifesto of this period as the *Letter to Buttafuoco* is of the earlier period, he himself compares the Girondins to Paoli, and professes to think that the safety of the state requires a deeper kind of republicanism than theirs. The immediate occasion of this pamphlet is the civil war of the south, into which he was now plunged. Marseilles had declared against the Convention, and had sent an army under Rousselet which had occupied Avignon, but had evacuated it speedily on being attacked by the troops of the Mountain under Carteaux. Bonaparte took part in the attack, commanding the artillery, but it seems an unfounded statement that he specially distinguished himself. This was in July, and a month later the pamphlet was written. It is a dialogue between inhabitants of Marseilles, Nîmes, and Montpellier and a military man. It is highly characteristic, full of keen and sarcastic sagacity, of clear military views; but the temperature of its author's mind has evidently fallen suddenly; it has no warmth, but a remarkable cynical coldness. Among the Representatives in Mission recently arrived at Avignon was the younger Robespierre, with whom Salicetti was intimate. Bonaparte, introduced by Salicetti and recommended by this pamphlet, naturally rose high in his favour. He is now a Jacobin. We must not be misled by the violence with which Bonaparte attacked this party some years later, and the horror he professed to feel for their crimes, so as to conclude that his connexion with the Jacobins, and especially the Robespierres, was purely accidental and professional. What contemporary evidence we have exhibits Bonaparte at this time as holding the language of a terrorist, and we shall see how narrowly he escaped perishing with the Robespierres in Thermidor. Of course it is not necessary to disbelieve Marmont when he says that the atrocities of the Robespierrists were not to Bonaparte's taste, and that he did much to check them within the sphere of his influence.

Bonaparte marched with Carteaux into Marseilles late in August, and about the same time Toulon delivered itself into the hands of the English. Just at this moment he was promoted to the rank of *chef de bataillon* in the second regiment of artillery, which gave him practically the command of the artillery in the force which was now formed to besiege Toulon. The story of his relations with the generals who were sent successively to conduct the siege, Carteaux the painter, Doppet the physician, Dugommier the brave veteran, and of his discovery of the true way to take Toulon, are perhaps somewhat legendary, but he may probably have been eloquent and persuasive at the council of war held November 25th, in which the plan of the siege was laid down. That he distinguished himself in action is more certain, for Dugommier writes, "Among those who distinguished themselves most, and who most aided me to rally the troops and push them forward, are citizens Buona Parte, commanding the artillery, Arena and Cervoni, adjutants general" (*Moniteur*, December 7, 1793). He was now named general of brigade.

Bonaparte now passes out of the civil into the foreign war. The military system of the Convention is by this time in full operation. Distinct armies face each enemy, and the great military names of the Revolution are already in men's mouths. The army of the north has Jourdan, Leclerc, Vandamme, Brune, Mortier; that of the Moselle has Hoche, Bessières, Moreau; that of the Rhine Pichegru, Schérer, Berthier; that of the West Marceau and Kléber. Bonaparte joins the army of Italy as general of artillery and inspector-general; to the same army is attached Masséna as general of division; Dumerbion is general-in-chief. It is now that for the first time we find Bonaparte's exceptional ability remarked. Restless pushing ambition he had shown all along, but that he was more than a mere intriguer seems to have been first discerned by the younger Robespierre, who in a letter of April 5, 1794, describes him as "of transcendent merit." In the brief campaign of the army of Italy which occupied the month of July 1794 he took no part, while Masséna commanded in the illness of Dumerbion. But in July he made his first essay in diplomacy. Genoa was among the earliest of the many feeble neutral states which suffered in the conflict of the Revolution with the great powers, and at the expense of which the revolutionary empire was founded. Bonaparte was sent by the younger Robespierre to remonstrate with the Genoese Government upon the use which they suffered the Coalition to make of their neutral territory. He was in Genoa from July 16 to July 23; he urged the French claim with success; he returned to Nice on July 28. But July 28, 1794, is the 9th Thermidor, on which Bonaparte's patron perished with his elder brother on the scaffold.

Probably the connexion of Bonaparte with the Robespierres was closer than Bonaparte himself at a later time liked to have it thought. "He was their man, their planmaker," writes Salicetti; "he had acquired an ascendency over the Representatives (*i.e.*, especially Robespierre junior) which it is impossible to describe," writes Marmont. Accordingly after Thermidor the Representatives in Mission who remained with the army of Italy, viz., Salicetti, Albitte, and Laporte, suspended Bonaparte from his functions, and placed him provisionally under arrest (August 6). He was imprisoned at the Fort Carré near Antibes, but fortunately for him was not sent to Paris. On the 20th he was set provisionally at liberty on the ground of "the possible utility of the military and local knowledge of the said Bonaparte."

His escape was due, according to Marmont, to Salicetti's favour and to the powerful help he himself succeeded in procuring; "he moved heaven and earth." His power of attaching followers also now begins to appear; Junot and Marmont, who had become acquainted with him at Toulon, were prepared, if he had been sent to Paris, to set him free by killing the *gens d'armes* and carrying him into the Genoese territory. Marmont has graphically described the influence exerted upon himself at this time by Bonaparte; "there was so much future in his mind," he writes.

This was a passing check; early in 1795 he suffered a greater misfortune. He had been engaged in a maritime expedition of which the object was to recover Corsica, now completely in the power of the English. On March 3d he embarked with his brother Louis, Marmont, and others on the brig "Amitié." On the 11th the fleet set sail. It fell in with the English, lost two ships, and returned defeated. The enterprise was abandoned, and by the end of the same month we find Lacombe Saint Michel, member of the Committee of Public Safety, sending orders to the general of brigade Bonaparte to proceed immediately to the army of the west in order to take command of the artillery there. He left Marseilles for Paris on May 5, feeling that all the ground gained by his activity at Toulon, and by the admiration he had begun to inspire, was lost again, that his career was all to recommence, and in peculiarly unfavourable circumstances.

This is the last ill turn he ever received from fortune. It has been attributed to the Girondist spite of a certain Aubry against the Montagnard Bonaparte. The truth seems rather to be that the Committee of Public Safety felt that the Corsican element was too strong in the army of Italy; they remarked that "the patriotism of these refugees is less manifest than their disposition to enrich themselves." Lacombe Saint Michel knew Corsica; and the new general of the army of Italy, Schérer, remarks of Bonaparte just at this moment that "he is a really good artillerist, but has rather too much ambition and intrigue for his advancement."

The anecdote told by Bonaparte himself of his ordering an attack of outposts in order to treat a lady to a sight of real war, "how the French were successful, but necessarily no result could come out of it, the attack being a pure fancy, and yet some men were left on the field," belongs to the last months of his service in the army of Italy. It is worthy of notice, as showing his cynical insensibility, that he acted thus almost at the very beginning of his military career, and not when he had been hardened by long familiarity with bloodshed. On his arrival at Paris he avoids proceeding to the army of the west, and after a time obtains from Doulcet de Pontécoulant a post in the topographical section of the war office. Here he has an opportunity of resuming his old work, and we find him furnishing Doulcet, as he had before furnished Robespierre junior, with strategical plans for the conduct of the war in Italy. Late in August he applies for a commission from Government to go to Constantinople at the head of a party of artillerists in order to reform that department of the Turkish service. He sends in a testimonial from Doulcet which describes him as "a citizen who may be usefully employed whether in the artillery or in any other arm, and even in the department of foreign affairs." But at this moment occurs the crisis of his life. It coincides with a remarkable crisis in the history of France.

The Second Revolution (1792) had destroyed the monarchy, but a republic, properly speaking, had not yet been established. Between 1792 and 1795 the government had been provisionally in the hands of the National Convention, which had been summoned, not to govern, but to create a new constitution. Now at length, the danger from foreign enemies having been averted, the Convention could proceed to its proper work of establishing a definite republic.

But there was danger lest the country, when appealed to, should elect to undo the work of 1792 by recalling the Bourbons, or at least should avenge on the Mountain the atrocities of the Terror. To preserve the continuity of government an expedient was adopted. As under the new constitution the assemblies were to be renewed periodically to the extent only of one-third at a time, it was decreed that the existing Convention should be treated as the first Corps Législatif under the new system. Thus, instead of being dissolved and making way for new assemblies, it was to form the nucleus of the new legislature, and to be renewed only to the extent of one-third. This additional law, which was promulgated along with the new constitution, excited a rebellion in Paris. The sections (or wards) called into existence a revolutionary assembly, which met at the Odéon. This the Convention suppressed by military force, and the discontent of the individual sections was thereby increased. At the same time their confidence was heightened by a check they inflicted upon General Menou, who, in attempting to disarm the section Lepelletier, was imprisoned in the Rue Vivienne, and could only extricate himself by concluding a sort of capitulation with the insurgents. Thereupon the Convention, alarmed, put Menou under arrest, and gave the command of the armed force of Paris and of the army of the interior to Barras, a leading politician of the day, who had acquired a sort of military reputation by having held several times the post of Representative in Mission. Barras knew the army of Italy and the services which Bonaparte had rendered at Toulon, and nominated him second in command.

It does not seem that Bonaparte showed any remarkable firmness of character or originality of genius in meeting the revolt of the sections on the next day (Vendémiaire 13, *i.e.*, 5th October) with grape shot. The disgrace of Menou was a warning that the Convention required decisive action, and the invidiousness of the act fell upon Barras, not upon Bonaparte. Indeed in the official report drawn by Bonaparte himself his own name scarcely appears; instead of assuming courageously the responsibility of the deed, he took great pains to shirk it. He appeared in the matter merely as the instrument, as the skilful artillerist, by whom Barras and the Convention carried their resolute policy into effect. It will be observed that on this occasion he defends the cause of Jacobinism. This does not require to be explained, as at a later time he took much pains to explain it, by the consideration that, odious as Jacobinism was, on this particular occasion it was identified with "the great truths of our Revolution." Bonaparte at this period appears uniformly as a Jacobin. He was at the moment an official in the Jacobin Government, and speaks in his letters of the party of the sections just as a Government official might be expected to do.

In this affair he produced an impression of real military capacity among the leading men of France, and placed Barras himself under a personal obligation. He was rewarded by being appointed in succession to Barras, who now resigned, commander of the army of the interior. In this position, political and military at the same time, he preluded to the part reserved for him later of First Consul and Emperor. He also strengthened his new position materially by his marriage with Josephine de Beauharnais, née Tascher. The Bonaparte legend tells of a youth calling upon him to claim the sword of his father, guillotined in the Terror, of Bonaparte treating the youth kindly, of his mother paying a visit of thanks to the general, of an attachment following. But even if Bonaparte was really attached to Josephine, we must not think of the match as one of mere unworldly affection. It was scarcely less splendid for the young general Bonaparte than his second match was for the emperor Napoleon. Josephine was prominent in Parisian society, and for the lonely Corsican, so completely without connexions in Paris, or even in France, such an alliance was of priceless value. She had not much either of character or intellect, but real sweetness of disposition. Her personal charm was not so much that of beauty as of grace, social tact, and taste in dress. The act of marriage is dated Ventose 19, year IV. (*i.e.*, 9th March 1796). On this day Bonaparte had already been appointed to the command of the army of Italy. His great European career now begins.

The fourth year of the Revolutionary War was opening. The peculiar characteristic of that war is that, having been for France, at the commencement, a national war of liberation on the grandest scale, it changed its character after two years and became an equally unprecedented national war of conquest. The conquest of Austrian Flanders had been made in 1794, that of Holland in the winter of the same year. The whole left bank of the Rhine was in French occupation, and the war had passed over to the right bank. The question was no longer of the principles of the Revolution, but only of inducing the emperor and the Germanic body to conclude treaties in which Belgium and the left bank should be ceded. It was a war for territory similar to so many wars of the 18th century, but exceeding all of them in the energy with which it was conducted and the extent which it covered. Never had the warlike spirit been so predominant before in Europe. Bonaparte did not introduce, but found already introduced, the principle of conquest.

Prussia, with most of the North-German princes and Spain, had retired from the war early in 1795. Austria was now the great enemy of France by land. Accordingly the direct struggle was waged chiefly on the upper Rhine, where Austria had then extensive territories. But Austria could also be attacked on the side of Italy, where she possessed the duchy of Milan. On this side, however, a less important belligerent intervened, viz., Sardinia. It was natural to suppose that Sardinia, which since 1792 had lost Savoy and Nice, which since the military regeneration of France could not expect victory, and which had been in the habit of regarding Austria rather as a rival than as a friend, would gladly be quit of the war. Could she but be pushed aside, Austria might be attacked on the plains of Lombardy. Bonaparte had nursed this idea ever since he had been connected with the army of Italy; since Vendémiaire he had discussed it with Carnot, and it was Carnot, now one of the five Directors, who, as he himself tells us, procured Bonaparte's appointment to the Italian command.

But not only Austria could be attacked in Italy.. The French Revolution, by undertaking a sort of crusade against monarchy, had furnished itself with a justification for attacking almost all states alike, for almost all were either monarchical or at least aristocratic. Italy was full of small states which could be attacked as Mainz or Holland had been attacked before. Tuscany had an Austrian prince; Rome was the patron of the *prêtres insermentés*; Venice was aristocratic. Bonaparte instinctively saw that he had a charter for indiscriminate conquest and plunder. He announced this to the army without the least disguise: "Soldiers, you are naked and ill fed; I will lead you into the most fruitful plains in the world. Rich provinces, great cities will be in your power. There you will find honour and fame and wealth!" In this announcement is the key to the history of Europe for the next twenty years.

This order of the day was issued from Nice, where Bonaparte had arrived on March 27th. The campaign began on April 10th. This, the first of Bonaparte's campaigns, has been compared to his last. As in 1815 he tried to separate Blücher and Wellington, hoping to overcome them in turn, so now with more success he attacked first the Austrians under Beaulieu and then the Sardinians under Colli. Defeating the Austrians at Montenotte, Millesimo, and Dego, he turned on the 15th against Colli, defeated him at Ceva, then at Mondovi, and concluded the convention of Cherasco on the 28th. By this convention, which was soon after turned into a treaty of peace, Sardinia was severed from the Coalition, and her principal fortresses put into the hands of France. What Bonaparte had so long dreamed of he accomplished in a single month, and turned himself at once to the conquest of Lombardy.

The month of May was devoted to the invasion. On the 7th he crossed the Po at Piacenza, stormed the bridge over the Adda at Lodi on the 11th, and, as the archduke who governed Lombardy had quitted Milan on the 9th, retiring by Bergamo into Germany, Bonaparte entered

Milan on the 15th. That day Bonaparte told Marmont that his success hitherto was nothing to what was reserved for him. "In our days," he added, "no one has conceived anything great; it falls to me to give the example." June was spent in consolidating the conquest of Lombardy, in spoiling the country, and repressing the insurrections which broke out among the Italians, astonished to find themselves plundered by their "liberators." From the middle of July the war, as far as Austria is concerned, becomes a war for Mantua. Austria makes desperate and repeated efforts to raise the siege of this all-important fortress. On July 29 arrived Würmser at the head of 50,000 men, making his way through Tyrol from the Rhine. He advanced on both sides of the Lake of Garda, and threatened Bonaparte's communications by occupying Brescia. Bonaparte abandoned the siege of Mantua, and brought his whole force to meet the enemy. On this one occasion we find the young commander's resource and courage failing him. He called councils of war, and declared in favour of retreating across the Po. When Augereau resisted this determination, he left the room declaring that he would have nothing to do with the matter, and, when Augereau asked who was to give orders, answered "You!" The desperate course was rewarded with success. The Austrians were defeated at Castiglione on August 5th, and retired into Tyrol. But Mantua had been revictualled, and Bonaparte had suffered the loss of his siege-train.

Early in September Bonaparte, having received reinforcements from France, assumed the offensive against Würmser, and after defeating him at Bassano forced him to throw himself with the remainder of his army into Mantua (September 15).

At the end of October Austria had assembled a new army of 50,000 men, mostly, however, raw recruits. They were placed under the command of Alvinzi. Bonaparte was to be overwhelmed between this army and that of Würmser issuing from Mantua. But by a night march he fell upon Alvinzi's rear at Arcola. The struggle lasted through three days, during which Bonaparte's life was at one moment in great danger, and ended in a complete victory for the French (November 15–17). From Arcola he used ever afterwards to date his profound confidence in his own fortune. Mantua, however, still held out, and early in January (1797) a fourth and last attempt was made by Alvinzi to relieve it, but he was again completely defeated at Rivoli, and a whole Austrian *corps d'armée* under Provera laid down its arms at Roverbella (January 16). On receiving the intelligence of this disaster Würmser concluded the capitulation by which the French were put in possession of Mantua.

Such was the campaign of Bonaparte against Austria, by which he raised his reputation at once above that of all the other generals of the republic, Jourdan, Moreau, or Hoche. But he had acted by no means merely as a general of the republic against Austria. He had assumed from the beginning the part of an independent conqueror, neither bound by the orders of his Government nor by any rules of international law or morality.

The commander of a victorious army wields a force which only a Government long and firmly established can hold in check. A new Government, such as the Directory in France, having no root in the country, is powerless before a young victor such as Bonaparte. The danger had been early perceived: Hoche had been pronounced dangerous by Robespierre; it became imminent when Bonaparte with his unrestrained ambition pushed before the other generals. The *coup d'état* of Brumaire was in Bonaparte's mind before he had been many weeks at the head of the army of Italy. But long before he ventured to strike the existing Government we see that he has completely emancipated himself from it, and that his acts are those of an independent ruler, as had been those of Cæsar in Gaul or of Pompey in the East while the Roman republic was still nominally standing. As early as June 1796 he said to Miot, "The commissioners of the Directory have no concern with my policy; I do what I please."

From the outset it had been contemplated to make the invasion of Italy financially profitable. Contributions were levied so rapaciously that in the duchy of Milan, where the French had professed to appear as brothers and liberators, a rebellion against them speedily broke out, which Bonaparte suppressed with the merciless cruelty he always showed in such cases. He kept the promise of his first proclamation: he made the army rich. "From this moment," writes Marmont, "the chief part of the pay and salaries was paid in coin. This led to a great change in the situation of the officers, and to a certain extent in their manners. The army of Italy was at that time the only one which had escaped from the unprecedented misery which all the armies had so long endured." The amount of confiscation seems to have been enormous. Besides direct contributions levied in the conquered territory, the domains of dispossessed Governments, the revenues and property of churches and hospitals, were at Bonaparte's disposal. There seems reason to think that but a small proportion of this plunder was ever accounted for. It went to the army chest, over which Bonaparte retained the control, and the pains that he took to corrupt his officers is attested in the narrative of Marmont, who relates that Bonaparte once caused a large sum to pass through his hands, and when he took great pains to render a full account of it, as the officers had then *une fleur de délicatesse*, Bonaparte blamed him for not having kept it for himself.

As he made himself financially independent of the Government, so he began to develop an independent policy. Hitherto he has had no politics, but has been content to talk the Jacobinism of the ruling party; now he takes a line, and it is not quite that of the Government. He had already, in June 1796, invaded the papal territory, and concluded a convention at Bologna by which he extorted 15 millions from the pope; immediately after the fall of Mantua he entered the States of the Church again, and concluded the treaty of Tolentino on February 19. We see how freely he combines diplomacy with war; he writes without disguise to the Directory, October 5, "You incur the greatest risk whenever your general in Italy is not the centre of everything." But now in dealing with the pope he separates his policy from that of the Directory. He demands indeed the cession of Bologna, Ferrara, and the Romagna, besides Avignon and the Venaissin, and the temporary cession of Ancona. But he recognizes the pope by treating with him, and towards the Catholic religion and the priesthood he shows himself unexpectedly merciful. Religion is not to be altered in the ceded Legations, and Bonaparte extends his protection in the most ostentatious manner to the *prêtres insermentés*, whom he found in large numbers in the States of the Church. This was the more marked as they were at this time objects of the bitterest persecution in France. Here is the first indication of the policy of the Concordat, but it is also a mark of Bonaparte's independent position, the position rather of a prince than of a responsible official; nay, it marks a deliberate intention to set himself up as a rival of the Government. His manner of conducting the war was as unprecedented as his relation to the Government, and in like manner foreshadowed the Napoleonic period. It was not that of a civilized belligerent, but of a universal conqueror. The Revolution had put all international law into abeyance. Bonaparte in Italy, as in his later wars, knows nothing of neutrality. Thus Tuscany, the first of all states to conclude a treaty with the French republic, is not thereby saved from invasion. Bonaparte's troops march in, seize Leghorn, and take possession of all the English property found in that port. More remarkable still is the treatment of Venice. The territory of the republic is turned unceremoniously into a field of battle between France and Austria, and at the end of the war the Venetian republic is blotted out of the map.

Further is to be remarked the curious development which was given to the principle of plunder. The financial distress of France and the impoverishment of the army at the opening of the campaign might account for much simple spoliation. But Bonaparte introduced the practice of transferring pictures and statues from the Italian palaces and galleries to France. This singular revival of primitive barbaric modes of making war becomes more striking when we reflect that the spoiler of Italy was himself an Italian.

Altogether these campaigns brought to light a personality entirely without precedent in modern European history. True, the Revolution behind him and the circumstances around him were absolutely unprecedented. Marmont remarked at the time the rapid and continual development which just then showed itself in Bonaparte's character. "Every day," he writes, "he seemed to see before him a new horizon." An ambitious man had suddenly become aware that a career entirely unparalleled was open to him, if only he could find audacity and unscrupulous energy to enter upon it. Add to this that he had lived for three years in the midst of disorders and horrors such as might well have dissipated all principles, beliefs, and restraints. Even as early as the 13th Vendémiaire we find him impressed with a fatalist belief in his own luck ("I received no hurt; I am always lucky," he writes), and there are indications that his wonderful escape at Arcola greatly heightened this belief in a mind naturally somewhat superstitious.

At this moment, as Bonaparte's private political views begin to appear, his Jacobinism, even his republicanism, slips from him like a robe. As early as May 1797 he said to Miot and Melzi, "Do you suppose that I triumph in Italy for the glory of the lawyers of the Directory, a Carnot or a Barras? Do you suppose I mean to found a republic? What an idea! a republic of thirty millions of people! with our morals, our vices! how is such a thing possible? The nation wants a chief, a chief covered with glory, not theories of government, phrases, ideological essays that the French do not understand. They want some playthings; that will be enough; they will play with them and let themselves be led, always supposing they are cleverly prevented from seeing the goal towards which they are moving." His contempt for the French character and his opinion of their unfitness for republican institutions was sincere; it was the opinion of a Corsican accustomed to more primitive, more masculine ways of life; we meet with it in Bonaparte's earliest letters, written before the thought of himself ruling France had occurred to him.

When the fall of Mantua had established the French power in North Italy, Bonaparte's next thought was to strike at the heart of Austria from this new basis. Early in March, having secured his position in Italy by the treaty of Tolentino with Rome and by a treaty with Sardinia, he set his troops in motion. He sent Joubert with 18,000 men into Tyrol, while he prepared to march in person upon Vienna from Friuli through Carinthia and Styria. The archduke Charles had been called to the command of the troops opposed to him, but these were thoroughly demoralized. Bonaparte dislodged him from the line of the Tagliamento, then from that of the Isonzo, and advanced steadily until he reached Leoben in Styria on April 7th. Here began negotiations.

There has been much misconception of the preliminaries of Leoben, because Bonaparte's position and objects have not been properly understood. We expect to find these preliminaries containing conditions most triumphant for France, since they were won by an invasion which stopped little short of Vienna, and followed a series of victories most ruinous to the Austrian military power. But it was not France that imposed these conditions, it was Bonaparte, whose interest was not by any means identical with that of France. His object was not so much to vanquish Austria as to eclipse the French generals on the Rhine and wrest from them the honour of concluding the war. In order to do this it was necessary to surprise Austria by his moderation, and this he did in the preliminaries of Leoben. The object of the war on the part of France had long been to obtain definitive possession of Belgium and the Rhine frontier; this might now have been obtained at the expense of Bonaparte's Italian conquests. At Leoben, however, no such arrangement was made. Belgium indeed, so far as it belonged to Austria, was ceded, and the emperor agreed to "recognize the limits of France as decreed by the laws of the republic." This expression afterwards was made to seem ambiguous, but at the time it appears to have been understood to refer almost exclusively to the Belgian territories, which had been organized by the French into nine departments. It seems certainly not to have included that large territory limited by the Rhine which it was not competent to Austria to cede, since in the main it did not belong to Austria but to the Germanic empire. But what was to become of Bonaparte's conquests in Lombardy? Here we meet with a principle of action which, though not invented by him, was mainly instrumental in founding his empire. An independent republic was to be set up in Lombardy, and for this Austria was to receive as an indemnity the continental possessions of the Venetian republic as far as the Oglio, with Istria and Dalmatia. But how came this territory to be at the disposal of Bonaparte, since the Venetian republic was a neutral state? The answer is that its neutrality had been utterly disregarded by Bonaparte during the war, and that, as its territory had been freely trampled on by his troops, irritation had necessarily arisen among the Venetians, thence quarrels with the French, thence on the side of the French an attack on the aristocratic government and the setting up of a democracy. Of all this the result was now found to be that the Venetian empire was a conquered territory, which in her next treaty France could cede in exchange for any desired advantage. This had been the principle of the partition of Poland; it was now to be the principle of a universal conquest.

The summer of 1797 was passed by Bonaparte at Montebello near Milan. Here he rehearsed in Italy the part of emperor, formed his court, and accustomed himself to all the functions of government. He was chiefly engaged at this time in accomplishing the dissolution of the Venetian republic. He had begun early in the spring by provoking insurrections in Brescia and Bergamo. In April the insolence of a French officer provoked a rising against the French at Salò, for which Junot, sent by Bonaparte, demanded satisfaction of the senate on the 15th. The French now attempted to disarm all the Venetian garrisons that remained on the *terra firma*, and this led to a rising at Verona in which some hundreds of Frenchmen were massacred (April 17th). On the 19th a French sea-captain, violating the customs of the port at the Lido, was fired upon from a Venetian fort. Bonaparte now declared that he would be a new Attila to Venice, and issued a declaration of war. The feeble Government could only submit. A revolution took place at Venice, and French troops took possession of the town on May 16th. A treaty was now concluded by Bonaparte "establishing peace and friendship between the French republic and the republic of Venice," and providing that "the French occupation should cease as soon as the new Government should declare that it no longer needed foreign assistance." "A principal object of this treaty," as Bonaparte candidly explained to the Directory, "was to obtain possession without hindrance of the city, the arsenal, and everything." At the time that he was thus establishing friendship he was, as we know, ceding the territory of Venice, including at last the town, to Austria.

When we read the letters written by him at this period we see that already, only a year after he assumed for the first time the command of an army, he has fully conceived the utmost of what he afterwards realized. Had he been shown in vision at this time what he was to be at his zenith in 1812, when he was the astonishment and terror of the world, he would probably have said that it fell short of his expectations.

One concession he had made in order to prevent Hoche and Moreau from sharing his laurels; at Leoben he had granted good terms to Austria. But the definitive treaty was not yet concluded, and it was still possible to withdraw this concession. This was the more possible as Austria might now be threatened with an attack from Bonaparte and Hoche at the same time. By virtue of the new principle she might also be bribed. The town of Venice might be ceded to her as well as the province, and in return for the left bank of the Rhine indemnity might be granted to her within the Germanic empire. The principle of ceding what is not one's own is evidently capable of wide application. But Austria had still one hope, for it seemed impossible that France herself could suffer Bonaparte to run his headlong career without interference, especially as she now had popular assemblies. The difficulty which Bonaparte had dissipated by his cannon in Vendémiaire had returned, as it could not fail to do. A Jacobinical regicide republic had to support itself in the midst of a nation which was by no means Jacobinical, and which had representative assemblies. These assemblies, renewed by a third for the second time in the spring of 1797, placed Pichegru, suspected of royalism, in the chair of the Five Hundred, and Europe began to ask whether the restoration of the Bourbons was about to follow. Bonaparte at Montebello found that the Austrian negotiators were bent upon delay.

The rising party was not perhaps mainly royalist; its most conspicuous representative, Carnot, the Director, was himself a regicide. In the main it aimed only at respectable government and peace, but a minority were open to some suspicion of royalism. This suspicion was fatal to the whole party, since royalism had at this time been thoroughly discredited by the follies of the *émigrés*. An outcry is raised by the soldiers. We can measure the steady progress which had been made by the military power since Vendémiaire; it had then been an instrument in the hands of the Government, now it gives the law and makes the Government its instrument. The armies of the Rhine, represented by Hoche, oppose the new movement; as to Bonaparte, he was driven into opposition by self-defence. Dumolard, a deputy, had called attention to his monstrous treatment of the Venetian republic; he anticipated the judgment of history by comparing it to the partition of Poland. Bonaparte had already divulged to a friend the secret that he despised republicanism, but this attack made him once more, for the last time, a republican and a Jacobin. It is, however, probable that he would in any case have sided with the majority of the Directory, since anything which favoured the Bourbons was a hindrance to his ambition. And thus the armies of the republic stood united against the tendency of public opinion at home. Imperialism stood opposed to parliamentary government, believing itself—such was the bewilderment of the time—to be more in favour of the sovereignty of the people than the people itself, and not aware that it was paving the way for a military despot.

The catastrophe came on 18th Fructidor (September 4, 1797), when Augereau, one of Bonaparte's generals of division, who had been sent by Bonaparte to Paris, surrounded the Corps Législatif with twelve thousand men and arrested the most obnoxious representatives, while another force marched to the Luxembourg, arrested the Director Barthélemi, and would have arrested Carnot had he not received warning in time to make his escape. This stroke was followed by an outrageous proscription of the new party, of whom a large number, consisting partly of members of the Councils, partly of journalists, were transported to die at Cayenne, and the elections were annulled in forty-eight departments.

Such was Fructidor, which may be considered as the third of the revolutions which compose the complex event usually known as the French Revolution. In 1789 the absolute monarchy had given place to a constitutional monarchy, which was definitively established in 1791. In 1792 the constitutional monarchy fell, giving place to a republic which was definitively established in 1795. Since 1795 it had been understood that revolution was over, and that France was living under a constitution. But in Fructidor this constitution also fell, and government became revolutionary again. It was evident that a third constitution must be established; it was evident also that this constitution must set up a military form of government,—that is, an imperialism; but two more years passed before this was done.

The benefit of the change was reaped in the end by Bonaparte. Naturally he favoured it and took a great share in contriving it. But it seems an exaggeration to represent him as the exclusive or even the principal author of Fructidor. Hoche took the same side as Bonaparte; Augereau outran him (and yet Augereau at this time was by no means a mere echo of Bonaparte); the division of the army of Italy commanded by Bernadotte, which had been recently detached from the army of Sambre-et-Meuse, and stood somewhat aloof from Bonaparte's influence, sided with him in this instance. The truth is that the rising party of Moderates gave offence to the whole military world by making peace their watchword. Outside the armies too there was profound alarm in the whole republican party, so that the circle of Madame de Staël was strongly Fructidorian, and this certainly was not guided by the influence of Bonaparte, though at this time Madame de Staël was among his warmest admirers. When the blow had been struck, Bonaparte knew how to reap the utmost advantage from it, and to exhibit it in its true light as mortal at the same time to the Moderates and to the republican Government itself, which now ceased to be legal and became once more revolutionary, and as favourable only to the military power and to the rising imperialism. He congratulated the armies on the fall of "the enemies of the soldier and especially of the army of Italy," but accorded only the faintest approval to the Directory.

The death of Hoche, occurring soon after, removed from Bonaparte's path his only rival in the affections of the already omnipotent soldiery. Hoche alone among the generals beside Bonaparte had shown political talents;

had he lived longer, he might have played with success the part in which Moreau afterwards failed.

The revolution of Fructidor, being military, had an immediate effect on foreign affairs. It commences the period which was to last till the fall of Napoleon, a period of war pursued by France for its own sake, and as a kind of national business. As negotiations with England are at once violently broken off, so a change comes over the negotiations with Austria. With the fall of the peace party Austria loses all hope of favourable terms. Bonaparte is now residing at Passeriano in a villa belonging to Doge Manin, and the negotiations take place at Udine in the neighbourhood. As at Leoben, Bonaparte is more pacific than the Directory. They are prepared to recommence the war; his ambition is to win from the other generals the distinction of terminating it. The struggle between them concerns the fate of Venice, the complete possession of which is a bribe sufficient to induce Austria to recede entirely from the preliminaries of Leoben, but which the Directory is unwilling to cede. Between the beginning of September and the middle of October this struggle continued; at length, on October 17th, the treaty was signed at the little village of Campo Formio (more correctly Campo Formido) close to Udina. Bonaparte took his own course, gave Venice, Istria, Dalmatia, and all Venetian territory beyond the Adige to Austria, founded the Cisalpine Republic, and reserved for France, besides Belgium, Corfu and the Ionian Islands. A congress was to open at Rastatt, and Austria bound herself by a secret article to do her best to procure for France from the Germanic body the left bank of the Rhine. By retaining the Ionian Islands Bonaparte gave the first intimation of his design of opening the Eastern question.

He now left Italy, setting out from Milan on November 17th, made a flying visit to Rastatt, where the congress had already assembled, and reached Paris on December 5th. What next would be attempted by the man who at twenty-seven had conquered Italy and brought to an end the most memorable Continental war of modern times? From a speech delivered by him on the occasion of his reception by the Directory it appears that he had two thoughts in his mind,—to make a revolution in France ("when the happiness of the French people shall be based on the best [or on better] organic laws, all Europe will be free") and to emancipate Greece ("the two most beautiful parts of Europe, once so illustrious for arts, sciences, and the great men of whom they were the cradle, see with the loftiest hopes the genius of liberty issue from the tombs of their ancestors"). He had now some months in which to arrange the execution of these plans. The Directory, seeing no safety but in giving him employment, now committed the war with England to his charge. He becomes "général en-chef de l'armée d'Angleterre." His study of internal politics soon landed him in perplexity. Should he become a Director, procuring an exemption from the rule which required the Directors to be more than forty years of age? He could decide on nothing, but felt himself unprepared to mingle in French party strife. He decided therefore that "the pear was not ripe," and turned again to the military schemes which might raise his renown still higher during the year or two which the Directory would require to ruin itself. It seemed possible to combine war against England with the Oriental plan which had been suggested to him, it is said, by Monge at Passeriano. During the last war between Russia and Turkey some publicists (including Volney, an acquaintance of Bonaparte's) had recommended France to abandon her ancient alliance with Turkey and seek rather to share with Russia in her spoils. Thus was suggested to Bonaparte in Italy the thought of seizing Greece. Now as head of the army of England he fixed his eyes on Egypt also. In India the game was not yet quite lost for France, but England had now seized the Cape of Good Hope. To save therefore what remained of her establishments in India, France must seize Egypt. She must not only conquer but colonize it ("if forty or fifty thousand European families fixed their industries, their laws, and their administration in Egypt, India would be presently lost to the English much more even by the force of events than by that of arms"). Such was the scheme, according to which Turkey was to be partitioned in the course of a war with England, as Venice had disappeared in the course of a war with Austria.

That such a scheme could scarcely fail to kindle a new European war more universal than that which Bonaparte had just brought to a close was probably its principal recommendation in his eyes. He also instinctively saw that, while he conquered in the East, France, deprived of her best troops and generals, would suffer disasters at home, though he could not anticipate what actually happened—that she would be unfortunate both at home and in the East. But the European war showed signs of recommencing even before he could set sail. For the tide of militarism in France could not be arrested for a moment; scarcely a month passed but was marked by some new aggression and annexation. In the spring of 1798 the old constitution of Switzerland was overthrown, French troops entered Bern and seized a treasure of 40,000,000 francs; at the same time a quarrel was picked with the Papal Government; it was overthrown, the treasury plundered, and the aged pope, Pius VI., carried into captivity. Thus, as Berthier said, money was furnished for the Egyptian campaign; but on the other hand Europe was thoroughly roused; England could meet the threatened attack by forming a new Coalition, and at the beginning of May, three weeks before Bonaparte set sail, the probability of a new Continental war was already so great that he writes, for the benefit of General Brune, a plan for defending Italy against an attack by a superior force of Austrians. It is asserted by Miot that at the last moment Bonaparte would gladly have abandoned his Eastern expedition, since it would have suited him as well to take the command again against Austria, but that the Directory to be rid of him at all hazards, forced him to depart.

In any case the departure of Bonaparte for the East with 30,000 men and Generals Murat, Berthier, Desaix, Kléber, Lannes, and Marmont—Nelson in front of him and a European war behind—perhaps marks the moment of wildest confusion in the modern history of Europe. From his letters written on board "L'Orient" it would seem that he scarcely realised the terrible risk he ran; it is to be considered that the superiority of the English marine had not yet been clearly proved, and that the name of Nelson was not yet redoubtable. He set sail on May 19, having stimulated the zeal of his soldiers by promising that each should return rich enough to buy six "arpents" of land (the Directory were obliged to deny the genuineness of the proclamation), and, eluding Nelson, who had been driven by a storm to the island of St Pietro near Sardinia, arrived on June 9 at Malta, where a squadron from Civita Vecchia and another from Ajaccio had preceded him. This island was in the possession of the Knights of St John of Jerusalem, who acknowledged the king of Naples as their feudal superior and the czar as their protector. To attack them was the direct way to involve France in war both with Naples and Russia. Bonaparte, demanding admission into the harbour for his fleet, and receiving answer that the treaties which guaranteed the neutrality of Malta permitted only the admission of four ships, attacked at once, as indeed he had been expressly commanded by the Directory to do (*Nap. Corr.*, iv. 53). The people rose against the knights; the grand master Hompesch opened negotiations, and on the 12th Bonaparte entered La Valette. He is enthusiastic about the strength and importance of the position thus won. "It is the strongest place in Europe; those who would dislodge us must pay dear." He spent some days in organizing a new Government for the island, and set sail again on the 19th. On July 2 he issues his first order in Alexandria.

During the passage we find him prosecuting his earlier scheme of the emancipation of Greece. Thus from Malta he sends Lavalette with a letter to Ali Pasha of Janina. His plan therefore seems to embrace Greece and Egypt at once, and thus to take for granted the command of the sea, almost as if no English fleet existed. The miscalculation was soon made manifest. Bonaparte himself, after occupying Alexandria, set out again on the 8th and marched on Cairo; he defeated the Mamelukes first at Chebreiss and then at Embabeh within sight of the Pyramids, where the enemy lost 2000 and the French about 20 or 30 killed and 120 wounded. He is in Cairo on the 24th, where for the most part he remains till January of 1799. But a week after his arrival in Cairo the fleet which had brought him from France, with its admiral Brueys, was destroyed by Nelson in Aboukir Bay. For the first time, in reporting this event to the Directory, it seems to flash on Bonaparte's mind that the English are masters of the sea. The grand design is ruined by this single stroke. France is left at war with almost all Europe, and with Turkey also (for Bonaparte's hope of deceiving the sultan by representing himself as asserting his cause against the Mamelukes was frustrated), and her best generals with a fine army are imprisoned in another continent.

It might still be possible to create a revolution in Turkey in Asia, if not in Turkey in Europe. The Turks were preparing an army in Syria, and in February 1799 Bonaparte anticipated their attack by invading Syria with about 12,000 men. He took El Arish on the 20th, then Gaza, and arrived at Jaffa on March 3. It was taken by assault, and a massacre commenced which, unfortunately for Bonaparte's reputation, was stopped by some officers. The consequence was that upwards of 2000 prisoners were taken. Bonaparte, unwilling either to spare food for them or to let them go, ordered the adjutant-general to take them to the sea-shore and there shoot them, taking precautions to prevent any from escaping. This was done. "Now," writes Bonaparte, "there remains St Jean D'Acre." This fortress was the seat of the pasha, Jezzar. It is on the sea-shore, and accordingly England could intervene. Admiral Sir Sidney Smith, commanding a squadron on the coast, opened fire on the French as they approached the shore, and was surprised to find his fire answered only by musketry. In a moment he divined that the siege artillery was to come from Alexandria by sea, and very speedily he discovered the ships that carried it and took possession of them. On March 19 Bonaparte is before Acre, but the place receives supplies from the sea, and support from the English ships, while his artillery is lost. He is detained there for two whole months, and retires at last without success. This check, he said, changed the destiny of the world, for he calculated that the fall of Jezzar would have been followed by the adhesion of all the subject tribes, Druses and Christians, which would have given him an army ready for the conquest of Asia.

The failure had been partially redeemed by a victory won in April over an army which had marched from the interior to the relief of Acre under Abdallah Pasha, and which Bonaparte defeated on the plain of Esdraelon (the battle is usually named from Mount Tabor). In the middle of May the retreat began, a counterpart on a small scale of the retreat from Moscow, heat and pestilence taking the place of frost and the Cossacks. On the 24th he is again at Jaffa, from which he writes his report to the Directory explaining that he had deliberately abstained from entering Acre because of the plague which, as he heard, was ravaging the city. On June 14 his letters are again dated from Cairo. His second stay in Egypt lasts two months, which were spent partly in hunting the dethroned chief of the Mamelukes, Murad Bey, partly in meeting a new Turkish army, which arrived in July in the Bay of Aboukir. He inflicted on it an annihilating defeat near its landing-place; according to his own account ten or twelve thousand persons were drowned. This victory masked the final failure of the expedition. It was a failure such as would have ruined Bonaparte in a state enjoying publicity, where the responsibility could have been brought home to him and the facts could have been discussed. For a year of warfare, for the loss of the fleet, of 6000 soldiers, and of several distinguished officers (Brueys, Caffarelli, Cretin), for disastrous defeats suffered in Europe, which might have been averted by Bonaparte and his army, for the loss for an indefinite time of the army itself, which could only return to France by permission of the English, there was nothing to show. No progress was made in conciliating the people. Bonaparte had arrived with an intention of appealing to the religious instinct of the Semitic races. He had imagined apparently that the rebellion of France against the Catholic religion might be presented to the Moslems as a victory of their faith. He had declared himself a Mussulman commissioned by the Most High to humble the cross. He had hoped at the same time to conciliate the sultan; it had been arranged that Talleyrand should go to Constantinople for the purpose. But Talleyrand remained at Paris, the sultan was not conciliated, the people were not deluded by Bonaparte's religious appeals. Rebellion after rebellion had broken out, and had been repressed with savage cruelty. It was time for him to extricate himself from so miserable a business.

It appears from the correspondence that he had promised to be back in France as early as October 1798, a fact which shows how completely all his calculations had been disappointed. Sir Sidney Smith now contrived that he should receive a packet of journals, by which he was informed of all that had passed recently in Europe and of the disasters that France had suffered. His resolution was immediately taken. On August 22 he wrote to Kléber announcing that he transferred to him the command of the expedition, and that he himself would return to Europe, taking with him Berthier, Lannes, Murat, Andréossi, Marmont, Monge, and Berthollet, and giving orders that Junot should follow in October and Desaix in November. After carefully spreading false accounts of his intentions, he set sail with two frigates in the night of the same day. He arrived after a voyage of more than six weeks, during which he revisited Corsica, in the harbour of Fréjus on October 9.

From this moment the tide of his fortune began to flow again. His reappearance seemed providential, and was hailed with delight throughout France. The system established in Fructidor was essentially military. It had led directly to the violent aggressions of 1798, and to a great law of military service introduced by General Jourdan, which was the basis of the Napoleonic armies; it had created a new European war. But it was evidently inconsistent with the form of government established in 1795. A Directory of civilians were not qualified to conduct a policy so systematically warlike. Hence the war of 1799 had been palpably mismanaged. The armies and the generals were there, but the presiding strategist and statesman was wanting. In Italy conquest had been pushed too far. Half the troops were locked up in fortresses or occupied in suppressing rebellions; hence Macdonald at the Trebbia and Joubert at Novi were defeated by Suwaroff, Mantua fell, and the work of Bonaparte in Italy was well-nigh undone. Government was shaken by these disasters. A kind of revolution took place in June. Four new members entered the Directory, of whom three—Gohier, Roger-Ducos, and General Moulin—represented on the whole the revival of the Jacobinism of 1793, while the fourth, Sieyès, the most important politician of this crisis, represented the desire for some new constitutional experiment. The remedy which first suggested itself was to return to the warlike fury and terrorism of 1793. The Jacobin Club revived and held its sittings in the Salle du Manége. Many leading generals, especially Jourdan and Bernadotte, favoured it. But 1793 was not to be revived. Its passions had gone to sleep, and the memory of it was a nightmare. Nevertheless a sort of Terror began. The hardship of recruitment caused rebellions, particularly in the west. Chouannerie and Royalism revived, and the odious Law of Hostages was passed to meet them. After seven years of misery France in the autumn of 1799 was perhaps more miserable than ever.

If 1793 could not be revived, what alternative? Sieyès perceived that what was needed was a supreme general to direct the war. But, though he had ceased to believe in popular institutions, and had become a convert to a new kind of aristocracy, he did not wish his supreme general to control civil affairs. He looked for an officer who should be intelligent without being too ambitious. His choice fell upon Joubert, who was nominated commander of the army of Italy that he might acquire the necessary renown. But Joubert was killed at Novi in August. From this time Sieyès had remained uncertain. Advances were made in vain to Moreau. Who can say what might have happened in a few months? Some general of abilities not very commanding would have risen to a position in which he would have controlled the fate of France. Perhaps Masséna, whose reputation at this moment reached its highest point through the victories of Zurich, but who was not made either for an emperor or for a statesman, might have come forward to play the part of Monk.

Upon this perplexing gloom the reappearance of Bonaparte came like a tropical sunrise, too dazzling for Sieyès himself, who wanted a general, but a general he could control. On October 16 he arrived at his old Parisian house in the Rue de la Victoire, and on the 9th and 10th of November (Brumaire 18, 19) the revolution took place. Bonaparte had some difficulty at first in understanding the position. He found a Jacobin party clamouring for strong measures and for a vigorous prosecution of the war; at the head of this party he saw military men, particularly Jourdan and Bernadotte. As an old Robespierrist, a Fructidorian, and a soldier, he was at first attracted to this faction. Sieyès, the object of their most bitter attacks, he was at first disposed to regard as his principal enemy. Gradually he came to perceive that this time he was to rise not as a Jacobin but as the soldier of anti-Jacobinism, and that he must place his sword at the service of Sieyès. For his part Sieyès could not but perceive that Bonaparte was not precisely the war minister he sought. But by the efforts of Lucien and Joseph Bonaparte, of Roederer, and Talleyrand a coalition was at last effected between them, though Sieyès continued to predict that after the success Bonaparte would throw him off. The movement which now took place was the most respectable, the most hopeful, as for a long time it seemed the most successful, effort that had been made since 1792 to lift France out of the slough. Instead of reviving Jacobinism it was resolved to organize a strong and skilled Government. A grand party of respectability rallied round Sieyès to put down Jacobinism. Ducos among the Directors (he had been converted), the majority of the Council of Ancients, Moreau and Macdonald, the generals of purest reputation, Bonaparte and the generals personally attached to him, composed this party. On the other side the Jacobinical party consisted of the Directors Gohier and Moulin, the majority of the Council of Five Hundred, Generals Jourdan and Bernadotte. Which party would be followed by the rank and file of the army was an anxious question.

It was determined to take advantage of a provision of the constitution which had been originally inserted by the Girondists as a safeguard against aggressions from the municipality of Paris, and to cause the Council of Ancients to decree a meeting of the Councils outside Paris at the palace of St Cloud. At this meeting it was intended to propose a reform of the constitution. The proposal would be supported by a majority in the Council of Ancients, and by many, but probably not a majority, in the Council of Five Hundred. It was foreseen that the Jacobins might give trouble, and might need to be eliminated, as they had themselves eliminated the Girondins. With a view to this, when the decree was passed on November 9th, General Bonaparte, made commander of all the troops in Paris, was entrusted with the execution of it. It is carefully to be observed that he does not, like Cromwell, act of his own free will against the assembly, but is appointed by the assembly to act in its name. No one thought of destroying the republic; the question was of introducing the famous perfect constitution Sieyès. Bonaparte appeared, surrounded by the generals of his party, in the Council of Ancients, where he skilfully evaded taking the oath to the constitution. He then reviewed the troops, and it became apparent that he could count on them. From this moment Brumaire may be said to have been decided. The next step was that Sieyès and Ducos resigned their places on the Directory; Barras was induced to follow their example; but Gohier and Moulin were firm. Gohier was placed under ward of Moreau at the Luxembourg, while Moulin made his escape. It now only remained to deal with the Council of Five Hundred, the stronghold of Jacobinism.

The revolution was consummated on the next day at St Cloud. Bonaparte and Sieyès sat in a private room while the Councils began their deliberations; but, being informed that it was proposed to renew the oath to the existing constitution, Bonaparte determined to interfere. There seems to have been mismanagement here. Sieyès, not Bonaparte, should have interfered, but probably he was rendered helpless, as often happened to him, by timidity. Bonaparte then entered the Council of Ancients, where he delivered a confused harangue which did him little good, though the assembly was well-disposed to him. His position was a false one, though he urged very justly that the existing constitution had been practically destroyed by the illegalities of Fructidor, Floréal, and Prairial. He then passed to the hostile Council of Five Hundred, where he was received with cries of *Hors la loi! A bas le dictateur!* He was seized by the collar and attempts were made to push him out of the hall.

He was now almost in despair, and no wonder! By the backwardness of Sieyès he had been pushed into the part of Cromwell. But Cromwell had soldiers devoted to him, and of theocratic rather than republican ideas; the soldiers of Bonaparte had only just been put under his command, and they were fanatical republicans. The false step must be retrieved. The soldiers must be persuaded that Bonaparte was no Cromwell, but a staunch republican, and that they were not called upon to act against an assembly, but only against a traitorous minority, as at Fructidor. Lucien Bonaparte, who was president of the Five Hundred, performed this miracle. Bonaparte had sent grenadiers to rescue him. Lucien was at the tribune, where he was defending his brother amidst noisy interruption. At the appearance of the grenadiers he threw off his official dress and retired under their escort. In the hall he mounted on horseback and addressed the troops who were employed to guard the legislature, declaring that the council was oppressed by assassins, brigands paid by England; he charged the soldiers to deliver the majority from this oppression by clearing the hall. He brandished a sword and swore to stab his brother if ever he attacked the liberties of Frenchmen. On the clear understanding that no violence against the assembly was intended, and with the express sanction of its president, the soldiers then cleared the hall. In the evening at 9 o'clock Lucien reassembled a certain number of the members and proposed to them to nominate a committee which should report on the state of affairs. This committee was at once named, and speedily presented a report to the effect that Sieyès, Roger-Ducos, and Bonaparte should compose a provisional executive under the title of consuls, that the legislature should adjourn till February 20 (1 Ventose), a committee of twenty-five members from each Council being left to deliberate along with the consuls upon the changes to be made in the constitution; at the same time, as in Fructidor, a certain number of members (fifty-five) were to be expelled from the Councils.

Thus the original plan was on the whole carried into effect. But it had been sadly marred by the unseemly appearance of Bonaparte and by his gasconades, in which he bade the Council remember that he "marched under the escort of the god of fortune and the god of war." An attempt was made to conceal these mistakes by publishing in the *Moniteur* a garbled report of his speech.

Brumaire taken by itself is the victory of Sieyès rather than of Bonaparte. It raised Sieyès to the position he had so long coveted of legislator for France. The constitution now introduced was really in great part his work, but his work so signally altered in one point that it resulted in the absolute supremacy of Bonaparte. We should especially notice that it is Sieyès, not Bonaparte, who practically suppresses representative institutions. The long-expected scheme of Sieyès was at last promulgated, and we see with astonishment that the man of 1789, the author of *Qu'est ce que le Tiers État?* himself condemns political liberty. In this scheme the assemblies, of which there are three, the Senate, the Tribunate, and the Corps Législatif, are not chosen by popular election at all. The two latter are nominated by the Senate, and the Senate is chosen at the outset in part by the provisional consuls and in part by co-optation. The Tribunate alone had the right of public debate, which was separated from the right of voting. This latter was assigned to the Corps Législatif. These arrangements, which caused the nullity of parliamentary institutions in the Napoleonic period, were devised not by Bonaparte but by Sieyès, who confined popular election to certain lists of notability out of which the assemblies were required to be chosen. By this scheme Sieyès, who retained all his hatred for the old régime and the old noblesse, passed sentence upon the whole constructive work of the Revolution; this sentence was only ratified by Bonaparte.

But, while he absolutely condemned democracy, Sieyès did not want to set up despotism. The Senate was to be supreme; it was to be a kind of hereditary aristocracy, the depositary of the tradition of the Revolution; above it, and capable of being deposed by it, was to be a doge called Grand Elector, whose main function consisted in choosing two consuls, of whom one was to take the home and the other the foreign department. Here again Bonaparte acquiesced as far as he could. He adopted the consuls and the triple executive, even lowering apparently the grand elector of Sieyès by giving him the more republican title of First Consul. But he displayed signally and for the first time the adroitness, rapid and audacious, which was to be the characteristic of his diplomacy. He declaimed violently against the feebleness of the grand elector and the consuls in this scheme, feigning to overlook that it concentrated power intentionally in the Senate; then instead of sending back the scheme for revision he simply strengthened immensely the attributions of the first consul, leaving the other consuls and the assemblies as weak as before. By this stroke a strong aristocracy was turned into a strong despotism, and at the same time advantage was taken of the very peculiar character of Sieyès, who always when he met with opposition sank into an impenetrable silence. Bonaparte boasted afterwards that he had sealed his victory over Sieyès by a handsome bribe at the expense of the public.

The provisional consulate of Sieyès, Ducos, and Bonaparte lasted only from November 10th to December 13th. Then through the promulgation of the new constitution it made way for the definitive consulate of Bonaparte, Cambacérès, and Lebrun, which lasted four years. By the constitution of 22 Frimaire, year VIII. (which was never debated in any assembly, but, after being devised by the two legislative committees meeting at the Luxembourg under the presidency of Bonaparte, and in the presence of the other consuls, and after being redacted by Daunou, was introduced by a popular vote), Bonaparte became First Consul for ten years with a salary of half a million francs, with a sole power of nominating the council of state, the ministers, ambassadors, officers of army and fleet, and most of the judges and local officials, and with a power in nominal conjunction with the other consuls of initiating all legislation and deciding war and peace. Sieyès and Ducos retired, and under the new constitution the second and third consuls were Cambacérès, an eminent legist, and Lebrun, an old official of Louis XV.'s time. The party of Brumaire had intended to set up a republic, but this constitution created a strong monarchy under the thinnest disguise.

For the moment it was much that France renounced Jacobinism and ceased to tear herself to pieces. The civil war of the west and the foreign war were alike energetically taken in hand. A proclamation to the inhabitants of the west (December 28th) breathed for the first time the spirit of tolerance, of respect for religion, and consideration for the clergy. It was a precursor of the Concordat, and attacked the civil war at its root. It was accompanied by the most imperious threats against the refractory, who are to be treated "like the Arabs of the desert," who are warned that they have to do with a man "accustomed to rigorous and energetic measures,"—an allusion apparently to the massacres of Jaffa and Cairo. This policy, accompanied by decisive military action, was speedily successful. By the end of February all was quiet in the west; Frotté, the most active leader in Normandy, had surrendered at discretion, and had been shot, though Bonaparte had expressly announced that if he surrendered he might count on the generosity of the Government. In preaching a religious peace at home Bonaparte was sincere; he was less so in announcing a policy of peace in Europe, for he well knew that he needed a victory to cover his apostasy from republicanism. Nevertheless the announcement was necessary as part of the national renunciation of Jacobinism; and it was harmless, for the Coalition was scarcely likely to accept peace when they had the military advantage. Indeed they could not consistently do so, since they had gone to war on the ground that peace with the Directory had appeared in 1798 to be less endurable than war, and the accession of Bonaparte could not but seem to them likely to make matters worse. In thinking thus they were substantially right, as the sequel proved, but they did not sufficiently understand that Bonaparte was not now the "champion of Jacobinism," as Pitt called him, but had become its enemy and destroyer. When England and Austria refused his overtures, Bonaparte had the good fortune of getting precisely what he wanted, viz., war, in precisely the way he wished, that is, as apparently forced upon him. This war is peculiar in the circumstance that throughout its course Bonaparte has a military rival with whom he is afraid to break, and who keeps pace with him in achievements—Moreau. To Moreau the success of Brumaire had been mainly due, and he had perhaps thought that the new constitution, as it did not seem to contemplate the First Consul commanding an army, had removed Bonaparte from the path of his ambition. He now held the command of the principal army, that of the Rhine, in which post Bonaparte could not venture to supersede him. The problem for Bonaparte throughout the war was to prevent Moreau, and in a less degree Masséna, who was now in command of the army of Italy, from eclipsing his own military reputation. Russia had now retired from the Coalition, so that, as in 1796, Austria and England were the only belligerents. Italy had been almost entirely lost, and Masséna, at the head of the army of Italy, opposed to General Melas, was almost where Bonaparte had been before his Italian campaign began. But France had retained the control of Switzerland, and Moreau with more than 100,000 men arranged along the Rhine from the Lake of Constance to Alsace stood opposed to Kray, whose headquarters were at Donaueschingen. It seemed that the campaign would be conducted by Moreau and Masséna receiving instructions from Bonaparte at Paris. That the decisive campaign would have been in Bavaria seems so evident that the military writer Bülow conjectures that the French were afraid of alarming Europe by a too decisive victory, which would have brought them at once to the walls of Vienna, and that they therefore transferred the campaign to Italy. But where would Bonaparte have been had Moreau won Hohenlinden in the spring of 1800 while he remained ingloriously at Paris? While therefore in writing to Moreau he carefully adopts the language of one who, much to his own regret, has become a mere civilian, he plans the campaign so that both Moreau and Masséna are confined to the task of holding the enemy in play while an army of reserve descends from one of the Alpine passes into Italy. This army of reserve, which was so carefully concealed that few people believed in its existence, is to be commanded, he writes, by some general "to be named by the consuls"; a little later Berthier is nominated. As late as the end of March he told Miot that he did not mean to leave Paris. Moreau is also to detach 25,000 men under Lecourbe, who are to join Berthier in Italy; in this way security was taken that Moreau should not be too successful. On April 24 the campaign in Germany began by the passage of the Rhine at a number of points at once. Up to May 10 Moreau is the hero of the war. He is victorious at Engen, at Mösskirchen, and forces Kray to retire to Ulm. But on May 9 Bonaparte is at Geneva, and it appears at once that he is commander, and Berthier only his chief of the staff. At the same time Carnot in person is sent with unusual formality to demand from Moreau the detachment of troops.

The campaign of Marengo was astonishingly short. On May 11 Bonaparte left Geneva, and he is in Paris again before the end of June. Since the beginning of April Masséna had been struggling vainly against the superior forces of Melas; since the 21st he had been shut up in Genoa, where Austria and England could co-operate in the siege. In Italy the affairs of France looked darker than ever, when Bonaparte threw himself on the rear of Melas by passing the Great St Bernard between May 15 and 20. Other divisions passed the Little St Bernard and the Mont Cenis, while the detachment from Moreau's army (under Moncey, not Lecourbe) descended the St Gotthard. It seems that the Austrians had absolutely refused to believe, what nevertheless was openly discussed in the Paris journals, that Bonaparte intended to cross the Alps. Bonaparte had another surprise in store for them. Though Genoa was now suffering all the horrors of famine, he made no attempt to relieve it, but turned to the left, entered Milan, and took possession of the whole line of the Ticino and the Po. Meanwhile Genoa capitulated to General Ott. Melas was now at Alessandria, where Bonaparte sought him on the 13th. On the 14th Melas marched out, crossed the Bormida, and arrived at Marengo. The victory here won by Bonaparte, though in its consequences more decisive than any other, and marking in a certain sense the culmination of his career, yet was due almost entirely to accident. A sudden charge of cavalry by Kellermann changed a great Austrian victory into a decisive Austrian defeat. On the next day Melas (having, as it seems, quite lost his head) signed a convention by which Austria sacrificed almost all North Italy, restoring something like the position of Campo Formio. "Had he fought another battle," says Marmont, "he would certainly have beaten us." Bonaparte returns to Paris, victorious at once over Austria and over Moreau and Masséna. He did not, however, succeed in tearing from Moreau the honour of concluding the war. Marengo did not lead to peace; this was won, where naturally it could only be won, in Bavaria by Moreau's victory of Hohenlinden (December 3d), a victory perhaps greater than any of which at that time Bonaparte could boast.

Never was Bonaparte more recklessly audacious, never was he more completely and undeservedly successful, than in this campaign. Brumaire had given him a very uncertain position. Sieyès and the republicans were on the watch for him on the one side; Moreau seemed on the point of eclipsing him on the other. His family felt their critical position: "had he fallen at Marengo," writes Lucien, "we should have been all proscribed." Perhaps nothing but a stroke so rapid and startling as that of Marengo could have saved him from these difficulties. But this did more, and developed the empire out of the consulate.

His appeal for peace after Brumaire had not been purely insincere, though he wanted victory before peace. He proposes to Rouget de l'Isle to write "a battle hymn which shall express the idea that with great nations peace comes after victory." After Marengo he devotes himself to giving peace to the world; he did this by three great acts, so that in 1802 for the first time for ten years under the new Augustus "no war or battle sound was heard the world around." These three acts are the treaty of Lunéville, February 1801, the Concordat, July 1801, the treaty of Amiens, March 1802 It is worth noticing that the negotiator of all of them is his brother Joseph, as if he especially desired to connect his family name with the pacification of the world.

1. The treaty of Lunéville gave peace to the Continent. It is to be observed that here Bonaparte shows himself at least less rapacious than the Directory. He surrenders

most of the usurpations of 1798, the Roman and Parthenopean Republics, and returns in the main to the arrangements of Campo Formio,—a proof of moderation which must have led the cabinets to consider whether after all it might not be possible to find a *modus vivendi* with the Government of Brumaire.

2. By the Concordat he professed to close the religious war. In reality he crushed the national Gallican Church, which had been created by the Constitution Civile, and which had perhaps begun to take root, and restored the Papal Church, shorn of its endowments and dependent, so long as he lived, on the state. As part of the great pacification, the Concordat was perhaps mainly a stroke of stage-effect, though its influence upon the later history of France has been great. For Bonaparte himself it was important as severing the clerical party from the Bourbons and attaching it to himself, as giving him through the clergy an influence over the peasantry, upon whom he depended for his armies, also as in some degree welding together through the ubiquitous influence of the clergy the different states which were already subject to his government. In negotiating it with Cardinal Consalvi, Bonaparte had recourse more than once to the vulgar fraud and knavery which earned for him the title of Jupiter-Scapin.

3. After the treaty of Lunéville, as after that of Campo Formio, England was left to fight France alone; but Bonaparte had now a higher estimate than in 1798 of England's naval power. He was able, however, in 1801 to attack her in another way. By her conduct at Malta she had given offence to the czar Paul, and taking advantage of this Bonaparte was able to revive against her the armed neutrality of 1780. Not only Russia but Prussia was thus brought for the first time, along with Sweden and Denmark, into the French alliance, and the system of Tilsit was for the first time sketched out. But it lasted only for a moment. At the beginning of April the announcement of the murder of Paul and the bombardment of Copenhagen by Nelson dissolved it. England and France were now alike disposed for peace, the former because she had lost the support of a European Coalition, the latter because she had lost all means of attack, and also because of Bonaparte's grand plan of pacification. In the summer Bonaparte's endeavours are confined to saving the French colony in Egypt from the English, and to snatching a little territory from England's ally Portugal by means of Spain. But Cairo capitulated to the English in June, in which month also Spain made peace with Portugal. Accordingly in October the preliminaries of London were signed, and the treaty of Amiens followed in March. The allies of France paid for her naval defeats, Spain losing Trinidad and Holland Ceylon; but France, though she lost nothing, acquiesced by this treaty in the total failure of all her designs upon the East.

The globe was now at peace, and thanked Bonaparte for it. The equilibrium which had been destroyed by the Revolution seemed at length to be restored. Meanwhile the legislative reconstruction of France proceeded rapidly. This is the glorious period of Bonaparte's life, not, as has often been alleged, because he was as yet uncorrupted by power, but simply because a strong intelligent Government was the great need of France and repose the great need of Europe, and Bonaparte at this time satisfied both needs. The work of reconstruction which distinguishes the consulate, though it was continued under the empire, is the most enduring of all the achievements of Napoleon. The institutions of modern France date, not, as is often said, from the Revolution, but from the consulate. Not that Napoleon personally was endowed with a supreme legislative genius; his principal merit was to have given to France the first secure Government, the first Government capable of effective legislation, that she had had since the destruction of her ancient institutions. The task of reconstruction fell to him of necessity; his personal interference was in many respects, as we shall see, mischievous rather than beneficial; it is, however, also true that he appreciated the greatness of the work, urged it on with vigour, entered into it, impressed it with the stamp of his own personality, and left upon it the traces of his keen sagacity.

The institutions now created, and which form the organization of modern France, are—(1) the restored Church, resting on the Concordat; (2) the University, resting on the law of 11 Floréal, An X. (May 1, 1802); (3) the judicial system, commenced by the law of 27 Ventose, An VIII. (March 18, 1800), and completed by other laws in 1810; (4) the Codes:—(*a*) Code Civil (commission nominated 24 Thermidor, An VIII., August 12, 1800; it received the name Code Napoléon on September 3, 1807), (*b*) Code de Commerce, promulgated on September 10, 1807, (*c*) Code Pénal, (*d*) Code d'Instruction Criminelle (came into force January 1, 1811); (5) the system of local government, resting on the law of 18 Pluviose, An VIII. (February 7, 1800); (6) the Bank of France, established 28 Nivose, An VIII. (January 18, 1800); (7) the Legion of Honour, established 29 Floréal, An X. (May 19, 1802). These institutions, along with the military system, have in the main continued to the present day after the downfall of all the Napoleonic institutions which were purely political. It is rather the fortune than the merit of Napoleon that no similar mass of legislation can be ascribed to any other sovereign, since no other sovereign has ruled securely over an ancient and civilized country which has been suddenly deprived of all its institutions. It is also a matter of course that much of this legislation has been beneficial, since a *tabula rasa* relieves the legislator of many hindrances. In several points, on the other hand, we can see that France was sacrificed to Napoleon's personal interest. Thus the Concordat restored the ancient Papal Church, shorn of its wealth, and receiving from the state a subsidy of about £2,000,000. It was right to restore religion, and the Constitution Civile, which was cancelled by the Concordat, had been an insane act, the principal cause of the miseries of France for ten years. Nevertheless a great opportunity was lost of trying some new experiment, which might have led to a genuine revival of religion; but for this Napoleon cared nothing so long as he could pose as a new Constantine, detach the church from the cause of the Bourbons, and have the pope at his beck. In like manner the freedom of local government was sacrificed to the exigencies of his despotism. Among the most remarkable of his institutions was the University. The twenty-one universities of old France, including the great mother university of Paris, had fallen victims in 1792 to the insanity of the Legislative Assembly; nothing of the least efficiency had been established in their place, so that in March 1800 Lucien Bonaparte could write, "since the suppression of the teaching corporations instruction has almost ceased to exist in France." By laws of May 1806 and March 1808 was founded the modern University, that is, the whole teaching profession formed into a corporation and endowed by the state, a kind of church of education. This remarkable institution still exists. It has far too much centralization, and is in no way equal to the old system when that is intelligently worked, as in Germany; many learned men have severely condemned it; still it was a great constructive effort, and gave Napoleon the occasion for some striking and original remarks.

From the time of the battle of Marengo the system of Brumaire began to take a development which perhaps had not been clearly foreseen. Sieyès had wished to confine Bonaparte to the war department, Moreau perhaps had wished to keep him at Paris; in either case it had not been intended to create an august monarchy. But the fabulous success of Marengo, joined to the proofs Bonaparte gave of a really superior intelligence and commanding character, turned the French mind back into that monarchical groove in which it had so long run before the Revolution. Popular liberty had been already renounced by Sieyès, and the disastrous failure of republican institutions, which in four years, from 1795 to 1799, had brought the country to bankruptcy, civil war, and almost barbarism, inclined all public men to agree with him. The choice then could only lie between some form of aristocracy and the revival of monarchy either in the Bourbon family or in another. Napoleon's personal character decided this question. By the Concordat he wrested from the Bourbons the support of the church; by his military glory he seduced the noblesse, as is seen in the case of Ségur; by the pacification of the world he half reconciled to himself the foreign cabinets. But no sooner did this new form of monarchy begin to appear than Bonaparte began to find himself surrounded by new dangers. He was exposed to the hatred of the republicans, who had hitherto been appeased by the title of consul, and were now thrown into coalition with the defeated Jacobins, and also to the despair of the royalists, who saw themselves disappointed of restoration at the moment of the failure of republicanism. Nearer his person at the same time court-parties began to spring up. His brothers and sisters with Corsican shamelessness began to claim their share in the spoils. While he doubted what form his monarchy should take, and whether some character greater and more unique than that of a hereditary king could not be invented, they urged the claims of the *family*. Thus arose a standing feud between the Bonapartes and the Beauharnais, who in the interest of Josephine, already dreading divorce for her childlessness, opposed the principle of heredity.

In grappling with the defeated parties Bonaparte found a great advantage in his position. The constitution of Brumaire itself gave him great powers; popular institutions had been destroyed, not by him, but by the nation itself, which was weary of them; under the Directory the public had grown accustomed to the suppression of journals and to periodic *coups d'état* of the most savage violence. Bonaparte therefore could establish a rigorous despotism under the forms of a consular republic, mutilate the assemblies, and silence public opinion; he could venture occasionally upon acts of the most sweeping tyranny without shocking a people which had so lately seen Fructidor, not to say the Reign of Terror, and had been accustomed to call them liberty. The conspiracies began immediately after the return from Marengo, when the Corsicans Arena and Ceracchi, guilty apparently of little more than wild talk, were arrested in October 1800 at the Théâtre Français. But on December 24th of the same year, as he drove with Josephine to the opera, a sudden explosion took place in the Rue Saint-Nicaise, which killed and wounded several people and damaged about fifty houses; the carriage of Bonaparte escaped. He was still in the first fervour of his conversion from Jacobinism, and had not yet become alive to the danger to which he was exposed from royalism. He could therefore see nothing but Jacobinism in this plot, and proposed to meet the danger by some general measure calculated to eradicate what remained of the Jacobin party. But before this measure could be taken Fouché convinced him that he had been in error, and that he was in the presence of a new enemy, royalism roused into new vigour by the recent change in public opinion. Upon this Bonaparte acted most characteristically. By a singular stretch of Machiavelism he made use of the mistake into which he had himself led the public to crush the enemy which for the moment he feared most. He arrested and transported one hundred and thirty persons, whom he knew to be innocent of the plot, on the general ground of Jacobinism, substituting for all legal trial a resolution passed by the servile senate to the effect that "the measure was conservative of the constitution." This is Nivose, an act as enormous as Fructidor, and with a perfidy of its own.

Making use of victory was almost more Bonaparte's talent than winning it. These plots, so far from impeding his ascent to monarchy, were converted by him into steps upon which he mounted. They were so many arguments for heredity, which, in case Bonaparte should fall a prey to them, would furnish a successor. It had already been argued in the *Parallèle entre César, Cromwell, et Bonaparte* (October 1800) that heredity only could prevent the nation from falling again under the domination of the assemblies, under the yoke of the S (not Sieyès surely but Soldats) or under that of the Bourbons. He also made the plot of Nivose the occasion of a constitutional innovation. The assemblies devised by Sieyès had hitherto been simply useless, so much idle machinery. But in Nivose the precedent was set of giving the Senate a constituent power. To guard the constitution was its nominal function; this was now converted into a function of sanctioning alterations in the constitution, since every innovation became legal when the Senate declared it to be conservative of the constitution. In the hands of Bonaparte such a principle soon became fruitful enough.

The first open step towards monarchy was made at the conclusion of the treaty of Amiens. As pacificator of the globe, it was declared in the tribunate that Bonaparte deserved some mark of public gratitude. Upon this the Senate proposed to re-elect him First Consul for a further term of ten years. Bonaparte, disappointed, declared that he could only owe a prorogation of his magistracy to the people; to them therefore the question was referred, but in the form, Shall Napoleon Bonaparte be elected consul for life? and in this form it was adopted. Before the final step was taken and the First Consul transformed himself into the Emperor Napoleon, a great and portentous change had taken place in the spirit of his government. Before the year 1803 there was no fair reason to conclude that Bonaparte was too fond of war. For the two wars of the Revolution he had not been responsible: the first broke out when he was in Corsica, the second when he was in Egypt. But both wars had been brought to an end by him; he had closed the Temple of Janus, he was the great pacificator. In constructive legislation he had shown such zeal that it was easy to imagine him, though a great commander, as one who was capable of feeling the blessedness of the peacemaker. These illusions began to vanish in 1803 at the rupture of the peace of Amiens. This year 1803 is the turning-point in his life, and a great turning-point in French history. It may be considered the first year of modern France. The Revolution is at last over; the new organization begins to work regularly. The old noblesse is gone, and in place of the old Church there is the humbled Church of the Concordat. France is covered with an army of functionaries, servilely dependent on the Government; a strange silence has settled on the country which under the old régime had been noisy with the debate—if for the most part fruitless debate—of parliaments and estates. The Government is tenfold more imperious than it had been before 1789. And now it appears that Bonaparte had desired only the glory of having made peace, not peace itself, just as earlier after making the peace of Campo Formio, he had taken measures by the Egyptian expedition to embroil Europe again. What he wants is to complete his military success by humbling England. He had failed in 1798, when he had controlled but a small part of the power of France, a single army shut up in Egypt, when the French Government had been feeble and unintelligent, when England had been able to rally a European Coalition to her side. But surely he would succeed now, when the whole power of France, drawing after it Spain, Holland, Switzerland, and North Italy, was in his single hand, and when he could add the fleets of the other maritime powers to that of France; especially as coalitions against France seemed out of date, since Russia and Prussia had been united against England in 1801, and Germany was now suffering internal transformation under the united influence of France and Russia. But after so many years of war could he call on France for another effort? In the first place all the new institutions of France, having grown up in war, were adapted for war rather than for anything else; in the second place he hoped to spare the French all war-taxation by making the expense fall upon the allies.

From this memorable rupture flowed all the terrible events of the Napoleonic age. It is in one respect difficult to understand, because in the eleven years of the war with England Bonaparte was never able to strike a single blow at his enemy, while that enemy destroyed his fleets, conquered his colonies, and by arming all Europe against him at length brought down his power. Why did Bonaparte engage in a war in which he was condemned to be so purely passive? It seems that, as in 1798, he totally miscalculated the English maritime power, and that in 1803, though to Lord Whitworth he spoke of the invasion of England as almost impossible, yet in reality he expected to achieve that impossibility, as he had achieved so many others. Thus the angry negotiation with Lord Whitworth, the stormy scene at the Tuileries, the violent detention of the English residents in France at the moment of the rupture, are to be regarded as studied contrivances by which he concealed the wantonness of his breach of the European peace and tried to throw the blame of it upon the English. That he was really bent upon forcing a war appears from his allowing Sébastiani's report of his mission in the East, full of hints of the intention of France to re-occupy Egypt at the first opportunity, to appear in the *Moniteur*. This report, besides offending England, caused her to keep resolute possession of Malta, and, when Bonaparte appealed to the treaty of Amiens, England replied by pointing to the new annexations of France, which had just divided Piedmont into departments. "Ce sont des bagatelles," Lord Whitworth reports Bonaparte to have answered, but he adds in a parenthesis which has never been printed, "The expression he made use of was too trivial and vulgar to find a place in a despatch or anywhere but in the mouth of a hackney coachman!"

By this rupture Europe relapsed into the fearful disorder from which Brumaire seemed to have rescued it; only in place of revolutionary fanaticism the disturbing cause was now the deliberate calculating ambition of a great general and crafty politician, who already commanded the resources of a large part of Europe. This same year 1803 saw the first steps taken towards the subjugation of Germany. The annexation to France of the left bank of the Rhine led to a revolution in the Germanic system and to a complete transformation of the Diet, by which Austria lost the greater part of her influence over the minor German states; this influence passed to France. As soon as the rupture with England took place Bonaparte took up a position in the heart of Germany by seizing Hanover.

All this was done while Bonaparte was still nominally only consul in the French republic. But the rupture with England furnished him with the occasion of throwing off the last disguise and openly restoring monarchy. It was a step which required all his audacity and cunning. He had crushed Jacobinism, but two great parties remained. There was first the more moderate republicanism, which might be called Girondism, and was widely spread among all classes and particularly in the army. Secondly, there was the old royalism, which after many years of helpless weakness had revived since Brumaire. These two parties, though hostile to each other, were forced into a sort of alliance by the new attitude of Bonaparte, who was hurrying France at once into a new revolution at home and into an abyss of war abroad. England too, after the rupture, favoured the efforts of these parties. Royalism from England began to open communications with moderate republicanism in France. Pichegru acted for the former, and the great representative of the latter was Moreau, who had helped to make Brumaire in the tacit expectation probably of rising to the consulate in due course when Bonaparte's term should have expired, and was therefore hurt in his personal claims as well as in his republican principles. Bonaparte watched the movement through his ubiquitous police, and with characteristic strategy determined not merely to defeat it but to make it his stepping stone to monarchy. He would ruin Moreau by fastening on him the stigma of royalism; he would persuade France to make him emperor in order to keep out the Bourbons. He achieved this with the peculiar mastery which he always showed in villainous intrigue. Moreau had in 1797 incurred blame by concealing his knowledge of Pichegru's dealings with the royalists. That he should now meet and hold conversation with Pichegru at a moment when Pichegru was engaged in contriving a royalist rebellion associated his name still more closely with royalism, and Pichegru brought with him wilder partisans such as Georges the Chouan. That Moreau would gladly have seen and gladly have helped an insurrection against Bonaparte is certain; any republican, and what is more any patriot, would at that moment have risked much to save France from the ruin that Bonaparte was bringing on her. But Bonaparte succeeded in associating him with royalist schemes and with schemes of assassination. Controlling the Senate, he was able to suppress the jury; controlling every avenue of publicity, he was able to suppress opinion; and the army, Moreau's fortress, was won through its hatred of royalism. In this way Bonaparte's last personal rival was removed. There remained the royalists, and Bonaparte hoped to seize their leader, the Comte d'Artois, who was expected, as the police knew, soon to join Pichegru and Georges at Paris. What Bonaparte would have done with him we may judge from the course he took when the Comte did not come. On March 15, 1804, the Duc d'Enghien, grandson of the Prince de Condé, residing at Ettenheim in Baden, was seized at midnight by a party of dragoons, brought to Paris, where he arrived on the 20th, confined in the castle of Vincennes, brought before a military commission at 2 o'clock the next morning asked whether he had not borne arms against the republic, which he acknowledged himself to have done, conducted to a staircase above the moat and there shot, and buried in the moat.

This deed was perfectly consistent with Bonaparte's professed principles, so that no misunderstanding or passing fit of passion is required to explain it. He had made, shortly before, a formal offer to the pretender through the king of Prussia, by which he had undertaken to pay him a handsome pension in return for the formal abdication of his rights. This had been refused, and Bonaparte felt free. That the best course was to strike at the heads of the family was a shrewd conclusion. Neither Louis nor Charles were precisely heroes; and then the whole revolutionary party in France would applaud a new tragedy like that of January 1793. (Accordingly Bernadotte and Curée were delighted with it.) That the Duc d'Enghien was innocent of the conspiracy was nothing to the purpose; the act was political, not judicial; accordingly he was not even charged with complicity. That the execution would strike horror into the cabinets, and perhaps bring about a new Coalition, belonged to a class of considerations which at this time Bonaparte systematically disregarded.

This affair led immediately to the thought of giving heredity to Bonaparte's power. The thought seems to have commended itself irresistibly even to strong republicans and to those who were most shocked by the murder. To make Bonaparte's position more secure seemed the only way of averting a new Reign of Terror or new convulsions. He himself felt some embarrassment. Like Cromwell, he was afraid of the republicanism of the army, and heredity pure and simple brought him face to face with the question of divorcing Josephine. To propitiate the army he chose from the titles suggested to him—consul, stadtholder, &c.—that of emperor, undoubtedly the most accurate, and having a sufficiently military sound. The other difficulty, after much furious dissension among the two families of Bonaparte and Beauharnais, was evaded by giving Napoleon himself (but none of his successors) a power of adoption, and fixing the succession, in default of a direct heir natural or adoptive, first in Joseph and his descendants, then in Louis and his descendants. Except abstaining from the regal title, no attempt was made to conceal the abolition of republicanism. Bonaparte was to be called Napoleon, and "sire" and "majesté"; grand dignitaries with grand titles were appointed; and "citoyen" from this time gave way to "monsieur." The change was made by the constituent power of the Senate, and the senatus-consulte is dated May 18, 1804.

It required some impudence to condemn Moreau for royalism at the very moment that his rival was re-establishing monarchy. Yet his trial began on May 15th. The death of Pichegru, nominally by suicide, on April 6th had already furnished the rising sultanism with its first dark mystery. Moreau was condemned to two years' imprisonment, but was allowed to retire to the United States.

These changes destroyed all that remained of the political life of France. Jacobinism had been eradicated in Nivose; republicanism and royalism were paralysed now. Henceforth there was no power or person in France but Bonaparte, and over Europe there hung a danger more terrible than had ever threatened it before. The combined resources of several countries and an unparalleled military force were at the absolute disposal of a general and administrator of commanding ability, who had shown by the manner of his rupture with England that he was bent upon undertaking vast military enterprises. This danger, which was clearly visible early in 1804, could not be averted. His scheme indeed failed. He did not conquer England, nor recover Malta and reoccupy Egypt. His forces were drawn in another direction. But, if England suffered less, Europe suffered far more than could have been feared in 1804. The wars which now begin are not, like those of the French Revolution, wars of principle, for the principles of the Revolution have been recanted and are held by no one in so much contempt as by Bonaparte. Nor are they armed litigations like the old wars of Europe, but unique experiments in which millions of lives are sacrificed to the ambition of an individual.

Throughout 1804 and the first part of 1805 the policy of Bonaparte is such as might be called insane, if he had had the ordinary objects of a ruler; it is explained by the consideration that he wants war, even if it should be war with all the world. He had acted in a similar way in 1798. In thinking that he should profit by war he was not mistaken. Had he only gone to war with the whole Continent at once, he would not, as the event proved, have overestimated his strength. But he was not, in the long run, a match for England and the Continent together; he made at starting the irremediable mistake of not dividing these two enemies. He seems indeed to have set out with a monstrous miscalculation which might have ruined him very speedily, for he had laid his plan for an invasion of England and a war in Europe at the same time. If we imagine the invasion successfully begun, we see France thrown back into the position of 1799, her best general and army cut off from her by the sea, while Austria, Russia, and perhaps Prussia pour their armies across the Rhine; but we see that the position would have been far worse than in 1799, since France without Bonaparte in 1805 would have been wholly paralysed. As it was, the signal failure of his English enterprise left room for a triumphant campaign in Germany, and Ulm concealed Trafalgar from the view of the Continent. The European Coalition had been disarmed since Brumaire by the belief that Bonaparte's Government was less intolerably aggressive than that of the Directory; this belief gave place in 1803 to a conviction that he was quite as aggressive and much more dangerous. England therefore might hope to revive the Coalition, and in the spring of 1804 she recalled Pitt to the helm in order that he might do this. The violent proceedings of Bonaparte on the occasion of the rupture, his occupation of Hanover, his persecution of the English representatives in Germany,—Spencer Smith at Stuttgart, Drake at Munich, Sir G. Rumbold at Hamburg,—created an alarm in the cabinets greater than that of 1798, and the murder of D'Enghien shocked as much as it alarmed them. Positive conquest and annexation of territory too now went on as rapidly and as openly as in 1798. The new empire compared itself to that of Charlemagne, which extended over Italy and Germany, and on December 2, 1804, a parody of the famous transference of the empire took place in Notre Dame, the pope (Pius VII.) appearing there to crown Napoleon, who, however, took the crown from his hands and placed it himself upon his own head. Meanwhile the Italian republic was changed into a kingdom, which at first Bonaparte intended to give to his brother Joseph, but in the end accepted for himself. In the first months of 1805, fresh from the *sacre* in Notre Dame, he visited Italy and received the iron crown of the Lombard kings at Milan. Soon after the Ligurian republic was annexed, and a principality was found for his brother-in-law Bacciochi in Lucca and Piombino. By these acts he seemed to show himself not only ready but eager to fight with all Europe at once. It was not his fault that in the autumn of 1805, when he fought with Austria and Russia in Germany, he was not also maintaining a desperate struggle in the heart of England; it was not his fault that Prussia was not also at war with him, for his aggressions had driven Prussia almost to despair, and only once—that is, in the matter of Sir G. Rumbold—had he shown the smallest consideration for her. And yet at first fortune did not seem to favour him.

Had public opinion been less enslaved in France, had the frivolity of the nation been less skilfully amused by the operatic exhibitions of the new court and the *sacre* in Notre Dame, it would have been remarked that, after most needlessly involving France in war with England, Bonaparte had suffered half the year 1803, all the year 1804, and again more than half the year 1805 to pass without striking a single blow, that after the most gigantic and costly preparations the scheme of invasion was given up, and that finally France suffered a crushing defeat at Trafalgar which paralysed her on the side of England for the rest of the war. In order to understand in any degree the course he took, it seems necessary to suppose that the intoxication of the Marengo campaign still held him, that as then, contrary to all expectation, he had passed the Alps, crushed his enemy, and instantly returned, so now he made no doubt of passing the Channel, signing peace in London, and returning in a month with a fabulous indemnity in his pocket to meet the Coalition in Germany. To conquer England it was worth while to wait two years, but his position was very critical when, after losing two years, he was obliged to confess himself foiled. He retrieved his position suddenly, and achieved a triumph which, though less complete than that which he had counted on, was still prodigious,—the greatest triumph of his life. At the moment when his English scheme was ending in deplorable failure, he produced another, less gigantic but more solid, which he unfolded with a rapid precision and secrecy peculiar to himself. In the five years which had passed since Marengo his position for the purposes of a Continental war had improved vastly. Then he had no footing either in Germany or Italy, and his new office of First Consul gave him a very precarious control over the armies, which themselves were in a poor condition. Now his military authority was absolute, and the armies after five years of imperialism were in perfect organization; he had North Italy to the Adige; he had Hanover; and since the Germanic revolution of 1803 Bavaria, Würtemberg, and Baden had passed over to his side. Therefore as the Coalition consisted only of Austria, Russia, and England he might count upon success, and the more confidently if he could strike Austria before the arrival of the Russian army. It is strange that in this estimate it should be unnecessary to take Prussia into the account, since the Prussian army (consisting of 250,000 men) was at that time supposed to be a match by itself for the French. At the last moment, and in the midst of the Austerlitz campaign, Napoleon might have been brought near to ruin by a sudden resolution on the part of the king of Prussia, and it is to be added that he did not escape this risk by any circumspection of his own. But for ten years Prussia had been rooted in the strangest system of immovable neutrality, and in this war both sides had to put up with the uncertainty whether the prodigious weight of the army of Frederick would not be thrown suddenly either into its own or into the opposite scale. It was at the end of August 1805 that Napoleon made his sudden change of front. At the beginning of that month he had been still intent on the invasion of England; ever since March maritime manœuvres on an unparalleled scale had been carried on with the object of decoying the English fleets away from the Channel, and so giving an opportunity for the army of invasion to cross it in a flotilla under the protection of French fleets. But in spite of all manœuvres a great English fleet remained stationary at Brest, and Nelson, having been for a moment decoyed to Barbados, returned again. In the last days of August Admiral Villeneuve, issuing from Ferrol, took alarm at the news of the approach of an English fleet, and instead of sailing northward faced about and retired to Cadiz. Then for the first time Napoleon admitted the idea of failure, and saw the necessity of screening it by some great achievement in another quarter. He resolved to throw his whole force upon the Coalition, and to do it suddenly. Prussia was to be bribed by the very substantial present of Hanover.

Five years had passed since Napoleon had taken the field when the second period of his military career began. He now begins to make war as a sovereign with a boundless command of means. For five years from 1805 to 1809 he takes the field regularly, and in these campaigns he founds the great Napoleonic empire. By the first he breaks up the Germanic system and attaches the minor German states to France, by the second he humbles Prussia, by the third he forces Russia into an alliance, by the fourth he reduces Spain to submission, by the fifth he humbles Austria. Then follows a second pause, during which for three years Napoleon's sword is in the sheath, and he is once more ruler, not soldier.

From the beginning of this second series of wars the principles of the Revolution are entirely forgotten by France, which is now a monarchy and even a propagator of monarchical principles.

Napoleon's strategy always aims at an overwhelming surprise. As in 1800, when all eyes were intent on Genoa, and from Genoa the Austrians hoped to penetrate into France, he created an overwhelming confusion by throwing himself across the Alps and marching not upon Genoa but upon Milan, so now he appeared not in front of the Austrians but behind them and between them and Vienna. The wavering faith of Bavaria had caused the Austrians to pass the Inn and to advance across the country to Ulm. It was intended that the Russians should join them here, and that the united host should invade France, taking Napoleon, as they fondly hoped, by surprise. So often unfortunate in their choice of generals, they had this time made the most unfortunate choice of all. Mack, who at Naples in 1799 had moved the impatient contempt of Nelson, now stood matched against Napoleon at the height of his power. He occupied the line of the Iller from Ulm to Memmingen, expecting the attack of Napoleon, who personally lingered at Strasburg, in front. Meanwhile the French armies swarmed from Hanover and down the Rhine, treating the small German states half as allies half as conquered dependants, and disregarding all neutrality, even that of Prussia, till they took up their positions along the Danube from Donauwörth to Ratisbon far in the rear of Mack. The surprise was so complete that Mack, who in the early days of October used the language of confident hope, on the 19th surrendered at Ulm with about 26,000 men, while another division, that of Werneck, surrendered on the 18th to Murat at Nördlingen. In a month the whole Austrian army, consisting of 80,000 men, was entirely dissolved. Napoleon was master of Bavaria, recalled the elector to Munich, and received the congratulations of the electors of Würtemberg and Baden (they had just at this time the title of electors). It was the stroke of Marengo repeated, but without a doubtful battle and without undeserved good luck.

After Marengo it had been left to Moreau to win the decisive victory and to conclude the war; this time there was no Moreau to divide the laurels. The second part of the campaign begins at once; on October 28 Napoleon reports that a division of his army has crossed the Inn. He has now to deal with the Russians, of whom 40,000 men have arrived under Kutusoff. He reaches Linz on November 4, where Gyulai brought him the emperor's proposals for an armistice. He replies by demanding Venice and Tyrol and insisting upon the exclusion of Russia from the negotiations, conditions which, as he no doubt foresaw, Gyulai did not think himself authorized to accept. But Napoleon did not intend this time, as in 1797 and in 1800, to stop short of Vienna. Nothing now could resist his advance, for the other Austrian armies, that of the archduke John in Tyrol and that of the archduke Charles on the Adige, were held in play by Ney and Masséna, and compelled at last, instead of advancing to the rescue, to retire through Carniola into Hungary. On November 14 he dates from the palace of Schönbrunn; on the day before Murat had entered Vienna, which the Austrian emperor, from motives of humanity, had resolved not to defend, and the French also succeeded by an unscrupulous trick in getting possession of the bridges over the Danube. So far his progress had been triumphant, and yet his position was now extremely critical. The archduke Charles was approaching from Hungary with 80,000 Austrians; another Russian army was entering Moravia to join Kutusoff, who had with great skill escaped from the pursuit of Murat after the capture of Vienna. Napoleon, though he had brought 200,000 men into Germany, had not now, since he was obliged to keep open his communications down the valley of the Danube, a large army available for the field. But, what was much more serious, he had recklessly driven Prussia into the opposite camp. He had marched troops across her territory of Ansbach, violating her neutrality, and in consequence on November 3 (while Napoleon was at Linz) she had signed with Russia the treaty of Potsdam, which practically placed 180,000 of the most highly drilled troops in the world at the service of the Coalition. Such had been Napoleon's rashness, for his audacious daring was balanced indeed by infinite cunning and ingenuity, but was seldom tempered by prudence. In this position, it may be asked, how could he expect ever to make his way back to France? What he had done to Mack Prussia would now do to him. The army of Frederick would block the Danube between him and France, while the Russians and Austrians united under the archduke would seek him at Vienna.

As at Marengo, fortune favoured his desperate play. The allies had only to play a waiting game, but this the Russians and their young czar, who was now in the Moravian headquarters, would not consent to do. He was surrounded by young and rash counsellors, and the Russians, remembering the victories of Suwaroff in 1799, and remarking that almost all Napoleon's victories hitherto had been won over Austrians, had not yet learned to be afraid of him. Napoleon became aware of their sanguine confidence from Savary, whom he had sent to the czar with proposals; he contrived to heighten it by exhibiting his army as ill-prepared to Dolgorouki, sent to him on the part of the czar. The end was that the Russians (80,000 men, aided by about 15,000 Austrians) rushed into the battle of Austerlitz (December 2, 1805), which brought the third Coalition to an end, as that of Hohenlinden had brought the second. Nowhere was Napoleon's superiority more manifest; the Russians lost more than 20,000 men, the Austrians 6000. The former retired at once under a military convention, and before the year 1805 was out the treaty at Pressburg was concluded with Austria (December 26) and that of Schönbrunn with Prussia (December 15).

It was a transformation-scene more bewildering than even that of Marengo, and completely altered the position of Napoleon before Europe. To the French indeed Austerlitz was not, as a matter of exultation, equal to Marengo, for it did not deliver the state from danger, but only raised it from a perilous eminence to an eminence more perilous still. But as a military achievement it was far greater, exhibiting the army at the height of its valour and organization (the illusion of liberty not yet quite dissipated), and the commander at the height of his tactical skill; and in its historical results it is greater still, ranking among the great events of the world. For not only did it found the ephemeral Napoleonic empire by handing over Venetia to the Napoleonic monarchy of Italy, and Tyrol and Vorarlberg to Napoleon's new client Bavaria; it also destroyed the Holy Roman Empire while it divided the remains of Hither Austria between Würtemberg and Baden. In the summer of 1806 the emperor of Austria (he had this title since 1804) solemnly abdicated the title of Roman emperor; the ancient diet of Ratisbon was dissolved, and a new organization was created under the name of Confederation of the Rhine, in which the minor states of Germany were united under the protectorate of Napoleon. Bavaria and Würtemberg at the same time were raised into kingdoms. In all the changes which have happened since, the Holy Roman Empire has never been revived, and this event remains the greatest in the modern history of Germany.

But Austerlitz was greater than Marengo in another way. That victory had a tranquillizing effect, and was soon followed by a peace which lasted more than four years. But the equilibrium established after Austerlitz was of the most unstable kind; it was but momentary, and was followed by a succession of the most appalling convulsions; the very report of the battle was fatal to William Pitt. A French ascendency had existed since 1797, and Napoleon's Government had at first promised to make it less intolerable. Since 1803 this hope had vanished, but now suddenly the ascendency was converted into something like a universal monarchy. Europe could not settle down. The first half of 1806 was devoted to the internal reconstruction of Germany and to the negotiation of peace with the two great belligerents who remained after Austria and Prussia had retired, viz., England and Russia. But these negotiations failed, and in failing created suddenly a new Coalition. In England, Fox showed unexpectedly all the firmness of Pitt; and the czar refused his ratification to the treaty which his representative at Paris, D'Oubril, had signed. But the negotiations had gone far enough to give Prussia deep offence. At a moment when she found herself almost shut out of the German world by the new Confederation, Napoléon was found coolly treating with England for the restoration of Hanover to George III. In August 1806, just at the moment of the dissolution of the Holy Roman Empire and the formation of the Confederation of the Rhine, Prussia suddenly mobilized her army, and about the same time Russia rejected the treaty. This amounted practically to a new Coalition, or to a revival of the old one with Prussia in the place of Austria. No one knew so well as Napoleon the advantage given by suddenness and rapidity. The year before he had succeeded in crushing the Austrians before the Russians could come up; against Prussia he had now the advantage that she had long been politically isolated, and could not immediately get help either from Russia or England,—for the moment only Saxony and Hesse-Cassel stood by her,—while his armies, to the number of 200,000 men, were already stationed in Bavaria and Swabia, whence in a few days they could arrive on the scene of action. The year before Austria had been ruined by the incapacity of Mack; Prussia now suffered from an incapacity diffused through the higher ranks both of the military and civil service. Generals too old, such as Brunswick and Möllendorf, a military system corrupted by long peace, a policy without clearness, a diplomacy without honour, had converted the great power founded by Frederick into a body without a soul. There began a new war of which the incidents are almost precisely parallel to those of the war which had so lately closed. As the Austrians at Ulm, so now Napoleon crushed the Prussians at Jena and Auerstädt (October 14) before the appearance of the Russians; as he entered Vienna, so now he enters Berlin (October 27); as he fought a second war in Moravia, in which Austria played a second part to Russia, so now from November 1806 to June 1807 he fights in East Prussia against the Russians aided with smaller numbers by the Prussians; as he might then, after all his successes, have been ruined by the intervention of Prussia, so now, had Austria struck in, he might have found much difficulty in making his way back to France; as at Austerlitz, so at Friedland in June 1807 the Russians ran hastily into a decisive battle in which they ruined their ally but not themselves; as Austria at Pressburg, so Prussia at Tilsit signed a most humiliating treaty, while Russia, as before, escaped, not this time by simply retiring from the scene, but by a treaty in which Napoleon admitted her to a share in the spoils of victory.

Here was a second catastrophe far more surprising and disastrous than that which it followed so closely. The defeat of Austria in 1805 had been similar to her former defeats in 1800 and 1797; Ulm had been similar to Hohenlinden, the treaty of Pressburg to that of Lunéville. But the double defeat of Jena and Auerstädt, in which the duke of Brunswick, the old general not only of 1792 but of the Seven Years' War, found his death, dissolved for ever the army of the great Frederick; and it was followed by a general panic, surrender of fortresses, and submission on the part of civil officials, which seemed almost to amount to a dissolution of the Prussian state. The defence of Colberg by Gneisenau and the conduct of the Prussian troops under Lestocq at Eylau were almost the only redeeming achievements of the famous army which half a century before had withstood for seven years the attack of three great powers at once. This downfall was expressed in the treaty of Tilsit, which was vastly more disastrous to Prussia than that of Pressburg had been to Austria. Prussia was partitioned between Saxony, Russia, and a newly established Napoleonic kingdom of Westphalia. Her population was reduced by one-half, her army from 250,000 to 42,000 (the number fixed a little later by the treaty of September 1808), and Napoleon contrived also by a trick to saddle her for some time with the support of a French army of 150,000 men. She was in fact, and continued till 1813 to be, a conquered state. Russia on the other hand came off with more credit, as well as with less loss, than in the former campaign. At Eylau in January 1807 she in part atoned for Austerlitz. It was perhaps the most murderous battle that had been fought since the wars began, and it was not a victory for Napoleon. Friedland too was well-contested.

In the two years between August 1805 and the treaty of Tilsit Napoleon had drifted far from his first plan of an invasion of England. But he seemed brought back to it now by another route. England had roused a Coalition against him, which he had not only dissolved, but seemed able now to make impossible for the future. Austria was humbled, Prussia beneath his feet. Why should Russia for the future side with England against him? From the outset her interference in the wars had been somewhat unnecessary; she had had little real interest in the questions of Malta, Naples, or Sardinia. The Russians themselves felt this so much that after Friedland they forced Alexander to make peace. But as Paul, when he left the Second Coalition, had actually joined France, Napoleon now saw the means of making Alexander do the same. England's tyranny of the seas had been attacked by the great Catherine and again by Paul; on this subject therefore Russian policy might co-operate with Napoleon, and, if a bribe were needed, he would countenance her in robbing her ally Prussia, and he could promise her freedom in her eastern enterprises. Such was the basis of the treaty of Tilsit, negotiated between Napoleon and Alexander on an island in the river Niemen, by which treaty the fate of Prussia was decided, and at the same time the foundation of the Napoleonic empire firmly laid. It was a coalition of France and Russia to humble England, chiefly by means of the Continental system. The invasion of England had failed, and England had destroyed at Trafalgar the allied fleets of France and Spain, a defeat which, to the public eye had been lost in the splendid triumph of Ulm; but Napoleon now returns to the attack upon England at the head of a universal confederacy which he has organised against her.

A pause occurs after Friedland during which Europe begins slowly to realise her position and to penetrate the character of Napoleon. It took some time to wear out his reputation of peace-maker; at his breach with England in 1803 he had appealed to that jealousy of England's maritime power which was widely spread; many thought the war was forced upon him, and as to the war of 1805 it could not be denied that Austria and Russia had attacked him. His absolute control over the French press enabled him almost to dictate public opinion.

But the conquest of Germany, achieved in little more time than had sufficed to Bonaparte ten years before for the conquest of Italy, put him in a new light. He had already passed through many phases: he had been the invincible champion of liberty, then the destroyer of Jacobinism and champion of order, then the new Constantine and restorer of the church, then the pacificator of the world, then the founder of a new monarchy in France. Now suddenly, in 1807, he stands forth in the new character of head of a great European confederacy. It has been usual to contrast the consulate with the empire, but the great transformation was made by the wars of 1805–7, and the true contrast is between the man of Brumaire and the man of Tilsit. The empire as founded in 1804 did not perhaps differ so much from the consulate after Marengo as both differed, alike in spirit and form, from the empire such as it began to appear after Pressburg and was consolidated after Tilsit. Between 1800 and 1805 Napoleon, under whatever title, was absolute ruler of France, including Belgium, the left bank of the Rhine, Savoy, and Nice, and practically also ruler of Holland, Switzerland, and North Italy to the Adige, which states had a republican form. The title emperor meant in 1804 little more than military ruler. But now emperor has rather its mediæval meaning of paramount over a confederacy of princes. Napoleon has become a king of kings. This system had been commenced in the consulate, when a kingdom of Etruria under the consul's protection was created for the benefit of his ally, the king of Spain; it was carried a stage further on the eve of the war of 1805, when the kingdom of Italy was created, of which Napoleon himself assumed the sceptre, but committed the government to Eugène Beauharnais as viceroy. But now almost all Italy and a great part of Germany is subjected to this system. The Bonaparte family, which before had contended for the succession in France, so that Joseph actually refuses, as beneath him, the crown of Italy, now accept subordinate crowns. Joseph becomes king of Naples, the Bourbon dynasty having been expelled immediately after the peace of Pressburg; Louis becomes king of Holland; Jerome, the youngest brother, receives after Tilsit a kingdom in North Germany composed of territory taken from Prussia, of Hanover, and of the electorate of Hesse-Cassel, which had shared the fall of Prussia; somewhat earlier Murat, husband of the most ambitious of the Bonaparte sisters, Caroline, had received the grand-duchy of Berg. By the side of these Bonaparte princes there are the German princes who now look up to France, as under the Holy Roman Empire they had looked up to Austria. These are formed into a Confederation in which the archbishop of Mainz (Dalberg) presides, as he had before presided in the empire. Two of the princes have now the title of kings, and, enriched as they are by the secularization of church lands, the mediatization of immediate nobles, and the subjugation of free cities, they have also the substantial power. A princess of Bavaria weds Eugène Beauharnais, a princess of Würtemberg Jerome Bonaparte. At its foundation in 1806 the Confederation had twelve members, but in the end it came to include almost all the states of Germany except Austria and Prussia.

A change seems to take place at the same time in Napoleon's personal relations. In 1804, though the divorce of Josephine was debated, yet it appears to be Napoleon's fixed intention to bequeath his crown by the method of adoption to the eldest son of Louis by Hortense Beauharnais. But this child died suddenly of croup in the spring of 1807, while Napoleon was absent in Germany, and the event occurring at the moment when he attained his position of king of kings probably decided him in his own mind to proceed to the divorce.

It was impossible to give crowns and principalities to the Bonaparte family without allowing a share of similar distinctions to the leading politicians and generals of France. He was therefore driven to revive titles of nobility. To do this was to abandon the revolutionary principle of equality, but Napoleon always bore in mind the necessity of bribing in the most splendid manner the party upon whose support ever since Brumaire he had depended, and which may be described shortly as the Senate. When in 1802 he received the life-consulate, he had proceeded instantly to create new dotations for the senators; now he feels that he must devise for them still more splendid bribes. His first plan is to give them feudal lordships outside France. Thus Berthier, his most indispensable minister, becomes sovereign prince of Neufchatel, Bernadotte sovereign prince of Pontecorvo, Talleyrand sovereign prince of Benevento. Especially out of the Venetian territory, given to France at Pressburg, are taken fiefs (not less than twelve in all), to which are attached the title of duke. These innovations fall in 1806, that is, in the middle of the period of transformation. But after Tilsit, when Napoleon felt more strongly both the power and the necessity of rewarding his servants, he created formally a new noblesse and revived the *majorat* in defiance of the revolutionary code. In the end, besides the three sovereign princes just mentioned, he created four hereditary princes (Berthier is in both lists) and thirty-one hereditary dukes. There were also many counts and barons. The system was prodigiously wasteful. Of public money Berthier received more than £50,000 a year, Davoust about £30,000, nine other officials more than £10,000, and twenty-three others more than £4000.

After Marengo he had seen the importance of reconciling Europe to his greatness by making peace. After Tilsit it was still more urgently necessary that he should dispel the alarm which his conquests had now excited everywhere. But this time he made no attempt to do so; this time he can think of nothing but pushing his success to the destruction of England; and Europe gradually became aware that the evil so long dreaded of a destruction of the balance of power had come in the very worst form conceivable, and that her destiny was in the hands of a man whose headlong ambition was as unprecedented as his energy and good fortune.

As in 1805 he had been drawn into the conquest of Germany in the course of a war with England, so now he assails all the neutral powers, and shortly afterwards violently annexes Spain, not so much from abstract love of conquest as in order to turn against England the forces of all the Continent at once. As he had left Boulogne for Germany, he now, as it were, returns to Boulogne. His successes had put into his hands two new instruments of war against England, instruments none the less welcome because the very act of using them made him master of the whole Continent. He had hinted at the first of these when the war with England began in 1803, by saying that in this war he did not intend that there should be any neutrality; what he meant was explained in 1806 by the edict issued from Berlin. In addition to that limited right which the belligerent has by international law to prevent by blockade the trade of a neutral with the enemy and to punish the individual trader by confiscation of ship and goods, Napoleon now assumed the right of preventing such commerce without blockade by controlling the neutral Governments. English goods were to be seized everywhere, and the harbours of neutrals to be closed against English ships under penalty of war with France. Such a threat, involving a claim to criticize and judge the acts of neutral Governments and to inflict on them an enormous pecuniary fine, was almost equivalent to the annexation at one stroke of all the neutral states. The other instrument had a similar character. The French fleet having been crippled at Trafalgar, he proposed now to reinforce it by all the other fleets in Europe, and to get possession of all the resources of all the maritime states. His eyes therefore become now fixed on Denmark, Portugal, and Spain.

Such is Napoleon as king of kings, and such are his views. This unique phase of European history lasted five years, reckoning from the treaty of Tilsit to the breach with Russia. Europe consists now of a confederacy of monarchical states looking up to a paramount power (like India at the present day). The confederacy is held together by the war with England, which it puts under an ineffective commercial blockade, suffering itself in return a more effective one. But Napoleon feels that Spain and Portugal must be brought under his immediate administration, in order that their maritime resources may be properly turned against England. Austria also has by no means been sufficiently humbled, and Prussia is humbled so intolerably that she is forced into plans of insurrection. Throughout these five years a European party of insurrection is gradually forming. It has two great divisions, one scattered through Germany, at the head of which Austria places herself in 1809, the other in Spain and Portugal, which is aided by England. In Germany this movement is successfully repressed until 1813, but in the Peninsula it gains ground steadily from 1809. After 1812 both movements swell the great Anti-Napoleonic Revolution which then sets in.

Immediately after Tilsit Napoleon entered on his new course, which had been arranged with Russia in secret articles. In August he required the king of Denmark to declare war with England; but here England, seeing herself threatened by a coalition of all Europe at once, interfered with desperate resolution. She required Denmark to surrender her fleet (consisting of twenty ships of the line and a number of frigates) in deposit, promising to restore it at the peace, and when she received a refusal took possession of it by force. At the same time an army is formed under Junot for the invasion of Portugal, with which state, as the old ally of England, Napoleon used no ceremony. The feeble state consented to almost all his demands, agreed to enter the Continental system and to declare war against England; only the regent had a scruple which restrained him from confiscating the property of private Englishmen. From this moment Portugal is doomed and negotiations are opened with Spain concerning the partition of it. But out of these negotiations grew unexpected events.

For more than ten years Spain had been drawn in the wake of revolutionary France; to Napoleon from the beginning of his reign she had been as subservient as Holland or Switzerland; she had made war and peace at his bidding, had surrendered Trinidad to make the treaty of Amiens, had given her fleet to destruction at Trafalgar. In other states equally subservient, such as Holland and the Italian Republic, Napoleon had remodelled the government at his pleasure, and in the end had put his own family at the head of it. After Tilsit he thought himself strong enough to make a similar change in Spain, and the occupation of Portugal seemed to afford the opportunity of doing this. By two conventions signed at Fontainebleau on October 27th the partition of Portugal was arranged with Spain. The Prince of the Peace was to become a sovereign prince of the Algarves, the king of Spain was to have Brazil with the title of emperor of the two Americas, &c.; but the main provision was that a French army was to stand on the threshold of Spain ready to resist any intervention of England. The occupation of Portugal took place soon after, Junot arriving at Lisbon on November 30, just as the royal family with a following of several thousands set sail for Brazil under protection of the English fleet. At the same time there commenced in defiance of all treaties a passage of French troops into Spain, which continued until 80,000 had arrived, and had taken quiet possession of a number of Spanish fortresses. At last Murat was appointed to the command of the army of Spain. He entered the country on March 1, 1808, and marched on Madrid, calculating that the king would take flight and take refuge at Seville or Cadiz. This act revealed to the world the nature of the power which had been created at Tilsit. The lawless acts of Napoleon's earlier life were palliated by the name of the French Revolution, and since Brumaire he had established a character for comparative moderation. But here was naked violence without the excuse of fanaticism; and on what a scale! One of the greater states of Europe was in the hands of a burglar, who would moreover, if successful, become king not only of Spain but of a boundless empire in the New World. The sequel was worse even than this commencement, although the course which events took seems to show that by means of a little delay he might have attained his end without such open defiance of law. The administration of Spain had long been in the contemptible hands of Manuel Godoy, supposed to be the queen's lover, yet at the same time high in the favour of King Charles IV. Ferdinand, the heir apparent, headed an opposition, but in character he was not better than the trio he opposed, and he had lately been put under arrest on suspicion of designs upon his father's life. To have fomented this opposition without taking either side, and to have rendered both sides equally contemptible to the Spanish people, was Napoleon's game; the Spanish people, who profoundly admired him, might then have been induced to ask him for a king. Napoleon, however, perpetrated his crime before the scandal of the palace broke out. The march of Murat now brought it to a head. On March 17th a tumult broke out at Aranjuez, which led to the fall of the favourite, and then to the abdication of the king and the proclamation of Ferdinand amid universal truly Spanish enthusiasm. It was a fatal mistake to have forced on this popular explosion, and Napoleon has characteristically tried to conceal it by a supposititious letter, in which he tries to throw the blame upon Murat, to whom the letter professes to be addressed. It warns Murat against rousing the Spanish patriotism and creating an opposition which it will be impossible to put down; it predicts all that actually happened; but it has all the marks of invention, and was certainly never received by Murat. The reign of Ferdinand having thus begun, all that the French could do was to decline to acknowledge him, and to encourage Charles to withdraw his abdication as given under duress. By this means it became doubtful who was king of Spain, and Napoleon, having carefully abstained from taking a side, now presented himself as arbiter. Ferdinand was induced to betake himself to Napoleon's presence at Bayonne, where he arrived on April 21st; his father and mother followed on the 30th. Violent scenes took place between father and son; news arrived of an insurrection at Madrid and of the stern suppression of it by Murat; in the end Napoleon succeeded in extorting the abdication both of Charles and Ferdinand. It was learned too late that the insurrection of Spain had not really been suppressed.

This crime, as clumsy as it was monstrous, brought on that great popular insurrection of Europe against the universal monarchy which has profoundly modified all subsequent history, and makes the Anti-Napoleonic Revolution an event of the same order as the French Revolution. A rising unparalleled for its suddenness and sublime spontaneousness took place throughout Spain and speedily found a response in Germany. A new impulse was given, out of which grew the great nationality movement of the 19th century. Meanwhile Napoleon, having first offered the throne of Spain to his brother Louis, who refused it, named Joseph king, retaining, however, a reversion to himself and heirs in default of male heirs of Joseph, who had only daughters. The royal council first, afterwards a junta of nobles assembled at Bayonne, accepted him on July 7th. But it must have become clear to Napoleon almost at once that he had committed the most enormous of blunders. Instead of gaining Spain he had in fact lost it, for hitherto he had been master of its resources without trouble, but to support Joseph he was obliged in this same year to invade Spain in person with not less than 180,000 men. With Spain too he lost Portugal, which in June followed the Spanish example of insurrection, and had Spain henceforth for an ally and not for an enemy. Hitherto he had had no conception of any kind of war not strictly professional. He had known popular risings in Italy, La Vendée, and Egypt, but had never found it at all difficult to crush them. The determined insurrection of a whole nation of 11,000,000 was a new experience to him. How serious it might be he learned as early as July, when Dupont with about 20,000 men surrendered at Baylen in Andalusia to the Spanish general Castaños. In August he might wake to another miscalculation of which he had been guilty. An English army landed in Portugal, defeated Junot at Vimeiro, and forced him to sign the convention of Cintra. By this he evacuated Portugal, in which country the insurrection had already left him much isolated. This occurrence brought to light a capital feature of the insurrection of the Peninsula, viz., that it was in free communication everywhere with the power and resources of England.

Thus the monarchy of Tilsit suffered within a year the most terrible rebuff. Napoleon himself now appears upon the scene. His first step was to revive the memory of Tilsit by a theatrical meeting with Alexander, which was arranged at Erfurt in September. The power of the duumvirate was there displayed in the most imposing manner, and the alliance was strengthened by new engagements taken by Napoleon with respect to the Danubian principalities. At the same time he checked the rising spirit of resistance in Prussia by driving from office the great reforming minister Stein. At the beginning of November he was ready for the invasion of Spain. Joseph had retired to Vittoria, and the armies of the insurrection fronted him along the Ebro under the command of Blake, Castaños, and Palafox. Between November 7th and 11th the army of Blake was dissolved by Lefebvre, and Napoleon entered Burgos, which was mercilessly pillaged; on the 23d Castaños was defeated at Tudela by Lannes; by December 2d Napoleon, having forced the mountain passes, was before Madrid, and on the 4th he was in possession of the town, where, endeavouring somewhat late to conciliate the liberalism of Europe, he proclaimed the abolition of the Inquisition and of feudalism, and the reduction of the number of convents to one-third. He remained in Spain till the middle of January 1809, but he was not allowed repose during the interval. Sir John Moore had advanced from Portugal as far as Salamanca, and determined in the middle of December to assist the insurrection by marching on Valladolid. Soult was at Carrion and was threatened by this advance, since the English force, after Moore had effected his junction with Baird, who arrived from Corunna, at Majorga, amounted to 25,000 men. Napoleon hoped to cut its communications, and so deal one of his crushing blows at the enemy with whom he was always at war yet whom he never, except at Waterloo, met in the field. He set out on the 22d with about 40,000 men, and marched 200 miles in ten days over mountains in the middle of winter. Moore saw the danger, retired to Benavente, and blew up the bridges over the Ezla. Napoleon advanced as far as Astorga; but he had missed his mark, and professed to receive information which showed him that he was urgently wanted at Paris. He returned to Valladolid, whence on January 19th he set out for France. The end of Moore's expedition belongs to English history.

Another storm was indeed gathering. The downfall of Austria in 1805 had been out of all proportion to her military inferiority; it was impossible that she should acquiesce in it. The year that followed Tilsit had given her quite a new prospect. Spain, which before had given Napoleon help, now swallowed up 300,000 of his troops, so that in the autumn of 1808 he had been obliged to withdraw from Prussia the large army which he had kept for more than a year quartered on that unhappy country. Napoleon could now spare only half his force, and there was now no doubt that Prussia would be as hostile to him as she dared. True, the army of Frederick had ceased to exist, but the country was full of soldiers who had belonged to it, full of skilled officers, and Spain had filled all minds with the thought of popular war. Stein and Scharnhorst had been preparing a *levée en masse* in Prussia and an insurrection in the new kingdom of Westphalia. Under such circumstances began the war of 1809, which may be called the First German War of Liberation, under the leadership of Austria. It was provoked rather by Napoleon, who wanted new victories to retrieve his position, than by Austria, whose interest lay in gaining time, since time was likely to increase the ferment in Germany and weaken the alliance of Napoleon and Russia. Napoleon's superiority, though on the wane, was still enormous. Through the Confederation of the Rhine he had now a great German army at his disposal, which he placed under French generals. His frontier was most formidably advanced through the possession of Tyrol and Venetia. Russia was on his side, and, though she did not actively help him in the field, was of great use in holding down Prussia; England was against him, but could do little for an inland state such as Austria now was. In these circumstances the attitude of Austria had something heroic about it, like that of Spain, and the war throughout is like a somewhat pale copy of the Spanish insurrection. But Austria has what Spain had not, the advantage of organization and intelligence. Since Pressburg she had passed through a period of reform and shown some signs of moral regeneration, Stadion and the archduke Charles doing for her, though not so effectively, what Stein and Scharnhorst did for Prussia. Few wars have begun with less ostensible ground, or more evidently from an intolerable position. Napoleon accused Austria of arming, of wanting war; Austria expostulated, but in vain; and war began. It began early in April, and the proclamation of the archduke Charles was addressed to the whole German nation. The watchword of Austria against France was now liberty and nationality. A good general conception of the war may be obtained by comparing it with that of 1805, which it resembles in certain large features. Again there is a short but decisive passage of arms in Bavaria; in a five days' struggle, celebrated for Napoleon's masterly manoeuvres, the Austrians are driven out of Ratisbon, and the way to Vienna is laid open. Again Napoleon enters Vienna (May 13th). But the war in Italy this time begins farther east, on the Piave. Eugène Beauharnais, after an unfortunate commencement, when he was defeated at Sacile by the archduke John, makes a successful advance, and being joined by Marmont, who makes his way to him from Dalmatia by way of Fiume, drives the Austrian army into Hungary, defeats them at Raab, and effects a junction with Napoleon at Bruck. Then, as before, the war is transferred from Vienna to the other side of the Danube. But the Austrian resistance is now far more obstinate than in 1805. From the island of Lobau Napoleon throws his troops across the river in the face of the archduke. A battle takes place which occupies two successive days, and is sometimes called the battle of the Marchfeld, but is sometimes named from the villages of Gross-Aspern and Essling. Like that of Eylau in 1807 it is among the most terrible and bloody battles of the period. In all perhaps 50,000 men fell, among whom was Marshal Lannes, and the French were driven back into their island. Five weeks passed in inaction before Napoleon could retrieve this check, five weeks during which the condition of Europe was indeed singular, since its whole destiny depended upon a single man, who, besides the ordinary risks of a campaign, was threatened by an able adversary who had recently brought him to the verge of destruction, and by outraged populations which might rise in insurrection round him. This is the moment of the glory of Hofer, the hero of the peasant-war in Tyrol. Once more, however, Napoleon's skill and fortune prevailed. On the night of July 4th he succeeded, under cover of a false attack, in throwing six bridges from Lobau to the left bank of the Danube, over which more than 100,000 men passed before morning and were arrayed upon the Marchfeld. The obstinate battle of Wagram followed, in which, by a miscalculation which became the subject of much controversy, the archduke John came too late to his brother's help. The Austrians were worsted, but by no means decisively, and retired in good order.

Austerlitz and Friedland had led at once to peace, because the principal belligerent, Russia, had little direct interest in the war; Wagram ought to have had no similar effect. Austria was engaged in a war of liberation; Tyrol was emulating Spain; there should therefore have been no negotiation with the invader. But Germany had as yet but half learnt the Spanish principle of war; in particular the Austrian Government and the archduke Charles himself belonged to Old Austria rather than to New Germany. In the campaign the archduke had fallen much below his reputation, having allowed it plainly to appear that Napoleon frightened him, and now, instead of appealing again to German patriotism, he signed at Znaim (July 11th) an armistice similar to that which Melas had so unaccountably concluded after Marengo. But it was by no means certain that all was yet over. North Germany might rise as Spain had risen and as Tyrol had risen. The archduke Ferdinand had marched into Poland and threatened Thorn, with the intention of provoking such a movement in Prussia, and England was preparing a great armament which the patriots of North Germany, who now began to emulate the Spanish guerilla leaders,—Schill, Dörnberg, Katt, Brunswick,—anxiously expected. There seems little doubt that, if this armament had made Germany its object, Germany would at once have sprung to arms and have attempted, perhaps prematurely, what in 1813 it accomplished. What was expected in Germany had happened already in the Peninsula. Arthur Wellesley had landed at Lisbon on April 22d, and in less than a month had driven Soult in confusion out of Portugal. In July he undertook an invasion of Spain by the valley of the Tagus. Thus both the quantity and quality of resistance to Napoleon was greater than at any former time; but it was scattered, and the question was whether it could concentrate itself.

But England was unfortunate this time in her intervention. The armament did not set sail till August, when in Austria the war seemed to be at an end, and when Wellesley, after winning the battle of Talavera, had seen himself obliged to retire into Portugal, and it was directed not to Germany but against Antwerp. It was therefore a mere diversion, and as such it proved unsuccessful. It created indeed a great flutter of alarm in the administration at Paris, which saw France itself left unprotected while its armies occupied Vienna and Madrid, but by mismanagement and misfortune the great enterprise failed, and accomplished nothing but the capture of Flushing.

And so the last triumph of Napoleon was achieved, and the treaty of Schönbrunn was signed on October 20th. By this treaty, as by former treaties, he did not merely end a war or annex territory, but developed his empire and gave it a new character. He now brought to an end the duumvirate which had been established at Tilsit. Since Tilsit his greatness had been dependent on the concert of Russia. He had had the czar's permission to seize Spain, the czar's co-operation in humbling Austria. Schönbrunn made his empire self-dependent and self-supporting, and thus in a manner completed the edifice. But he could not thus discard Russia without making her an enemy, and accordingly the Russian war appears on the horizon at the very moment that the Austrian war is terminated. This transformation was accomplished by first humbling Austria, and then, as it were, adopting her and giving her a favoured place in the European confederacy. She lost population to the amount of 3,500,000, besides her access to the sea; she paid an indemnity of more than £3,000,000, and engaged to reduce her army to 150,000. But, thus humbled, a high and unique honour was reserved for her. We cannot be quite certain whether it was part of Napoleon's original plan to claim the hand of an archduchess, though this seems likely, since Napoleon would hardly break with Russia unless he felt secure of the alliance of Austria, and yet in the treaty of Schönbrunn he does not hesitate to offend Russia by raising the Polish question. What is certain is that after his return to France Napoleon proceeded at once to the divorce, that at the same time he asked the czar for the hand of his sister, that upon this Austria, alarmed, and seeing her own doom in the Russian match, gave him to understand (as he may very well have calculated that she would do) that he might have an archduchess, and that upon this he extricated himself from his engagement to the czar with a rudeness which might seem intended to make him an enemy. At the same time he refused to enter into an engagement not to raise the Polish question.

At an earlier period we saw Napoleon urged by his brothers to divorce Josephine, but refusing steadfastly and apparently resolved upon adopting the eldest son of Louis and Hortense. He had now quite ceased to be influenced by his brothers, but at the same time he had risen to such greatness that he had himself come to think differently of the question. Fourteen years before he had been warmly attached to Josephine; this attachment had been an effective feature in the character of republican hero which he then sustained. Mme. de Staël had been profoundly struck, when, on being charged by her with not liking women, he had answered, "J'aime la mienne." "It was such an answer," she said, "as Epaminondas would have given!" He is now equally striking in the part of an Oriental sultan, and when he discards his Josephine for ambition he requires to be publicly flattered for his self-sacrifice by the officials, by Josephine herself and even by her son Eugène Beauharnais!

The archduchess Marie Louise, who now ventured to take the seat of Marie Antoinette, seems to have been of amiable but quite insignificant character. Her letters are childlike. She became a complete Frenchwoman, but, owing to a certain reserve of manner, was never specially popular. On March 20, 1811, she bore a son, who took the title of King of Rome, by which in the Holy Roman Empire the successor had been designated. France had thus become once more as monarchical as in the proudest days of Versailles; but the child of empire was reserved for what his father called "the saddest of fates, the fate of Astyanax."

Arrived now at the pinnacle, Napoleon pauses, as he had paused after Marengo. We are disposed to ask, What use will he now make of his boundless power? It was a question he never considered, because the object he had set before himself in 1803 was not yet attained; he was not in the least satiated, because, much as he had gained, he had not gained what he sought, that is, the humiliation of England. As after Tilsit, so after Schönbrunn, he only asks, How may the new resources be best directed against England? Yet he did not, as we might expect, devote himself to crushing the resistance of the Peninsula. This he seems to have regarded with a mixed feeling of contempt and despair, not knowing how to overcome it, and persuading himself that it was not worth a serious effort. He persisted in saying that the only serious element in the Spanish opposition was the English army; this would fall with England herself; and England, he thought, was on the point of yielding to the blockade of the Continental system. He devotes himself henceforth therefore to heightening the rigour of this blockade. From the beginning it had led to continual annexations, because only Napoleon's own administration could be trusted to carry it into effect. Accordingly the two years 1810–11 witness a series of annexations chiefly on the northern sea-coast of Europe, where it was important to make the blockade more efficient. But on this northern sea-coast lay the chief interests of Russia. As therefore in 1805 he had brought Austria and Russia on himself by attacking England, so in 1810 he presses his hostility to England to the point that it breaks the alliance of Tilsit and leads to a Russian war.

The year 1810 is occupied with this heightening of the Continental system and the annexations which it involved. That he had long contemplated the annexation of Holland appears from the offer of the crown of Spain which he made to Louis in 1808, and the language he then used ("La Hollande ne saura sortir de ses ruines"). He now took advantage of the resistance which Louis made to his ruinous exactions. Louis was driven to abdicate, and the country was organized in nine French departments. In August the troops of the king of Westphalia were forced to make way for French troops at the mouths of the Elbe and Weser, and a few months later the whole coast between the Rhine and the Elbe was annexed. At the same time Napoleon began to make war on neutral commerce, especially American, affirming that in order to complete the destruction of English trade it was only necessary to prohibit it when it made use of neutral bottoms. So thoroughly in earnest was he with his Continental system; and indeed it is beyond dispute that great distress and discontent, nay, at last a war with the United States, were inflicted upon England by this policy.

But the pressure of it was felt even more on the Continent, and the ultimate cause of the fall of Napoleon was this, that under the weight of the Continental system the alliance of Tilsit broke down sooner than the resistance of England. That alliance had been seriously weakened by the Austrian marriage, and by Napoleon's refusal to give the guarantees which Russia required that Poland should never be restored. Indeed Napoleon had seemed to take pleasure in weakening it, but perhaps he had only desired to make it less burdensome to himself without destroying it. At the end of 1810 measures were taken on both sides which conveyed the impression to Europe that it was practically at an end. Alexander refused to adopt Napoleon's policy towards neutrals; Napoleon answered by annexing Oldenburg, ruled by a duke of the Russian house; Alexander rejoined by an ukase (December 31st) which modified the restrictions on colonial trade and heightened those on French trade.

In 1811 the alliance of Tilsit gradually dissolves. Napoleon's Russian expedition is hardly to be regarded as a freak of insane pride. He himself regarded it as the unfortunate effect of a fatality, and he betrayed throughout an unwonted reluctance and perplexity. The truth is, he could not now stop. Upon the Continental system he had staked everything. He had united all Europe in the crusade against England, and no state, least of all such a state as Russia, could withdraw from the system without practically joining England. Nevertheless we may wonder that, if he felt obliged to make war on Russia, he should have chosen to wage it in the manner he did, by an overwhelming invasion. For an ordinary war his resources were greatly superior to those of Russia. A campaign on the Lithuanian frontier would no doubt have been unfavourable to Alexander, and might have forced him to concede the points at issue. Napoleon had already experienced in Spain the danger of rousing national spirit. It seems, however, that this lesson had been lost on him, and that he still lived in the ideas which the campaigns of 1805, 1806, and 1807 had awakened, when he had occupied Vienna and Berlin in succession, overthrown the Holy Roman Empire, and conquered Prussia. He makes a dispute about tariffs the ground of the greatest military expedition known to authentic history! In this we see a stroke of his favourite policy, which consisted in taking with great suddenness a measure far more decisive than had been expected; but such policy seems here to have been wholly out of place. He was perhaps partly driven to it by the ill-success of his diplomacy. War with France meant for Russia sooner or later alliance with England, but Napoleon was not able to get the help of Turkey, and Sweden joined Russia. Turkey had probably heard of the partition-schemes which were agitated at Tilsit, and was also influenced by the threats and promises of England. Sweden suffered grievously from the Continental system, and Bernadotte, who had lately become crown prince, and who felt that he could only secure his position by procuring for Sweden some compensation for the recent loss of Finland, offered his adhesion to the power which would help him in acquiring Norway. Napoleon declined to rob his ally, Denmark, but Alexander made the promise, and Sweden was won. Against Russia, Sweden, and England (a coalition which formed itself but tardily) Napoleon assembled the forces of France, Italy, and Germany, and hoped to win, as usual, by the rapid concentration of an overwhelming force. The army with which he invaded Russia consisted of somewhat more than 600,000 men,—the French troops mainly commanded by Davoust, Oudinot, and Ney, the Italian troops by Prince Eugene, the Poles by Poniatowski, the Austrian contingent (33,000 men) by Schwarzenberg, the remaining German troops by Gouvion St Cyr, Reynier, Vandamme, Victor, Macdonald (who had the Prussian contingent), and Augereau. When we consider that the war of the Peninsula was at the same time at its height, and that England was now at war with the United States, we may form a notion of the calamitous condition of the world!

Russia had been easily defeated at Austerlitz and Friedland, where it fought far from home for a cause in which it was but slightly interested. Against an invasion it was as invincible as Spain, being strengthened by a profound national religion and perfect loyalty to the Government; in addition it had the strength of its vast extent, its rigorous climate, and the half-nomad habits of its people. By his prodigious preparations Napoleon provoked a new national war under the most difficult circumstances, and yet he appears to have desired peace and to have advanced most reluctantly. His campaign runs the same course as against Austria in 1805 and 1809. There is the successful advance, the capture of the fortress (Smolensk), the great victory (at Borodino), the entry into the capital (Moscow); but of all this no result. No negotiation follows, and Napoleon suddenly finds himself helpless, as perhaps he would have done in 1805 and 1809, had the enemy shown the same firmness. On May 16, 1812, he arrived with Marie Louise at Dresden, where for the last time he appeared as king of kings,—the emperor of Austria, the king of Prussia, a multitude of German sovereigns, Metternich, and Hardenberg paying court to him. On the 28th he set out again and travelled by Glogau, Thorn, Dantzic, Königsberg, Gumbinnen, to Wilkowyski, where he arrived on June 21st. On the 24th the mass of the army passed the Niemen at Kovno, and on the 28th Napoleon entered Vilna, which was evacuated by the Russians. Here he remained till July 16th. In this long delay, as well as in other circumstances, the unwonted perplexity of his mind appears. Alexander, who has by this time gained greatly in decision of character, refuses to negotiate while the enemy stands on Russian territory; Napoleon in conversation with Balacheff shows an almost pathetic desire for an amicable arrangement. He is embarrassed again when a deputation from Warsaw, where a diet had met, bids him only say that "*Poland exists*, since his decree would be for the world equivalent to the reality." This word he declines to say, alleging his obligations to Austria. From his conversations with Narbonne (Villemain, *Souvenirs*) we find that he had deliberately considered and rejected what we may call the rational mode of waging war with Russia, that is, through the restoration of Poland. He admitted that he might indemnify Austria and, if necessary, Prussia elsewhere, but he argued that he could not afford to open the floodgates of republicanism: "Poland must be a camp, not a forum." He had in fact—perhaps mainly since his second marriage—come to regard himself as the representative of legitimacy against the Revolution. It was thus with his eyes open that he preferred the fatal course of striking at Moscow. His judgment was evidently bewildered by the successes of 1805 and 1806, and he indulges in chimerical imaginations of delivering Europe once for all from the danger of barbaric invasion. It is to be observed that he seems invariably to think of the Russians as Tartars!

In relating this war we have to beware of national exaggerations on both sides. On Napoleon's side it is absurdly said that he was only vanquished by winter, whereas it is eviden that he brought the winter upon himself, first by beginning so late, then by repeated delays, at Vilna, at Vitebsk, and most of all at Moscow. On the other side we must not admit absolutely the Russian story that he was lured onward by a Parthian policy, and that Moscow was sacrificed by a solemn universal act of patriotism. Wellington's policy of retrograde movements had indeed come into fashion among specialists, and an entrenched camp was preparing at Drissa on the Dwina in imitation of Torres Vedras. But the nation and the army were full of reckless confidence and impatience for battle; only their preparations were by no means complete. The long retreat to Moscow and beyond it was unintentional, and filled the Russians with despair, while at the same time it agreed with the views of some of the more enlightened strategists.

As usual, Napoleon took the enemy by surprise, and brought an overwhelming force to the critical point. When he crossed the Niemen the Russians were still thinking of an offensive war, and rumours had also been spread that he would enter Volhynia. Hence their force was divided into three armies: one, commanded by the Livonian Barclay de Tolly, had its headquarters at Vilna, a second under Prince Bagration was further south at Volkowysk, the third under Tormaseff was in Volhynia. But the total of these armies scarcely amounted to 200,000 men, and that of Barclay de Tolly opposed little more than 100,000 to the main body of Napoleon's host, which amounted nearly to 300,000. Hence it evacuates Vilna and retires by Svenziany to the camp at Drissa. Barclay arrives at Drissa on July 9th, and here for the first time the emperor and the generals seem to realize the extent of the danger. Alexander issues an ukase calling out the population in the proportion of five to every hundred males, and hurries to Moscow and thence to St Petersburg in order to rouse the national enthusiasm. The Drissa camp is also perceived to be untenable. It had been intended to screen St Petersburg, and Napoleon is seen to look rather in the direction of Moscow. Barclay retires to Vitebsk, but is obliged, in order to effect his junction with Bagration, to retreat still further, and Napoleon enters Vitebsk on the 28th. The road to Moscow passes between the Dwina, which flows northward, and the Dnieper, which flows southward, Vitebsk on the one river and Smolensk on the other forming, as it were, the two doorposts. We expect to find Napoleon at this point cutting the hostile armies in two and compelling that of Bagration to a surrender; he has a great superiority of numbers, and he might have had the advantage of a friendly population. But his host seems unmanageable, and the people are estranged by the rapacity and cruelty to which it is driven by insufficient supplies. Barclay and Bagration effect their junction at Smolensk on August 3d, and now have a compact army of at least 120,000 men. They evacuated Smolensk also on the 18th, but only after an obstinate defence which left Napoleon master of nothing but a burning ruin.

Both at Vitebsk and Smolensk he betrayed the extreme embarrassment of his mind. Should he go into winter quarters? should he press forward to Moscow? It was a choice of desperate courses. His army was dwindling away; he had forfeited the support of the Poles; Germany was full of discontent; and yet a large part of his army was Polish or German; how could he delay? And yet if he advanced, since August was already running out, he must encounter the Russian winter. He determined to advance, relying on the overwhelming effect that would be produced by the occupation of Moscow. He would win, as after Austerlitz and Friedland, through the feebleness and fickleness of Alexander.

Meanwhile his unresisted progress, and the abandonment by Barclay of one position after another, created the greatest consternation among the Russians, as well they might. Barclay was a German, and might well seem another Melas or Mack. A cry arose for his dismissal, to which the czar responded by putting old Kutusoff, who was at least a Russian, at the head of all his armies. This change necessarily brought on a great battle, which took place on September 6th near the village of Borodino. More than 100,000 men and about six hundred pieces of artillery were engaged on each side. It ended in a victory, but an almost fruitless victory, for the French. They lost perhaps 30,000 men, including Generals Montbrun and Caulaincourt, the Russians nearly 50,000, including Prince Bagration. Here again Napoleon displayed unwonted indecision. He refused to let loose his guard, consisting of 20,000 fresh troops, who might apparently have effected the complete dissolution of the hostile army, and materially altered the whole sequel of the campaign. He said, "At 800 leagues from Paris one must not risk one's last reserve."

This battle, the greatest after Leipsic of all the Napoleonic battles, was followed by the occupation of Moscow on September 14, which, to Napoleon's great disappointment, was found almost entirely empty. After a council of war held at Fili, Kutusoff had taken the resolution to abandon the old capital, the loss of which was held not to be so irreparable as the loss of the army. But, as with Old Russian craft he had announced Borodino to the emperor as a victory, the sensation produced upon the Russian public by the fall of Moscow was all the more overwhelming. Nor did the next occurrence, which immediately followed, at first bring any relief. Fires broke out in Moscow on the night after Napoleon's entrance; on the next night, by which time he was quartered in the Kremlin, the greater part of the city was in flames, and on the day following he was forced by the progress of the conflagration to evacuate the Kremlin again. But on the first intelligence of this catastrophe the destruction of Moscow was attributed in Russia to the French themselves, and was not by any means regarded as a crushing blow dealt at Napoleon by Russian patriotism.

It is indeed not clear that this event had any decisive influence upon the result of the war. Nor does it seem to have been the deliberate work of the patriotism of Moscow. The beginner of it was one man, Count Rostopchin, governor of Moscow, who is shown by many public utterances to have brooded for some time over the thought, and is proved to have made preparations for carrying it into effect before leaving the town. It is, however, supposed that what was begun by him was completed by a rabble which had no object but plunder, and partly by French soldiers. The immediate effect of it was to deepen the alarm of the Russians, and, when this feeling passed away, to deepen their hatred of the French. Now came the critical moment. Would Alexander negotiate? That is, would he listen to certain timid courtiers about him, such as Romanzoff, or would he be inspired by the patriotic ardour of his people and lean on his nobler counsellors, the German patriot Stein or Sir Robert Wilson? The pressure for a moment was great; we can imagine that had the Russian army been dissolved at Borodino it might have been irresistible. But he stood firm; he refused to negotiate; and Napoleon suddenly found that he had before him, not the simple problem he had solved so often in earlier life, but the insoluble puzzle he had first encountered in Spain. His failures in Egypt and in Spain had been more or less disguised. He was now in danger of a failure which could not be concealed, and on a far larger scale; but had he retreated forthwith and wintered in Vilna, where he might have arrived early in November, the conquest of Russia might have seemed only to be postponed for a year. Instead of this he delayed five weeks in Moscow, and then complained of the Russian winter! After planning a demonstration on St Petersburg, weighing Daru's scheme of wintering in Moscow (which he called "un conseil de lion"), and waiting in vain for the czar's submission, he set out on October 18th after blowing up the Kremlin. He marched southward to Kaluga, hoping to make his way through a richer and unexhausted country. But while his force had dwindled the Russian had increased. Peace with Sweden had released a Russian force in Finland; peace with Turkey released the army of the Danube; meanwhile levies were proceeding through the whole empire. Napoleon's plan was frustrated by a check he received at Malojaroslavetz, and he had to turn northward again and return as he had come. He reached Smolensk on November 9th, when he might have been at Vilna. He marched by Orcza to the Berezina, which he struck near Borisoff. Here Tchitchagoff at the head of the Danube army confronted him, and two other Russian armies were approaching. Napoleon on his side was joined by what remained of the corps of Oudinot and Victor, who had held the line of the Dwina. But what was the army of Napoleon which was thus reinforced?

In July it had consisted of more than 250,000 men. It had suffered no decisive defeat, and yet it amounted now only to 12,000; in the retreat from Moscow alone about 90,000 had been lost. The force which now joined it amounted to 18,000, and Napoleon's star had still influence enough to enable him to make his way across the Berezina, and so escape total ruin and captivity. But December came on, and the cold was more terrible than ever. On the evening of December 6th a miserable throng, like a crowd of beggars, tottered into Vilna.

The corps of Macdonald, Reynier, and Schwarzenberg (among whom were included the Austrian and Prussian contingents) had escaped destruction, having been posted partly on the Polish frontier partly in the Baltic provinces. For these we may deduct 100,000 from the total force; it then appears that half a million had perished or disappeared. They had perished not by unexpected cold; "the cold had but finished the work of dissolution and death almost accomplished by the enemy, by hardship, and especially by hunger" (Charras); nor is cold unusual in Russia in November! Napoleon's error was one which may be traced as clearly in the campaigns of 1805 and 1806, the error of making no provision whatever for the case of ill-success or even success less than complete. It was now the twentieth year that Europe was tearing itself to pieces. For some years past the pretence of Revolutionary principles had been given up. There was now no pretext for war except the so-called maritime tyranny of England; but yet the magnitude of wars had increased beyond all measurement. The campaign of 1812 left everything in civilized history far behind it. All the abuses of the old monarchy and all the atrocities of the Revolution put together were as nothing compared to this new plague, bred between the Revolution and the old monarchy, having the violence of the one and the vainglory of the other, with a barbarous destructiveness peculiar to imperialism superadded.

But what was Napoleon's position? Any Government but the strongest would have sunk under such a blow, but Napoleon's Government was the strongest, and at its strongest moment. Opposition had long been dead; public opinion was paralysed; no immediate rising was to be feared. Should he then simply take the lesson home, and make peace with Alexander? This was impossible; he must efface the disaster by new triumphs. But, as this was evident to all, Alexander could not but perceive that he must not lose a moment but must hasten forward and rouse Germany before Napoleon should have had time to levy a new army. 1813 must be filled with a war in Germany, as 1812 with the war in Russia.

Napoleon left the wreck of his army at Smorgoni on December 5 (as he had left his Egyptian army thirteen years before), travelling in a carriage placed upon a sledge and accompanied by Caulaincourt and Duroc. He had an interview with Maret outside Vilna, and then travelled to Warsaw, where he saw his ambassador De Pradt, who has left an account of his confused talk. Here, as in the famous 29th bulletin, published a little after, we observe that he consoles himself for the loss of his army by reflecting that his own health was never better—he kept on repeating this. Then he said, "From the sublime to the ridiculous there is but a step"; for the retreat from Moscow strikes him as *ridiculous*! From Warsaw he passed to Dresden, where he saw his ally the king of Saxony, and wrote letters to the emperor of Austria and to the king of Prussia. He then made his way by Erfurt and Mainz to Paris, where he arrived on December 18th. The bulletin had appeared two days before.

He had said to De Pradt that he intended to raise 300,000 men and be on the Niemen again in the spring. The first part of this intention he fulfilled, for in April he reappeared in the field with 300,000 men; but the campaign was fought not on the line of the Niemen, nor of the Vistula, nor of the Oder, and he had to fight a battle before he could even reach the Elbe. For a great event took place less than a fortnight after his arrival in Paris, the defection of the Prussian contingent under York from the grand army; this event led to the rising of Prussia against Napoleon. York's convention with the Russians is dated December 30th. On January 22, 1813, Stein appeared at Königsberg and procured the assembling of the estates of East Prussia, in which assembly the Prussian landwehr was set on foot. On February 27th he concluded for the czar the treaty of Kalisch with Prussia, by which the old Coalition of 1806 may be said to have been revived. Prussia now rushed to arms in a wholly new spirit, emulating Spain and Russia in devotion, and adding to devotion an intelligence peculiar to herself. At the same time measures were taken to break up the Confederation of the Rhine. Tettenborn cleared the French out of the northern departments in March; Saxony too passed into the hands of the allies, and it was hoped that the king himself might be induced to follow the example of the king of Prussia. But April came, and Napoleon took the field again.

By rapidity and energy he was still able to take the offensive. Though Russia and Prussia were now as Spain, yet the process of calling out and drilling their population was only just begun, and it proceeded slowly. Their united available force at the opening of the campaign scarcely exceeded 100,000 men. Austria and the middle states did not abandon Napoleon. With tact and with judicious concession he might yet retrieve his position; perhaps no one, as yet, had begun to think of his fall. He left Paris for Mainz on April 15th. His object was Saxony, where Dresden, the scene of his last display of omnipotence less than a year ago, was now the residence of the czar and the king of Prussia united against him. Eugene was maintaining himself on the lower Saale with an army of about 70,000 men, and Napoleon was to march by way of Erfurt to join him. Between Erfurt, Bamberg, and Mainz he had by this time about 150,000 men, troops indeed without discipline and with imperfect drill, youths, the last hope of France, but well officered and not wanting in the enthusiasm which his name still inspired. There was, however, a serious deficiency of cavalry. Meanwhile Davoust, stationed on the Weser with 30,000 men, was holding down the insurrection of North Germany.

The war which now commenced ended not only to the disadvantage of Napoleon, but unlike any former war it ended in a complete defeat of France, nay, in the conquest of France, an event to which nothing parallel had been seen in modern Europe. Nor was this result attained by any political or revolutionary means, *e.g.*, by exciting a republican or Bourbon party against Napoleon's authority, but by sheer military superiority. The causes of this remarkable result must be noted as we proceed. Meanwhile we remark that the war, though technically one, is really three distinct wars. There is first the war with Russia and Prussia which occupies the month of May, and is concluded by an armistice on June 4th. There is next a war with Russia, Prussia, and Austria, which begins in August and is practically terminated in October by the expulsion of Napoleon from Germany. Thirdly, there is an invasion of France by the same allied powers. This began in January 1814, and ended in April with the fall of Napoleon.

In the first of these wars Napoleon maintained on the whole his old superiority. It has excited needless admiration that with his raw levies he should still have been able to win victories, since of his two enemies Russia had suffered as much as himself in 1812, and Prussia's army was at the beginning of the year actually to make. In the first days of May he advanced down the valley of the Saale, making for Leipsic by Naumburg, Weissenfels, and Lützen. On the 2d was fought the battle commonly called from Lützen, though the Germans usually name it from the village of Gross-Görschen. By this battle, in which the great military reformer of Prussia, Scharnhorst, received the wound of which he died soon after, the allies were driven to retreat across the Elbe, and Dresden was restored to the king of Saxony. The Prussians attribute their ill-success partly to the insufficiency of the Russian commander Wittgenstein, under whom they fought. Napoleon soon pursued the allies across the Elbe, and another battle was fought on May 20 and 21 at Bautzen on the Spree. Here again Napoleon remained master of the field, though his loss seems to have been considerably greater than that of the enemy. The allies retired into Silesia, and a pause took place, which led to the armistice of Poischwitz, signed on June 4th. During this armistice Napoleon formed the resolution which led to his downfall.

He might seem now to have almost retrieved his losses. If he could not revive the great army of the Revolution which lay buried (or unburied) in Russia, he had reasserted the ascendency of France. Politically he had suffered but one substantial loss, in the rebellion of Prussia. The blows of Lützen and Bautzen had arrested the movement which threatened to dissolve the Confederation of the Rhine and to unite all Germany against him. They had also shaken the alliance of Prussia and Russia. Between the generals of the two armies there reigned much jealousy; the old question, raised after Austerlitz and Friedland, was beginning to be asked again by the Russians, Why should they fight for others?

At Tilsit Napoleon had dissolved the Coalition by forming as it were a partnership with Russia. It might seem possible now to form a similar partnership with Austria. This course had indeed been entered upon at the marriage of the archduchess. Napoleon seems to have taken this alliance seriously. He conceived it as the final suppression of the Revolution, as a complete adhesion on his own part to conservatism. The language of the bulletins at this time is ultra-conservative. Thus the enemy is described as "preaching anarchy and insurrection." Stein is charged with "rousing the rabble against the proprietors." But, though he had borrowed the Austrian tone, he had not yet enlisted Austrian interests on his side. It was evidently in his power to confer on Austria the greatest advantages, and, as it were, to divide his power with her. Less than this he could not offer, since the losses of France and Russia had given to Austria a decisive weight, but it might seem that he might offer it without much humiliation, as the alliance with Austria had subsisted since 1810 and had been cemented by marriage. If he did not thus win Austria, he might expect her to adhere to the other side, for in such a crisis neutrality was out of the question. Could Napoleon then hope to overcome a quadruple alliance of England, Russia, Prussia, and Austria? Such a hope was not justified by the victories of Lützen and Bautzen. The force of Prussia increased every day, and the Spanish enthusiasm with which her new army fought had been displayed even on those fields; the force of Austria had been impaired by no Russian campaign; while France was evidently near the end of her resources. The legerdemain by which, in 1800, 1805, 1806, Napoleon had made conquests was now worn out; his blows were no longer followed by abject submission and surrender; he was not even able, for want of cavalry, to make his victories decisive. Thus ample concessions to Austria were indispensable; but, these assumed, his position might seem good.

He took the momentous resolution to make no such concessions, saw Austria join the Coalition, and after a campaign of two months found himself driven in tumultuous ruin across the Rhine. This step is the counterpart of Tilsit, and destroyed the work of Tilsit. Was he simply blinded by passion? His language might lead us to think so. Austria was the state which he had oftenest defeated, and he seems to have been unable to regard it with the respect which he had shown to Russia at Tilsit. From the beginning of 1813 we find him calculating indeed on the help of Austria, and fully recognizing the importance of her alliance, yet indignant at the very thought of having to pay for it. He would prefer to make advances to his enemy Russia rather than give his ally Austria any equality with himself in the alliance. Austria on her part seems disposed to be faithful to him. She begins by adhering to the substance of her treaty of March 1812, but requiring certain modifications in it. Napoleon must withdraw from north-west Germany, dissolve the duchy of Warsaw, cede Illyria, perhaps also dissolve the Confederation of the Rhine. But on the last point she might probably have given way, so that Napoleon, already victorious against Russia and Prussia, might now, without yielding any substantial part of his power, have checkmated another Coalition by the help of Austria. Nevertheless it seems as if Napoleon, though this course was open to him for several months, was not for a moment attracted by it, though the clamour for peace which his own army and his own marshals raised compelled him to profess to take it into consideration. He continued deliberately to contemplate in preference a war against Russia, Prussia, and Austria united, and regarded the armistice simply as a delay which would enable him to bring up new forces. Austria on her part was gradually convinced that no concession was to be obtained from him, and drifted towards the decisive resolution which she could not avoid. Metternich has left us an account of the interview, lasting ten hours, which he had with Napoleon on June 28, in the Marcolini palace at Dresden. We see in it Napoleon's contempt for a power he has so often defeated, his inability to believe that it has still spirit to resist; at the same time we become aware that he believes himself to be necessary to the Austrian emperor, as being the bulwark of all thrones and of monarchy itself against the Revolution. Metternich can hardly have imagined the famous dramatic trait where Napoleon, on being told that his troops were "not soldiers, but children," answered, turning pale—"You are no soldier; you do not know what passes in a soldier's mind; I grew up in the field, and a man like me troubles himself little about the life of a million of men" (the actual expression he used, adds Metternich, cannot be reported), and then flung his hat into a corner of the room. That this was a true description of his way of thinking had become visible to most since the Russian catastrophe, and the audacious frankness with which he blurts it out is quite in his characteristic manner.

When this interview took place, a treaty had just been signed at Reichenbach by which Austria had engaged, as mediating power, formally to offer conditions of peace to Napoleon and to declare war on him in case of refusal. She proceeded to offer the conditions above mentioned with the exception of that which refers to the Confederation of the Rhine. A congress met at Prague in the course of July, but Napoleon did not allow its deliberations to make serious progress. He paid no attention to an ultimatum presented on August 8th. On midnight of August 10–11 the armistice was declared to be at an end, and the doom of Napoleon was sealed. It was a strange decision on his part, but perhaps he judged rightly that he had no choice but between ruin and absolute, impossible victory!

Europe now plunges again into a struggle as desperate and as destructive as that of 1812. More evidently even than in 1812 is Napoleon responsible for this ruin of all civilization. He cannot any longer speak even of the liberty of the seas, for he is forced himself to admit that the Continental system is dead, and yet refuses to surrender that ascendency for which the Continental system had all along been the pretext. Infatuated France, however, has by this time furnished more than 400,000 men to perish in a contest where there might be chances, but could be no probabilities, of victory. His headquarters are now at Dresden, and his armies are arranged along the whole course of the Elbe from Bohemia to its mouth. This position has been somewhat weakened by the adhesion of Austria to the Coalition, for Austria masses her troops on the north-west of Bohemia, threatening Dresden and Napoleon's communications from the left side of the Elbe. The force of the allies (approaching 500,000 men) consists of three great armies, of which the first, principally Austrian, and commanded by Prince Schwarzenberg, is stationed on the Eger in Bohemia; the sovereigns are here. The old Prusso-Russian army, which had made the convention of Poischwitz, is still in Silesia. It contains more Russians than Prussians, but a Prussian officer is now put at the head of it. This is Blücher, the dashing general of hussars, now an old man of seventy years; on his staff are some of the leading theorists and enthusiasts of the new Prussian army, such as Gneisenau. But the bulk of the Prussian force is stationed in the mark of Brandenburg. In this final muster of the armies of Europe we see that the moral forces have passed over from France to the allies. In the French camp there reigns weariness and desire for peace, among the Prussians and Russians heroic ardour and devotion. But the old mismanagement reappears on the side of the allies. In the Bohemian camp Schwarzenberg's authority was almost annulled by the presence of the sovereigns; in Silesia the heroic Prussian general is in command of an army mainly Russian. But in the mark perhaps the greatest blunder was made, for here the main Prussian force was put under the orders of the crown prince of Sweden, the Frenchman Bernadotte, wholly alien to the German cause, and bent upon propitiating French public opinion with a view to the succession of Napoleon. Bernadotte is not the only member of the old republican opposition who is seen in the allied camp now that Napoleon's fall begins to be thought of as possible. Moreau, the man who helped in 1799 to found the consulate, desiring probably to see France ruled by a series of Washingtons each holding office for a short term, appears in the Austrian camp. If Napoleon was to be dethroned, who had a better right to succeed him?

The campaign opens with a blow aimed at Berlin, where perhaps Napoleon wished to extinguish the popular insurrection at its source. Oudinot marches on it from Baruth, and is supported by a force from Magdeburg; Davoust sends another corps from Hamburg. Bernadotte proposes to retire and sacrifice Berlin, but in spite of him Bülow fights on August 23d the battle of Grossbeeren, within a few miles of the capital. Here first the landwehr distinguished itself, and Berlin was saved. The attack from Magdeburg was defeated by Hirschfeld at Hagelberg on the 27th. Meanwhile Napoleon himself, at the head of 150,000 men, had marched against Blücher on the Katzbach. Blücher retired before him, and he was compelled to return to the defence of Dresden, but he left Macdonald with perhaps 50,000 or 60,000 men to hold Blücher in check. Almost immediately after his departure (August 26th) Macdonald was defeated by Blücher in the battle of the Katzbach. Thus the campaign began with two Prussian victories. But when the great army of Bohemia moved upon Dresden Napoleon showed his old superiority. On August 27th he inflicted on it a terrible defeat. In this battle Moreau, the hero of Hohenlinden, was mortally wounded by a cannon-ball. It seemed for a moment likely that this battle, followed up with Napoleon's overwhelming rapidity, would decide the campaign. He prepared to cut off his enemy's retreat into Bohemia. But the news of Grossbeeren and Katzbach arrived; Napoleon is also said to have been attacked by illness; he altered his plan in the moment of execution. The grand stroke of the campaign failed, and, instead of cutting off the retreat of the grand army, Vandamme was taken prisoner at Kulm with 10,000 men after a battle in which he had lost half that number (August 30th). It was evident that the times of Marengo and Austerlitz were over. Napoleon's ability and authority were as great as ever; he controlled larger armies; he opposed a Coalition which was as unwieldy as former Coalitions; and yet he had suffered four defeats in a single week and had won but one victory. Within another week he suffered another blow. A new advance was made on Berlin by Ney, who was defeated with great loss at Dennewitz by the Prussians under Bülow (September 6th).

Here then ends Napoleon's ascendency; henceforth he fights in self-defence or in despair. Yet the massacre was to continue with unabated fury for two months longer. He spent the greater part of September in restless marches from Dresden, now into Silesia, now into Bohemia, by which he wore out his strength without winning any substantial advantage. Towards the end of the month a new phase of the war begins. From the beginning the allies had given each other rendezvous in the plain of Leipsic. Hitherto Napoleon had held the line of the Elbe, and had presented a single mass to the three separate armies of the Coalition. Now that his collapse begins to be visible, begins the converging advance on Leipsic. The Silesian army crossed the Elbe at Wartenburg on October 3d, and on the next days the northern army also crossed at several points. At the same moment the Confederation of the Rhine began rapidly to dissolve. A troop of Cossacks under Czernicheff upset the kingdom of Westphalia (October 1st). Bavaria abandoned Napoleon, and concluded the treaty of Ried with Austria (October 8th). But for form's sake a final massacre was still necessary. It took place on a satisfactory scale between October 14th and 19th, and ended in the decisive defeat of Napoleon and the capture of Leipsic. Perhaps nearly half a million of men were engaged in these final battles. It is reckoned that in the last three days the Prussians lost sixteen, the Russians twenty-one, and the Austrians fourteen thousand men—total, fifty-one thousand. Napoleon left twenty-three thousand behind him in the hospitals and fifteen thousand prisoners; his dead may have been fifteen thousand. He lost also three hundred pieces of artillery. The sufferings of the wounded almost exceed anything told of the retreat from Moscow. It is a misfortune that the victors allowed him to cross the Rhine in safety; had they pressed the pursuit vigorously, helped as they now were by the Bavarians, they might have brought his career to an end at this point. But for such a decisive measure perhaps even their political views were not yet ripe. However, as at the Berezina in 1812, so now, he had to clear his road by another battle. The Bavarians under Wrede met him at Hanau, eager to earn some merit with the victorious Coalition; but he broke his way through them and arrived at Frankfort. On November 1st and 2d he carried the remains of his army, some 70,000 men across the Rhine at Mainz.

The work of eight years was undone; Napoleon was thrown back to the position he had occupied at the rupture of the peace of Amiens. The Russian disaster had cancelled Friedland; Leipsic had cancelled Austerlitz. But could Napoleon consent to humble himself? If he could not make concessions in the summer, still less could he do so now. Could he return and reign quietly at Paris, a defeated general, his reputation crushed by the two greatest disasters of history? But he might by abdicating have spared France, already mortally exhausted, the burden of another war. It is among the most unpardonable even of his crimes to have dragged his unhappy country through yet another period of massacre, though nothing that could even appear to be a national interest was at stake. In November advances were made to him by the allies, in which peace was proposed on the basis of the "natural frontiers." This would have secured to France the main fruits of the First Revolutionary War, that is, Belgium, the Left Bank, Savoy, and Nice. Such terms seem generous when we consider the prostration of France and the overwhelming superiority of the allies. But though the Prussian war-party loudly protested against them, and maintained the necessity of weakening France so as to render her harmless, Austria favoured them, being jealous alike of Prussia and of the spirit of liberty which the war was rousing in the German population. A little compliance on the part of Napoleon might at this moment have made the general desire for peace irresistible. But he showed no such disposition. He first evaded the proposal, and then, too late, accepted it with suspicious qualifications. After having been decimated, France must now be invaded and subjugated, for him.

On December 1st the allies issued their manifesto from Frankfort, in which they declare themselves at war not with France but with Napoleon (an imitation of the Revolutionary principle "Peace with peoples, war with Governments"), and the invasion followed with almost Napoleonic rapidity. The three armies remain separate as they had been in Germany. The great army under Schwarzenberg passes through Switzerland, and makes its way to the plateau of Langres (the source of the Seine, Aube, and Marne), where it begins to arrive about the middle of January; Blücher's Silesian army crosses the middle Rhine to Nancy; the northern army, nominally under Bernadotte, passes through Holland. In the course of the march Switzerland and Holland were swept into the Coalition, the resources of which were now become overwhelming. It would be difficult to state for what object Napoleon now called on France to fight another campaign, particularly as the allies guaranteed to her a larger territory than she had possessed under the old monarchy. His officers indeed wondered what personal object he could have. They were astonished to hear him talk of another campaign in Germany to be undertaken next spring, of being soon on the Vistula again, &c. He was no doubt a prey to illusions, his fortune having accustomed him to expect results ten times greater than the probabilities justified, but his confidence was founded on (1) the great force which still remained to him shut up in German fortresses, (2) the mutual jealousy of the allies, (3) his own connexion with the emperor of Austria, (4) the patriotism which would be roused among the French, as in 1792, by the invasion. But his calculations were confounded by the rapidity of the invaders, who gave him no time to call out the nation. The Senate did indeed grant him 300,000 men, but to levy, drill, and arm them was impossible, and he had neglected to fortify Paris. In the armies which had returned from Germany there began desertion of all who were not French. The campaign opened at the end of January and was over at the end of March. The scene of it was the country between the Marne, Aube, and Seine, partly also the department of Aisne. At first, though successful at Brienne, Napoleon seemed unable to resist the superior numbers of the enemy. He was defeated at La Rothière. But the invaders were as yet irresolute; they divided their forces. This gave him an opportunity. He attacked Blücher, and, though with greatly inferior forces, won four battles in four days, at Champaubert (February 10th), at Montmirail (11th), at Château-Thierry (12th), at Vauchamps (13th). For the moment this brilliant success gave the campaign quite another character; the hopes and patriotic feelings of the French were roused. A congress had already been opened at Châtillon, and under the impression of these victories it would have been easy to conclude a peace, had not Napoleon's position made a reasonable peace inadmissible to him. He felt this, and fell back upon illusions and upon attempts to sever Austria from the Coalition. At the beginning of March the Coalition was strengthened by the treaty of Chaumont, in which each of the four powers bound themselves for twenty years to keep 150,000 men on foot. Directly afterwards Napoleon received a crushing blow from the fall of Soissons and the junction of Blücher with the northern army under Bülow, which had entered France by way of Holland and Belgium. Their united force amounted to more than 100,000 men. The battles of Craonne and Laon followed, in which Napoleon, without suffering actual defeat, saw his resources dwindle away. On March 18th the conferences at Châtillon came to an end, the plenipotentiaries of the allies declaring Napoleon to have no intention but that of gaining time. About the 24th the allies came to the resolution to march on Paris. They had before them only Marmont and Mortier, for Napoleon himself had resolved to manœuvre in their rear, and had marched to St Dizier. The marshals, after an engagement at Fère Champenoise, made good their retreat to Paris, where the enemy followed them on the 29th. Joseph Bonaparte withdrew Marie Louise and the king of Rome to Tours. On the 30th the allies attacked in three divisions,—the Silesian army on the side of Montmartre, Prince Eugene of Würtemberg and Barclay de Tolly by Pantin and Romainville, the crown prince of Würtemberg and Giulay by Vincennes and Charenton. In the afternoon, after an obstinate resistance, the marshals offered a capitulation, and engaged to evacuate the town before seven o'clock in the morning. Napoleon, advancing by forced marches, was too late. The military struggle is over; the political struggle begins.

Since 1804 there had been no independent political life in France. During the Russian expedition, indeed, a certain General Malet had spread a false report of Napoleon's death in Russia, and had produced a forged decree of the Senate restoring the republic. His attempt had for the moment had so much success that Napoleon had painfully felt the precariousness of his dynasty, the purely provisional character of the monarchy he had founded. Again, when Napoleon had made his last appeal for help to the Corps Législatif, Lainé of Bordeaux had conjured the emperor, while he defended the country, to maintain the entire execution of the laws which guarantee to the French liberty, security, and property, and to the nation the free exercise of its political rights. Napoleon had replied with an outburst of indignation. But now at last it became necessary to take an independent resolution, for in the influential classes it began to be understood that Napoleon must fall, and in particular the generals asked themselves for what rational purpose troops were still levied and battles still fought. But not even the germs were visible of any authority that could replace that of Napoleon. Should he be succeeded by another general, or by a regency for his son, or by the Bourbons? The first course might have been possible had some Moreau been at hand; even as it was, Bernadotte, who, like Napoleon, was a Jacobin developed into a prince, made pretensions which were favoured by the czar. Such a course would have been a revival of the consulate, but it would not have satisfied the republican party, while it would have been rejected by monarchists of every shade. In favour of the regency, as against the Bourbons, there was much to be said. It would not begin with a fantastic transformation-scene, and it would have a hold on the popular imagination. The decision fell out by a sort of accident. To a regency the natural road was by an abdication which would preserve the principle of inheritance. Such an abdication Napoleon gave. On April 4th he reviewed his troops at Fontainebleau, and announced his intention of attacking the allies in Paris. They received his words with enthusiasm; but just at this point the mainstay of his power failed him. The military aristocracy, the marshals, refused to follow him, and Napoleon perceived in a moment that the end was come. Though in arguing with them he had said that a regency of Marie Louise, whom he called "a child," was impossible, yet he now abdicated on condition that his son should succeed under the regency of the empress. Ney, Macdonald, and Caulaincourt set out for Paris to negotiate the establishment of the regency.

Napoleon's power rested first on the support of the great military magnates, but secondly on the great civil dignitaries, lavishly enriched by him, whose organ was the Senate. While the marshals forced him to abdicate, his reign had been brought to an end in a wholly different way by the Senate. Talleyrand, vice-president of this body, who had for some time been intriguing in favour of the Bourbons, pronounced openly in favour of them before the sovereigns when they entered Paris. "The regency," he said, "was an intrigue; the Bourbons alone were a principle." He convoked the Senate on April 1st, and on April 2d it voted the deposition of Napoleon and his family. This decision was ratified the next day by the Corps Législatif.

Then occurred the abdication in favour of his family, which had the support of the army. The instrument was brought to Paris by not less than three famous marshals, Ney and Macdonald having been joined on their way from Fontainebleau by Marmont. The two solutions were thus brought together before the allied sovereigns, of whom Alexander was not favourably disposed to the Bourbons, and Francis was the father of Marie Louise. For a moment the balance trembled.

But Marmont had been brought in contact, during his defence of Paris, with Talleyrand, and had committed himself to him before he knew of the view of the marshals. After evacuating Paris he had been stationed on the Essonne. Here he had entered into an engagement to place his corps at the service of the new provisional Government which the Senate had constituted; the arrangement was that on April 5th the corps should quit its position and march into Normandy. But when the marshals passing through his camp from Fontainebleau told him of their commission, he had revealed his secret with expressions of penitence; he had countermanded his orders to the inferior officers, and had gone with the marshals to Paris. In his absence, however, General Souham, influenced by a fear that the plot had become known to Napoleon, gave orders to the troops to march on Versailles. This appearance of division in the army was fatal to Napoleon's family. It decided Alexander to declare for the Bourbons, and Caulaincourt was instructed to demand from Napoleon an abdication pure and simple. In return he was to retain the title of emperor, and to have the island of Elba in sovereignty, while Marie Louise was to have a principality in Italy.

By an irony of fortune the Government founded at Brumaire, in which everything had been sacrificed to military efficiency, was the only one of the three Governments of France since 1789 which actually succumbed before an invader. The total result of so many conquests was that France, which, when Napoleon's name was first heard of, was in substantial possession of Belgium, the left bank of the Rhine, Savoy, and Nice, had now lost the first two acquisitions; and we shall see what measures he took to deprive her of the other two. His fatal power of bewildering the popular mind was already at work again. This last campaign, the most unpatriotic he ever fought, had seemed to redeem his faults, and had given him the name of a heroic defender of his country. This view made way fast, as soon as he had the restored Bourbons for a foil.

In the meantime, however, all the hatred, long suppressed, of individuals and of parties broke loose upon him. For the moment he seems to have utterly lost heart. On the night of April 11th, after signing the unconditional abdication, he is said to have taken a dose of a poison which ever since the Russian campaign he had kept by him. But vomitings, we are told, came on and saved him. On the 20th, when he bade farewell to his soldiers, he had resolved to live in order "to narrate to posterity the great deeds we have done together." He soon found another object for life; but a year later, after another downfall far more complete and ignominious, he clings to life, and he clings to it afterwards in captivity. The soldiers idolized him still, and his parting scene at Fontainebleau, when he kissed the eagle, was pathetic; but when he reached the south of France he met with other demonstrations of feeling. At Avignon and Orgon the crowd attacked the carriages, and wanted to throw the tyrant into the Rhone. He was compelled to disguise himself. At the coast he was met by an English frigate which landed him on May 4th at Porto Ferraio, in Elba. It seems to have been arranged among the sovereigns that his wife and child were not to rejoin him, nor did he complain of this. Marie Louise set out on April 23d, and was at Schönbrunn again before the end of May. About the same time Josephine died at Malmaison, in the arms of her children Eugène and Hortense.

It must have occurred to Napoleon very soon after his arrival in Elba that he was not yet driven to autobiography. Never was a great state in a position so untenable and monstrous as France after he quitted the helm. In twenty years of thrilling events, in the emotions first of tragedy and then of epic poetry, the French had forgotten the Bourbon court, when suddenly the old Comte de Provence (under the name of Louis XVIII.) and the Comte d'Artois, Condé and the Duc d'Angoulême, and the Orpheline du Temple reappeared and took possession of the country before even a royalist party had formed itself in France. Politically, indeed, they brought liberty, for they created a parliament where all assemblies had been mute and servile for fourteen years; but they unsettled all domestic affairs, the position of public men, the prospects of the army, the title of estates, in a manner so sudden and intolerable, and that at a moment when the country had suffered conquest from without, that some new convulsion seemed manifestly imminent. Disgraced, bewildered, and alarmed at the same time, the French could think with regret even of the reign of Napoleon. The wholesale massacre of the last two years might have been expected to seem like a bad dream as soon as the spell was snapped, but it began to seem regrettable in comparison with the present humiliation. Another event happened which was like a new revolution. The prisoners and the troops shut up in German fortresses returned to France under the treaty, perhaps not less than 300,000 men. What could be more evident than that if all these soldiers could take the field again, and under Napoleon, France might yet escape the humiliation of a Government imposed by foreigners, and perhaps also recover her lost frontiers. The congress of Vienna entered upon business in September, and from this time a new chapter of politics opened. France ceased to be the general bugbear, and new alliances began to be formed in order to check the aggressive spirit of Russia. The European Coalition, once dissolved, might not be so easily reconstituted. Internal politics also had altered. A wild party of ultras had sprung up among the royalists; the church was beginning to give disquiet to the holders of national property; the army was enraged by seeing *émigrés* who had fought against France appointed in great numbers to the command of regiments.

It was not the first time that Napoleon had gone into a sort of exile. As he had disappeared in the East, and returned to make Brumaire, so he might come from Elba to rescue France. The situation was not less intolerable than in 1799. As then, so now, had he not returned, a revolution would, nevertheless, have taken place. Fouché was weaving a military plot, which would have carried to power perhaps the duke of Orleans, perhaps the king of Rome.

He entered upon the last of his thousand adventures on February 20, 1815, when he set sail from Porto Ferraio with Generals Bertrand and Drouot and 1100 soldiers. On March 1st he reached the French coast between Cannes and Antibes. Twenty days after he entered the Tuileries in triumph.

He had judged the feeling of the army correctly, and also the effect which would be produced by his prodigious fame. These causes were more than enough to overthrow a Government so totally without root as that of the Bourbons. From the coast he took the way across the mountains of Provence by Sisteron and Gap to Grenoble. The soldiers sent from this town to stop him were disarmed when he uncovered his breast and asked, Which of them would fire on his emperor? He was then joined by the royalist La Bédoyère. Macdonald at Lyons stood firm, but was deserted by his soldiers. Ney, who commanded in the east, at first declared himself violently against his old chief, but the military feeling afterwards gained him, and he joined Napoleon at Auxerre. The king left the Tuileries on the 19th, retiring northward, and on the next day Napoleon entered Paris.

At Brumaire he had put down Jacobinism, and given the nation order and repose. Now he was summoned, in the name of liberty, to protect the acquisitions of the Revolution and to defend the national honour against the triumphant foreigner. The Hundred Days are the period of popular or democratic imperialism. Those who sided with him told him frankly that he must turn over a new leaf, and he professed himself ready to do so. It would be rash to say that this was impossible. He was but forty-five; his return from Elba was an astonishing proof that he still possessed that elasticity of spirit, that power of grasping the future, which he had often shown so remarkably. Here then, as at a second Brumaire, might begin a third Napoleonic period. The mad crusade against England and the world-empire which sprang out of it were now to be forgotten; he was to stand out as a hero of national independence and of modern ideas together, a representative of the free modern people against the Holy Alliance. This last and most surprising of his transformations was already most prosperously begun. But at this point fortune deserted him once for all. Napoleon Liberator remained a poetical idea, transforming his past life into legend, and endowing French politics with a new illusion; the attempt to realize it came to an end in a hundred days (March 13 to June 22).

The ultimate cause of this failure seems to have been a change in Napoleon himself. It had long been remarked that the emperor Napoleon was wholly different from the general Bonaparte of the Italian campaigns. Bonaparte had been lean, shy, laconic, all fire and spirit, the very type of republican virtue imagined by Rousseau; the emperor was fat and talkative, and had his fits, according to Marmont, of indolent ease. Once or twice there had been attacks of illness, by which he had been temporarily incapacitated; but this had been hushed up. On the whole he had never yet been wanting to himself. In the campaign of 1814 his activity had been prodigious, and the march to Paris in twenty days, with which he had opened 1815, had been a great display of vigour. But he could not maintain himself at this level. A physical decay had begun in him, affecting through his body, not indeed his mind, but his will and his power of application. "I do not know him again," said Carnot. "He talks instead of acting, he the man of rapid decisions; he asks opinions, he the imperious dictator, who seemed insulted by advice; his mind wanders, though he used to have the power of attending to everything when and as he would; he is sleepy, and he used to be able to sleep and wake at pleasure." This last symptom was the most striking; in some of the most critical and terrible moments of the Waterloo campaign he seems to have been scarcely able to keep himself awake.

The constitutional history of the Hundred Days may be despatched summarily, since it led to nothing. On March 13 an imperial decree was issued from Lyons dissolving the two chambers established by the Bourbons, and convoking an extraordinary assembly in Field of May for the purpose "of correcting and modifying our constitutions and of assisting at the coronation of the empress, our dear and well-beloved spouse, and of our dear and well-beloved son." But the prospect soon changed, and, as it was necessary that the empire, like the monarchy, should have its charter, it seemed impossible to wait till May. Napoleon had recourse to Benjamin Constant, that is, he marked his change of policy by sending for the leader of the opposition. The "Acte Additionnel aux Constitutions de l'Empire," dated April 22, was drawn by Constant, examined by a committee, and then adopted by the council of state. The most remarkable feature of it is the preamble, in which he explains his change of attitude by saying that "formerly he had endeavoured to organize a grand federal system in Europe, which he had regarded as agreeable to the spirit of the age and favourable to the progress of civilization," that "for this purpose he had adjourned the introduction of free institutions," but that "henceforward he had no other object but to increase the prosperity of France by strengthening public liberty."

This neat misrepresentation deserves notice as having imposed on many people. For the rest it is to be observed that this act creates an hereditary peerage. The Field of May was held, but not till June 1. Napoleon appeared in a grand costume and distributed flags, but the "well-beloved spouse and son" were not there; Europe had declared against him. On the 12th he set out for the campaign.

The great powers had issued, immediately on hearing of Napoleon's disembarkation (March 13th), a declaration putting him outside all civil and social relations, and consigning him to public vengeance as "an enemy and disturber of the peace of the world." On March 25th they reconstituted the Coalition. Was this a disappointment to Napoleon? A war of liberation was perhaps necessary to him. To be freely accepted by the French people, and then to be rejected by Europe, gave him precisely the opportunity he sought of standing forth as the heroic champion of national independence. He had now all the soldiers who at the time of his first fall had been locked up in fortresses or foreign prisons. His position was therefore such as it had been in 1813, not in 1814, and he proposed to defend not a vast empire but simply France, so that he had on his side patriotism and liberalism. All this, and his own genius! Would not so much suffice? Probably he remembered Brumaire, how low the fortune of France at that time had been, and how suddenly Marengo had restored all. For the moment, however, the inequality of numbers was great. In June the allies had in the field more than 700,000, Napoleon little more than 200,000, men. There were already English troops in Belgium, where they were engaged in establishing the new kingdom of the Netherlands, and there were Prussian troops in the Rhenish province which had just been given to Prussia. It was a question for Napoleon whether he should assume a defensive attitude and allow the allies to invade France—this in itself would have suited his new policy best—or carry the war into Belgium, a country long united with France, and attack the English and Prussians. He shrank from inflicting a new invasion upon France, especially on account of the strength of the royalist party in many regions, and thus it was that the scene of the campaign was laid in Belgium. The English had their headquarters at Brussels, the Prussians at Liége. He formed the plan of dividing them and beating them in turn, as he had served the Austrians and Sardinians at the very beginning of his career. Many circumstances, however, were different. Wellington and Blücher with Gneisenau were superior to Colli and Beaulieu; the Napoleon of 1815 was vastly inferior to the Bonaparte of 1796.

Of all the Napoleonic campaigns this was by far the most rapid and decisive. Even the Marengo campaign had lasted a month, but this was decided in three days. Leaving Paris on the 12th, Napoleon was in Paris again on the 21st, his own fate and that of his empire and that of France decided. Everything concurred to make this short struggle the most interesting military occurrence of modern history: its desperate intensity, its complete decisiveness, the presence for the first and last time of the English army in the front of the European contest, the presence of the three most renowned commanders, Napoleon, Wellington, and Blücher. Accordingly it has been debated with infinite curiosity, and misrepresented on all sides with infinite partiality. Napoleon's army amounted to 122,401 men; it contained a large number of veterans, besides many who had seen the campaigns of 1813–14, and was perhaps the finest army he had ever commanded. That of Wellington was composed of Englishmen, Hanoverians, Brunswickers, Nassauers, Germans, and Netherlanders; the total is stated at 105,950. But in the Netherlanders of the newly-established kingdom no confidence could be placed, and yet these amounted to nearly 30,000; the English too (about 35,000) were in great part raw recruits (the Peninsular veterans being mainly absent in America); altogether Wellington pronounced it "the worst army ever brought together." The army of Blücher numbered 116,897 disciplined troops, animated by an intensely warlike spirit. Napoleon's opening was prosperous. He maintained so much secrecy and used so much rapidity that he succeeded in throwing himself between the two armies. On the 15th he advanced and occupied Charleroi. On the 16th he engaged the Prussians at Ligny and the English at Quatrebras, desiring to block the cross-road between Quatrebras and Sombreffe, and so to sever the two armies. Napoleon personally commanded against the Prussians, and here he gained his last victory. The battle was very bloody; about 12,000 Prussians fell, and Blücher himself was wounded. At Quatrebras Ney met Wellington and was forced to retreat. But the defeat of Blücher made it necessary for Wellington to retire on Brussels in order to effect a junction with the Prussians. The 17th was spent in this retrograde movement, and on the 18th Wellington accepted battle on the heights of St Jean, from which the French name it, while the English give it the name of Waterloo, a village four miles nearer to Brussels, where Wellington wrote his despatch. He accepted battle in full reliance upon the help of the Prussians, who are not therefore to be considered as having saved him from defeat.

Military writers point out several errors, some of them considerable, committed by Wellington, but their criticism of Napoleon, which begins by sweeping away a mass of falsehood devised by himself and his admirers in order to throw the blame upon others, is so crushing that it seems to show us Napoleon after his brilliant commencement acting, as an indolent and inefficient general. He first, through mere want of energy, allows the Prussians to escape him after Ligny, and then sends Marshal Grouchy with 33,000 men in the wrong direction in pursuit of them. Owing to this mismanagement Grouchy is at Wavre on the day of the battle of Waterloo, fighting a useless battle against the Prussian corps of Thielemann, while Blücher is enabled to keep his engagement to Wellington. Everywhere during these days Napoleon appears negligent, inactive, inaccessible, and rather a Darius than an Alexander, so that it has been plausibly maintained that he was physically incapacitated by illness. The battle itself was one of the most remarkable and terrible ever fought, but it was perhaps on both sides rather a soldiers' than a generals' battle. It consisted of five distinct attacks on the English position:—(1) an attack on the English right by the division Reille, (2) an attack on the left by the division D'Erlon (here Picton was killed), (3) a grand cavalry attack, where the splendid French cavalry "foamed itself away" upon the English squares, (4) a successful attack by Ney on La Haye Sainte (which Wellington is thought to have too much neglected; it was after this that the French prospect seemed brightest), (5) the charge of the guard. In the middle of the third act of this drama the Prussians began to take part in the action. The battle seems to have begun about 11.30, and about 8 o'clock in the evening the cry "Sauve qui peut" rose from the guard. A general advance of the English decided the victory, and then the pursuit was very thoroughly accomplished by the Prussians under Gneisenau. Napoleon at first took refuge in a square. At Genappe he left this, and arrived at Charleroi about daybreak with an escort of about twenty horsemen.

He lost probably more than 30,000 out of 72,000 men, but the grand army was utterly dissolved. The whole loss of the allies was somewhat more than 22,000. Had Napoleon been victorious, he would but have opened the war prosperously, for half a million soldiers, in addition to those of Wellington and Blücher, were on the march for France; being completely defeated, he had no resource, but was ruined at once. France was conquered, as she had been conquered the year before; but her second fall appears far more humiliating and dismal than her first, when we consider how enthusiastically she had rallied to Napoleon and how instantaneously Napoleon and she had been struck down together. It was a moment of unrelieved despair for the public men who gathered round him on his return to Paris, and among these were several whose fame was of earlier date than his own. La Fayette, the man of 1789; Carnot, organizer of victory to the Convention; Lucien, who had decided the revolution of Brumaire,—all these met in that comfortless deliberation. Carnot was for a dictatorship of public safety, that is, for renewing his great days of 1793; Lucien too liked the Roman sound of the word dictator. "Dare!" he said to his brother, but the spring of that terrible will was broken at last. "I have dared too much already," said Napoleon. Meanwhile, in the Chamber of Representatives the word was not dictatorship but liberty. Here La Fayette caused the assembly to vote itself permanent, and to declare guilty of high treason whoever should attempt to dissolve it. He hinted that, if the word abdication were not soon pronounced on the other side, he would himself pronounce the word "dechéance." The second abdication took place on June 22d. "I offer myself a sacrifice to the hatred of the enemies of France. My public life is finished, and I proclaim my son emperor of the French." On the 25th he retired to Malmaison, where Josephine had died the year before. He had by no means even yet ceased to hope. When his son was passed over by the Chamber of Representatives, who named an executive commission of five, he protested that he had not intended to make way for a new Directory; and, as Carnot and Caulaincourt were on this commission, the circumstances of Brumaire seem to have flashed into his memory. He saw again two Directors supporting him, and the other three (Fouché, Grenier, and Quinette—a traitor and two babies, as he expressed it) might remind him of Barras, Moulin, and Gohier. On the 27th he went so far as to offer his services once more as general, "regarding myself still as the first soldier of the nation." He was met by a refusal, and left Malmaison on the 29th for Rochefort.

France was by this time entering upon another Reign of Terror. Massacre had begun at Marseilles as early as the 25th. What should Napoleon do? He had been before the enemy of every nation, and now he was the worst enemy, if not of France, yet of the triumphant faction in France. He lingered some days at Rochefort, where he had arrived on July 3d, and then, finding it impossible to escape the vigilance of the English cruisers, went on the 15th on board the "Bellerophon" and surrendered himself to Captain Maitland. It was explained to him that no conditions could be accepted, but that he would be "conveyed to England to be received in such manner as the prince regent should deem expedient." He had written at Rochefort the following characteristic letter to the prince regent:—"Royal Highness,—A prey to the factions which divide my country and to the enmity of the greatest powers of Europe, I have terminated my public career, and I come, like Themistocles, to seat myself at the hearth of the British people. I place myself under the protection of its laws, which I claim from your royal highness as the most powerful, the most constant, and the most generous of my enemies."

It was perhaps the only course open to him. In France his life could scarcely have been spared, and Blücher talked of executing him on the spot where the Duc d'Enghien had fallen. He therefore could do nothing but what he did. His reference to Themistocles shows that he was conscious of being the worst enemy that England had ever had. Perhaps he remembered that at the rupture of the treaty of Amiens he had studied to envenom the contest by detaining the English residents in France. Still he might reflect, on the other hand, that England was the only country which had not been trampled down and covered with massacre by his soldiers. It would have been inexcusable if the English Government had given way to vindictive feelings, especially as they could well afford to be magnanimous, having just won the greatest of all victories. But it was necessary to deprive him of the power of exciting new wars, and the experiment of Elba had shown that this involved depriving him of his liberty. The frenzy which had cost the lives of millions must be checked. This was the principle laid down in the declaration of March 15th, by which he had been excommunicated as a public enemy. It was therefore necessary to impose some restraint upon him. He must be separated from his party and from all the revolutionary party in Europe. So long as he remained in Europe this would involve positive imprisonment. The only arrangement therefore which would allow him tolerable personal comfort and enjoyment of life was to send him out of Europe. From these considerations grew the decision of the Government to send him to St Helena. An Act of Parliament was passed "for the better detaining in custody Napoleon Bonaparte," and another Act for subjecting St Helena to a special system of government.

He was kept on board the "Bellerophon" till August 4th, when he was transferred to the "Northumberland." On October 15th he arrived at St Helena, accompanied by Counts Montholon, Las Cases, and Bertrand, with their families, General Gourgaud, and a number of servants. In April 1816 arrived Sir Hudson Lowe, an officer who had been knighted for bringing the news of the capture of Paris in 1814, as governor.

The rest of his life, which continued till May 5, 1821, was occupied partly in quarrels with this governor, which have now lost their interest, partly in the task he had undertaken at the time of his first abdication, that of relating his past life. He did not himself write this narrative, nor does it appear that he even dictated it word for word. It is a report made partly by General Gourgaud, partly by Count Montholon, of Napoleon's impassioned recitals; but they assure us that this report, as published, has been read and corrected throughout by him. It gives a tolerably complete account of the period between the siege of Toulon and the battle of Marengo. On the later periods there is little except a memoir on the campaign of 1815, to which the editors of the *Correspondence* have been able to add another on Elba and the Hundred Days.

These memoirs have often been compared to the *Commentaries* of Cæsar, and their value would indeed be priceless if they related to a period imperfectly known. But an age which has abundance of information, and takes history very seriously, is struck particularly by the elaborate falsifications which they contain. A vast number of misstatements, many of them evidently intentional, have been brought home to him, and in several cases he has tried to foist into history apocryphal documents.

Here, as throughout his life, he shows quite a peculiar talent for misrepresentation. He knows that nine readers out of ten take a lucid statement for a true one, and his statements are always lucid, precise, and direct. And thus it has been, and is, particularly difficult to eradicate the Napoleonic legend, which has grown up in the very midst of the 19th century, and would perhaps never have been seriously shaken but for the failure of the Second Empire. Its growth was helped by the accident that at the moment of quitting the scene he seemed to be fighting for a good cause. Look at Napoleon's career between 1803 and 1814, when it was shaped most freely by his own will; here everything is anti-popular, illiberal, and immoral, as well as ruinous beyond all precedent. In particular he stands out as the great enemy and oppressor of nationalities, so that the nationality movement, when it begins in Spain and Tyrol and spreads through North Germany, is a reaction against his tyranny. But in 1815 he succeeded in posing as a champion and martyr of the nationality principle against the Holy Alliance. The curtain fell upon this pose. It brought back the memory of that Bonaparte who at the end of the 18th century had seemed the antique republican hero dreamed of by Rousseau, and men forgot once more how completely he had disappointed their expectations. By looking only at the beginning and end of his career, and by disregarding all the middle of it, an imaginary Napoleon has been obtained who is a republican, not a despot, a lover of liberty, not an authoritarian, a champion of the Revolution, not the destroyer of the Revolution, a hero of independence, not a conqueror, a friend of the people, not a contemner of the people, a man of heart and virtue, not a ruthless militarist, cynic, and Machiavellian. This illusion led to the restoration of the Napoleonic dynasty in 1851.

He died of an ulcer in the stomach on May 5, 1821. In his will he declared himself a Catholic, wished his ashes to repose "on the banks of the Seine in the midst of the French people whom he had loved so well," spoke tenderly of Marie Louise and his son, and of all his relatives except Louis, whom he "pardoned" for the libel he published in 1820, disavowed the *Manuscrit de Sainte-Hélène*, a mystification which had recently had much success, defended the execution of D'Enghien, imputed the two conquests of France to Marmont, Augereau, Talleyrand, and La Fayette, whom he "forgave," and devoted the English oligarchy, to whom he ascribed his premature death, to the vengeance of the English people. In a codicil he added a truly Corsican touch, bequeathing 10,000 francs to the subaltern officer Cantillon, "who has undergone a trial upon the charge of having endeavoured to assassinate Lord Wellington, of which he was pronounced innocent. Cantillon had as much right to assassinate that oligarchist as the latter had to send me to perish upon the rock of St Helena."

He was buried at Longwood in St Helena; but in the reign of Louis Philippe his remains were removed by permission of the English Government to the Invalides at Paris, where a stately dome was erected over the sarcophagus that contains them.

Posterity has not yet ceased to be perplexed by Napoleon's career. He inflames national partialities more than any other personage, and his activity, by embracing many countries, transcends the field of view of the historians of each nation. Till a recent time his life was written chiefly from French memoirs,—when by French writers, with great ignorance of all affairs not French, when by English writers, with imperfect knowledge of all affairs not French or English, and by all writers alike, especially French writers, with extreme prejudice. Then came M. Thiers (1845), professing to write from official papers; but his untrustworthiness in particular matters has long been demonstrated, and some recent investigators (see, for instance, De Martel, *Les Historiens Fantaisistes*) profess to convict him of the most outrageous contempt for truth. The story is now being slowly transferred from the basis of memoirs to that of official papers and correspondence. The *Correspondence* of Napoleon himself in thirty-two volumes (which began to appear in 1858) is necessarily the cornerstone, though it has been edited in the most unsatisfactory way, many letters having been withheld and others mutilated, even if some have not been garbled. On this foundation M. Lanfrey based his history, which extends unfortunately only as far as 1811. It is the first essay towards a serious estimate of the career; what the writer chiefly wants is a first-hand knowledge of the affairs of foreign nations. It still remains to fuse together these materials with those equally rich that have been lately furnished by German research and by the opening of the different national archives. On German affairs the principal works are those of Ranke, Pertz, Oncken, and Treitschke. For the substance of them the English reader may refer to Professor Seeley's *Life and Times of Stein*. A good account (founded on original documents) of the Russian campaign by Bogdanovitch may be read in German. Colonel Jung in two works, *Bonaparte et son Temps* and *Lucien Bonaparte et ses Mémoires*, shows himself a true historical critic. The former work renders earlier books on the first period of Bonaparte (Coston, Libri, &c.) superfluous. Of military works, Rüstow on the Italian campaigns, Charras on the campaign of 1815, and Charras's fragment on the campaign of 1813, with Mr Dorsey Gardner's volume on the campaign of 1815, may be recommended. Recent years have also brought valuable new memoirs, those of Marmont, of Miot de Melito, of Hardenberg (included in Ranke's *Life*), of Mme. de Rémusat, of Metternich. Mme. de Rémusat with the Duchesse d'Abrantès gives the best picture of his private life. This whole class of books should be used with caution. Marmont often excites distrust; still more the earlier memoir-writer Bourrienne. The reader must also be on his guard against apocryphal works, such as *Mémoires tirés des papiers d'un homme d'état*, long attributed quite without ground to Hardenberg, and the *Manuscrit venu de Ste-Hélène*. (J. R. S.)

NAPOLEON II. is the name given by Bonapartists to François Charles Joseph, duke of Reichstadt, the son of Napoleon I. and Marie Louise, who was born at Paris 20th March 1811, and died of laryngeal phthisis at Schönbrunn, near Vienna, 22d July 1832. His empty imperial title is derived from his father's two abdications in his favour in 1814 and 1815. He was created duke of Reichstadt in 1818 by his grandfather Francis I. of Austria, at whose court he resided after his father's fall.

NAPOLEON III. (1808–1873). Louis Napoleon, emperor of the French, was the younger son of Louis, king of Holland (brother of Napoleon I.), and of Hortense, daughter of the empress Josephine by her first husband Beauharnais. He was thus both nephew and step-grandson of Napoleon I. His father and mother were on the worst terms, and rarely lived together. Louis was born at Paris on April 20, 1808, at the house belonging to his mother in the street that is now Rue Lafitte. He was brought up at Paris, and was occasionally taken to the Tuileries and noticed by the emperor, who gave him the cordon of the Legion of Honour. But it is impossible that the child could have remembered much of Napoleon I., who, from the beginning of the Russian campaign in 1812, was constantly away from Paris. When, in 1814, the allies entered the French capital, generosity towards the conquered was the order of the day. Queen Hortense was courteously treated and visited by the czar Alexander, to whom her boy is said to have given a ring. The family continued to reside in France during the first restoration of the Bourbons, and were there when Napoleon returned from Elba. A story that when Napoleon was on the point of setting out for Waterloo the young Louis interrupted him in a conference with Marshal Soult, and begged him not to go to the war, is probably mythical. The second restoration of the Bourbons was not effected in so gentle a spirit as the first. The family of the Bonapartes was banished from France. Hortense—who, like the rest of her kindred, had enriched herself out of public property—retired to Switzerland, and purchased the chateau of Arenenberg, overlooking the Lake of Constance. The next fifteen years were passed by the young Louis partly at Arenenberg and partly at Augsburg, which his mother chose as the place of his education. He grew up a gentle, studious, brooding youth, and the influence of his Augsburg schooling remained both in his habits of thought and in his German-like pronunciation, which was noticeable long afterwards. Until 1830 he attracted little attention from those around him, and none at all from the world, for he was as yet only one among several cadets of the Napoleonic house, Napoleon's own son, the duke of Reichstadt, being still alive. He seems, however, to have had dreams of a great future at an early age; and the instinct that some knowledge of military affairs would be useful to him led him to serve as an artillery volunteer in the Swiss camp of Thun under Colonel Dufour. The revolution of 1830, which dethroned the Bourbons and awoke insurrectionary movements in so many countries, first launched Louis Napoleon upon his eventful career. Along with his elder brother he joined the Italian bands who were in revolt against the rule of the pope in Romagna. This revolt was put down by Austrian soldiers. The elder of the two brothers fell ill and died at Forli; Hortense, setting out to rescue her sons from their danger, found one dead and the other ill with fever, and on the point of falling into the hands of the Austrians at Ancona. After nursing Louis through his illness she succeeded in carrying him away in disguise, and the mother and son, after a most perilous journey, reached France, which they had not seen for sixteen years. They arrived in Paris in April 1831; but the law banishing the Bonapartes was still in force, and the Government of Louis Philippe did not allow them to remain there more than twelve days. They were sent on, like other exiles, to England, and stayed for some weeks in London, from which they returned to Arenenberg. Louis, now twenty-three years old, was beginning to form the political theories which the memory of the first empire and the actual state of affairs in France under Louis Philippe naturally suggested to a thoughtful and ambitious mind. A pamphlet called *Political Reveries*, containing the draft of a constitution for France, and an *Essay on Switzerland, Political and Military*, were written by him in 1832–33. The first of these contains in a crude and superficial form the ideas elaborated by the author in his later works; the second gained for him the complimentary rank of captain of artillery from the authorities of Bern. Louis remained quiet for some years in Switzerland, but the death of the duke of Reichstadt in 1832 had made him presumptive head of the house of Bonaparte,—his uncle Joseph, the actual head, having no sons; and, in company with some adventurous friends, he formed the design of overthrowing Louis Philippe's Government by presenting himself to the army. On the 28th October 1836 he came to Strasburg, and, after passing the next day in consultations with Colonel Vaudrey and a few officers who were in the plot, appeared at the quarters of the 4th artillery regiment, which Vaudrey commanded. This regiment welcomed him, and Louis then went on to the infantry barracks, where, however, the enterprise ended disastrously. He was arrested and imprisoned, and, after a short interval, sent to America by Louis Philippe without trial. He had not long been in the United States when he received a letter from his mother stating that she was about to undergo a dangerous operation. He returned to Switzerland in time to see her before her death (October 5, 1837), denying, probably with truth, that he had made any promise to Louis Philippe to remain absent from Europe. A pamphlet on the Strasburg affair, which was now published at his instigation by one of his companions, Lieutenant Laity, led the French ministry to demand his expulsion from Switzerland. The Swiss Government declining to expel him, and, difficulties with France becoming imminent, Louis voluntarily withdrew from the country and went to England. He lived there for the next two years, renting a house in Carlton Terrace, leading the life of a man of fashion, and associating with persons of prominence in society and on the turf. Among the gaieties of the time in which he took a part was Lord Eglinton's famous tournament. His real interests, however, were of a more serious character, and in the autumn of 1839 he published the treatise *Des Idées Napoléoniennes*, a vigorous but sophistical account of Napoleon's work as an administrator and organizer, and of his foreign policy. He idealized the emperor, contrasting his internal government with that of his successors in a series of questions addressed to the existing rulers of France, and he exhibited his wars of conquest as struggles forced upon him by the English and other Governments in consequence of his efforts to spread civilization, and to unite the peoples of Europe in a federal tie. This work was intended by its author to prepare the way for a new attempt against Louis Philippe; and in August 1840, while the body of Napoleon was being brought back from St Helena, he made his second descent upon France. Above fifty persons assisted him on this occasion, the best-known being Count Montholon, a companion of Napoleon I. in his exile. A ship was chartered, and the conspirators landed at Boulogne, carrying with them a tame eagle. The enterprise had not even the gleam of success which attended the expedition to Strasburg. No one joined them, and within an hour or two those of the party who were not shot or drowned in attempting to escape were lodged in prison. Louis was now brought to trial before the Chamber of Peers, where he was defended by Berryer. He was condemned to perpetual imprisonment, and the castle of Ham, on the Somme, was chosen as the place of his captivity. For the next six years Louis remained in confinement. He had the qualities which enable a man to bear imprisonment well,—patience, calmness, a low vitality and sluggish temperament, and the power of absorbing himself in work. The fortitude with which, during these six dreary years, he pursued the occupations which he had marked out for himself, and retained, with intervals of depression, the belief in his own future, had certainly something of nobility in it. "Happiness," he wrote, "lies much more in the imagination than in the real world; and as I carry my imaginary world with me, composed of memories and hopes, I feel as strong in solitude as in the crowd." In later life he described the prison of Ham as the university where he had taken his honours; and it was no doubt within this prison that he made himself, so far as literary study and discipline ever made him, a statesman. He published at intervals during his confinement, besides numerous occasional papers, an essay on the sugar question, in which he advocated a policy of protection; a treatise on the *Extinction of Pauperism*, in which he proposed the colonization of waste lands, and the establishment of communities organized on a somewhat socialistic basis; a scheme for cutting through the isthmus of Panama; and historical fragments on the English Revolution of 1688. He was working also at a *History of Artillery*, which was never finished. At the end of six years, after asking in vain for permission to visit his father, who was dying, Louis effected his escape, disguising himself with the aid of his faithful friend and fellow-prisoner, Dr Conneau, as a workman, and walking out of the gates of the castle with a plank over his shoulder (May 25, 1846). He went again to London, and it is characteristic of the life of exile and imprisonment which he had hitherto passed that he heard for the first time a French tragedy performed when Rachel played in London in July 1846. He was now again in the fashionable world, and he appears to have been compelled to raise very large sums of money from money-lenders. The house in which he lived was No. 10 King Street, St James's. In February 1848 Louis Philippe lost his throne. Louis Napoleon at once set off for Paris, offering his services to the provisional Government. He was, however, requested to withdraw from France, and did so. In April 1848, during the Chartist disturbances, he was serving in London as a special constable. But his name was kept before the public in France; he was put up for election to the assembly, and was elected at Paris and in three departments. As a Bonapartist movement was now evidently beginning, the executive commission demanded authority to arrest Prince Louis as an avowed pretender. This, however, was refused by the assembly, and it was voted that he should take his seat. Louis, however, had the astuteness to remain in the background until the workmen's insurrection of June was over, declaring himself unwilling to be the cause of any disturbance. The insurrection was put down by Cavaignac; reaction set in, and Louis now appeared upon the scene as the candidate of order and the representative of authority. His first appearance in the assembly was on September 26, 1848; and in December he was elected president of the republic by above 5,000,000 votes, Cavaignac, who was second on the list, receiving a million and a half, and Lamartine a few thousands. On assuming office he swore in the presence of God to remain faithful to the republic, and to fulfil the duties imposed on him by the constitution. From this time the political history of Louis Napoleon is the history of France (see article FRANCE). The principal foreign affair of his presidency was the expedition to Rome, in which, for the sake of anticipating the action of Austria, French troops put down the Roman republic by force, and restored the pope to his sovereignty. Abroad this gained for Louis Napoleon the bitter hostility of Italian patriots, who remembered him as a companion in insurrection against the pope in 1831; and it was one of the many inconsistencies of his position that he was at once a friend of Italian freedom in his heart and yet, as the "man of order" and the "saviour of society" in France, dependent to a great extent upon the support of the priesthood. On the 2d of December 1851 he executed the *coup d'état*, which made an end of constitutional government. Approved at first by an enormous majority of the French people, and even by English public men of the type of Palmerston, this act is now almost universally recognized as a disastrous crime. The sham constitution which was promulgated by the president immediately afterwards lasted less than twelve months. In the following November a plebiscite was taken upon the question whether the imperial dignity should be re-established in the person of Louis Napoleon, and an affirmative answer was given by nearly 8,000,000 voters, against a dissentient minority of 250,000. The empire was inaugurated on the anniversary of the *coup d'état*, and for eighteen years Louis Napoleon was sovereign of France. The first ten years of his reign were successful, and in some respects brilliant. His marriage with Eugenie de Montijo, countess of Téba (January 30, 1853), placed beside him a figure which long charmed Paris and its visitors. Adhering to the alliance with England which, since 1830, had served France well against the three eastern courts, Napoleon III. entered into war against Russia. He had always represented the restoration of Poland to be one of the tasks left by his uncle to France; and, had his army encountered fewer difficulties in the Crimea, or had the German powers shown any inclination to take part in the struggle against Russia, he would probably have made some serious attempt to restore at least the duchy of Warsaw. But he was no soldier himself; the war proved a serious and embarrassing matter, and in the end Napoleon was far more anxious to make peace than his English ally. The second nationality which associated itself with Napoleonic history, and which had been crushed by the treaties of 1815, was the Italian. Napoleon III. had warning that the cause of Italy could not be safely abandoned. In January 1858 Orsini attempted to take his life. Whether or not the act of Orsini and the letters which he wrote from prison had the effect of quickening the emperor's determination to do something for Italy may be disputed; but the time had now come, and in the interviews which took place between Napoleon and Cavour at Plombières in the autumn of 1858 the alliance between France and Sardinia against Austria was arranged. In the spring of 1859 French armies entered northern Italy, and the emperor himself took command. On the 4th of June he witnessed the battle of Magenta, and on the next morning entered Milan in company with Victor Emmanuel. During the battle of Solferino on June 24th, he gave directions from the tower of the church of Castiglione. He met the emperor of Austria at Villafranca on July 11th, and there agreed to those preliminaries of peace which so deeply disappointed the hopes that had been excited by his own words,—"Italy free from the Alps to the Adriatic." Venice was left to Austria; Lombardy west of the Mincio alone was liberated; and the subsequent union of the peninsula under the house of Savoy was no work of Napoleon III., whose own plan was to form an Italian federation under the presidency of the pope, and in virtual dependence upon France. Nevertheless the expulsion of Austria from Lombardy was in itself so great a blow that the later effects, though not foreseen by Napoleon, naturally resulted from it; and he has a better title to the gratitude of the Italians than they have generally acknowledged. The feelings with which Napoleon was regarded in Italy before and after the meeting of Villafranca are well exhibited in Mrs Browning's two poems, *Napoleon in Italy* and *An August Voice*. The annexation of Nice and Savoy to France excited great uneasiness in the British Government, but the treaty of commerce between France and England, which was signed in January 1860, gave the emperor a popularity in England which he retained even after his fall. With the termination of the Italian war and the inauguration of a policy of free trade the rule of Napoleon III. had reached its best. His ill-judged interference in the affairs of Mexico ended disastrously; the part played by France in reference to the Danish War of 1864 was weak and inconsequent; and when the great struggle between Prussia and Austria was impending Napoleon appears to have been duped by Count Bismarck, and to have expected to gain Rhenish territory without taking up arms. Meanwhile the splendour of the court, the continuous improvements in Paris, the rapid growth of wealth throughout France, the subservience of officials, deputies, and journalists, had veiled the decline of administrative energy and the progress of corruption and mismanagement. At length, after the establishment of a great North-German power in 1866, the prestige of the emperor unmistakably sank. He had to loosen the reins of government at home; and yet the grant of any degree of liberty appeared to jeopardise his own existence. Failing in health, in confidence, in reputation, he was hurried into the war of 1870 by the clerical party at court, and by advisers who saw no help for his dynasty but in a successful war. He was present with his only child[1] at the bombardment of Saarbrücken on August 2d, and then retired into Metz, which he left on the 15th, the day between the battles of Courcelles and Mars-la-Tour. The empress insisted on the relieving movement which was then undertaken by Macmahon, and the emperor, going with the army, was made prisoner with 90,000 men at Sedan on September 2d. He was sent to the castle of Wilhelmshöhe, near Cassel, from which he subsequently retired to England. He lived with the empress at Chislehurst, and died there on January 9, 1873.

Napoleon III. was a thinker and man of letters rather than a statesman. Presuming on the accident of birth to seize absolute power and to direct the affairs of a great nation, he proved himself totally incapable as an administrator, and allowed office, political and military, to fall into the most unfit hands. Far superior himself, as a man of ideas, to his conqueror the king of Prussia, he never chose and never possessed a minister or a general who could be compared with those selected by his rival. In private life he was kindly and amiable, and the worst acts of his reign were rather those of the adventurers who surrounded him than his own. (C. A. F.)

NAPOLEON, a round game of cards. Any number may play; about four or five makes the best game. When six play the dealer deals himself no hand, but pays or receives the same as the other players. A pack of fifty-two cards is required. The players cut for deal; the lowest deals. The cards rank as at whist; and the deal goes afterwards in rotation to the left, as at whist. The cards are shuffled, and cut to the dealer, who deals each player five cards by one at a time, as at whist. The deal being completed, the player to the dealer's left looks at his hand, and declares how many tricks he will play for (called "standing"). Some players make it compulsory for the eldest hand to declare one trick at least; but if this rule is not in force the eldest hand may decline to play, when he says "I pass." If the eldest hand passes, the next player to the left has a similar option of standing or passing, and so on all round. As soon as any one stands, the next player after him must either pass or stand for more tricks than the one before him, and so on all round. If all pass, the hand is not played, and the player to the dealer's left deals. Some players compel the dealer to play for at least one trick. The stand-hand plays against all the others. He has the first lead, and the first card he leads makes the trump suit. Each player plays one card at a time in rotation, as at whist, except that the played cards remain face upwards on the table in front of the persons playing them. The cards played one by each player constitute a "trick." The players must follow suit if able. If unable to follow suit a player may play any card he pleases. No one is obliged to head the trick nor to trump. If the stand-hand succeeds in making at least the number of tricks he stood for he wins; if not he loses. If he wins he receives from each of the other players the amount previously agreed on for each trick stood for; if he loses he similarly pays all the others. If any one declares "Nap," *i.e.*, that he will play for all five tricks, no subsequent player can stand. The hand is played as before. If the player declaring Nap wins he receives double stakes all round; if he loses he only pays single stakes all round.

Rules of Play.—There is no misdeal, and consequently no penalty for errors in dealing. If a card is exposed in dealing, or the cards are wrongly dealt, there must be a fresh deal, even if the hand has been partly played. Any one, except the stand-hand, playing out of turn, or exposing a card after the deal is completed, or playing with the wrong number of cards, has to pay a fine of the value of three tricks to the stand-hand, in addition to what he may lose if the hand is played out; and if the stand-hand loses the offender receives nothing. If the stand-hand plays with the wrong number of cards, and wins, he receives nothing, and there is a fresh deal. If a player, not the stand-hand, revokes he has to pay the value of five tricks to the stand-hand, in addition to what he may lose on the hand. The cards are played over again from the point at which the revoke was made, and if the stand-hand loses the revoker receives nothing. If the stand-hand revokes he loses what he declared to play for. A player is entitled to be informed how many tricks were stood for, and how many tricks the stand-hand has made.

NARA, the oldest of the successive capitals of Japan, is situated in the north of Sakai *ken* (province of Yamato), about 65 miles east of Ozaka, in 34° 4′ N. lat. and 135° 49′ E. long., on the slope of a range of picturesque hills, beautifully wooded, with cryptomerias, evergreen oaks, the rare *Podocarpus Nageia*, &c. From 710, when it was chosen as her residence by Gemmei Tenno, till 794, when Kioto was founded by Kuwammu Tenno, Nara was the chief seat of the mikados; and, as during that period Japanese art was in its early vigour, and was largely patronized by the Shinto and Buddhist religions, it rapidly became a great and sumptuous city. At present (though hardly a tenth of its former size) it has a population of about 21,500, living in 6000 houses; and in antiquarian interest it is hardly second to any place in the empire. The site of the old imperial palace, which stood about four miles from the town on the way to Ozaka, is now indicated only by a small Shinto temple; but about a mile off are the tombs of Gemmei Tenno and Gen-cho Tenno. Of the many religious buildings still extant, two especially demand attention—the Shinto temple of Kusuga and the Buddhist To-dai-ji (Great Temple of the East). The former was founded in 767 in the time of Sho-to-ku Tenno; and its Kami chapels with their rough red-painted log-work afford fine examples of primitive Japanese architecture. A rough wooden building constructed for storing the mikado's furniture in the 8th century is still extant, and among the articles accumulated within are many of those mentioned in the original inventory. In the temple-park are herds of tame deer (*Cervus shika*, Sieb.); and little images of deer and trinkets from deer's horn are the favourite charms purchased by the pilgrims. Within the enclosure stands a curious old trunk on which are growing the camellia, the cherry, the nandina, the wistaria, and what the Japanese call the seven-colour bush (nana-iro-iro ri). The To-dai-ji was begun by Shōmu Tenno in the 8th century, and was last restored in the 18th. At present the buildings enclose a quadrangle 520 feet by 620,—the south side being mainly occupied by the huge, ungainly, and no longer perpendicular hall containing the Dai Butsu, or colossal statue of Buddha. The casting of this wonderful piece of work was, after eight failures, accomplished in 749 by Takusho, an artist from Corea. On two occasions the head has been melted during the burning of the temple (1180 and 1567), and from 1567 to 1697 the statue stood exposed to the weather; but in the main it is marvellously perfect. The height of the figure is 55 feet, the face is 13 feet long, the ears 8, the nose 3, and the great halo has a diameter of 80 feet. On a hill to the east of the temple stands a bell-house with a monster bell, cast in 732, 13½ feet high, 9 feet across the mouth, and weighing 37 tons. Of the great Buddhist temple Ko-buku-ji, which was founded in 710, and burnt for the third time in 1717, there remains little save a five-storied pagoda 150 feet high, dating from 730.

NARBADA. See NERBUDDA.

NARBONNE, a city of France, chief town of an arrondissement in the department of Ande, lies 5 miles from the Mediterranean, on the Robine Canal, a branch of the Canal du Midi, which connects it with the port of La Nouvelle, and on the railway from Toulouse to Cette, 93 miles east-south-east of the former city, at the point where the line for Barcelona *via* Perpignan breaks off. The Robine Canal divides Narbonne into two distinct portions, the *bourg* and the *cité*. The latter is one of the oldest and most interesting of French towns. The cathedral (St Just) is the third on the site, and dates from the close of the 13th century, when the choir (130 feet high) was built. Two towers were added in the 15th century. An unusual effect is produced by a double row of crenellation taking the place of balustrades on the roof of the choir chapels and connecting the pillars of the flying buttresses. Among the sepulchral monuments in the chancel may be noticed the alabaster tomb of Cardinal de Briçonnet, minister of state under Charles VIII. The chapter-house, of the 15th century, has a vaulted roof supported on four free pillars. From the top of the towers, 194 feet high, a magnificent view is obtained over the Narbonne plain, the valley of the Aude, the Montagne Noire, the Cevennes, the hills of La Clape, which lie between the city and the sea, the Canigou, and the Corbières. The apse of the cathedral was formerly joined to the fortifications of the archiepiscopal palace, and the two buildings are still connected by a mutilated cloister of the 14th and 15th centuries. On the front of the palace are three square towers of unequal height. Between the Tour des Télégraphes (1318), crenellated and turreted at the corners, and that of St Martial (1380), machicolated and pierced by Gothic openings, a new facade was erected in the style of the 15th century after the plans of Viollet-le-Duc. This portion of the building now serves as hôtel de ville, and its upper stories are occupied by the Narbonne museum, one of the best outside of Paris, containing pictures, pottery, nearly three thousand medals, and (in the old guard-room) a rich variety of Greek, Carthaginian, and Roman antiquities. The palace garden also contains many fragments of Roman work once built into the now dismantled fortifications; and the Musée Lapidaire in the Lamourguier buildings (formerly a Benedictine convent) has six hundred and twenty bas-reliefs and three hundred and twenty-three ancient inscriptions. The church of St Paul, though partly Romanesque, is in the main a striking and for the south of France a rare example of a building of the first half of the 13th century in the Gothic style of the north. It possesses some ancient Christian sarcophaguses and fine Renaissance wood carving. Narbonne has a good trade, especially in wine and spirituous liquors,—the surrounding country growing (at the rate of 120 gallons per acre) strong alcoholic wines, largely in demand for "fortifying" weaker vintages. As a matter of course this gives employment to large numbers of coopers; and besides there are in the town several verdigris factories, a sulphur refinery, and tanneries. The honey of Narbonne is famed throughout Europe. The population in 1881 was 28,134.

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[1] Napoleon Eugène Louis, born at Paris, March 16, 1856, killed in Zululand, June 1, 1879.

Long before the Roman invasion of Gaul Narbonne was a flourishing city. It was there that the Romans in 118 B.C. founded their first colony in Gaul; and they constructed great works to protect the city from inundation and to improve its port. The seat of a proconsul and a station for the Roman fleet, Narbo Martius became the rival of Massilia. But in 150 A.D. it suffered greatly from a conflagration, and the division of Gallia Narbonensis into two provinces lessened its importance as a capital. Alans, Suevi, Vandals, each held the city for a brief space, and at last, in 413, it was more permanently occupied by the Visigoths. In 719, after a siege of two years, it was captured by the Saracens, and by them its fortifications were restored and extended. Charles Martel, after the battle of Poitiers, and Pippin the Short, in 752, were both repulsed from its walls; but on a new attempt, after an investment of seven years, and by aid of a traitor, the Franks managed again to force their way into Narbonne. Charlemagne made the city the capital of the duchy of Gothia, and divided it into three lordships—one for the bishop, another for a Frankish lord, and the third for the Jews, who, occupying their own quarter, possessed schools, synagogues, and a university famous in the Middle Ages. The viscounts who succeeded the Frankish lord sometimes acknowledged the authority of the counts of Toulouse, sometimes that of the counts of Barcelona. In the 13th century the crusade against the Albigenses spared the city, but the archbishopric was seized by the pope's legate Amaury, who took the title of duke of Narbonne. Simon de Montfort, however, deprived him of this dignity, receiving from Philip Augustus the duchy of Narbonne along with the county of Toulouse. By his expulsion of the Jews Philip the Fair hastened the decay of the city; and about the same period the Aude, which had formerly been diverted by the Romans, ceased to flow towards Narbonne and the harbour was silted up, to the further disadvantage of the place. United to the French crown in 1507, Narbonne was enclosed by a new line of walls under Francis I., but having ceased to be a garrison town it had the last portions of its ramparts demolished in 1870.

NARBOROUGH, Sir John (*ob.* 1688), naval commander, was descended from an old Norfolk family. He received his commission in 1664, and in 1666 was promoted lieutenant for gallantry in the action with the Dutch fleet off the Downs in June of that year. After the peace he was chosen to conduct a voyage of exploration in the South Seas. He set sail from Deptford on the 26th November 1669, and entered the Straits of Magellan in October of the following year, but returned home in June 1671 without accomplishing his original purpose. A narrative of the expedition was published at London in 1694 under the title *An Account of several late Voyages and Discoveries to the South and North.* During the second Dutch war Narborough was second captain of the lord high-admiral's ship the "Prince," and conducted himself with such conspicuous valour at the battle of Solebay (Southwold Bay) in May 1672 that he won special approbation, and shortly afterwards was made rear-admiral and knighted. In 1675 he was sent to suppress the Tripoline piracies, and by the bold expedient of despatching gunboats into the harbour of Tripoli at midnight and burning the ships he induced the dey to agree to a treaty. Shortly after his return he undertook a similar expedition against the Algerines. In 1680 he was appointed commissioner of the navy, an office he held till his death in 1688. He was buried at Knowlton church, Kent, where a beautiful marble monument has been erected to his memory.

NARCISSUS, a genus of bulbous plants belonging to the family *Amaryllidaceæ*. There are twenty or thirty wild forms, natives of central Europe and the Mediterranean region, while one extends through Asia to Japan. From these, or rather from some of these, by cultivation and hybridization, have arisen the very numerous forms which adorn our gardens in spring (see vol. xii. p. 257). The most interesting feature botanically is the "corona," or "cup," which springs from the base of the flower-segments. This gives the special character to the flower, and the members of the genus are classified according to the length of this organ as compared with that of the segments. Much has been written as to the real nature of this cup, but the most probable supposition is that it does not, as once supposed, represent one or more rows of modified stamens, but is simply an excrescence or "enation" from the mouth of the flower-tube, and probably is in some way connected with the fertilization of the flowers by insect agency.

NARCOTICS are substances having the physiological action, in a healthy animal, of producing lethargy or stupor, which may pass into a state of profound coma or unconsciousness along with complete paralysis, terminating in death. Certain substances of this class are used in medicine for the relief of pain, and are then called anodynes, whilst another group produce profound sleep, and are consequently known as hypnotics. In one sense, anæsthetics, such as chloroform and ether, may be held to be narcotics, but, as they are usually volatile substances causing unconsciousness for a comparatively short time, they are conveniently separated from the true narcotics, the effects of which are much more lasting. These distinctions are to a great extent artificial, as it is evident that a substance capable of producing partial insensibility to pain, or sleep, will inevitably in larger doses cause profound coma ending in death. Hence we find the same substances sometimes classed as anodynes and at other times as hypnotics. For example, small doses of opium, or of one or other of its preparations, relieve pain, whilst larger doses act as hypnotics, causing deep sleep passing into coma. As examples of anodynes, we have opium and some of the alkaloids in it, *Cannabis indica* or Indian hemp, belladonna and its alkaloid atropia, hyoscyamus or henbane and its alkaloid hyoscyamia, and the anæsthetics properly so called, such as chloroform, ether, ethidene, &c. The hypnotics are such substances as opium and its alkaloids, chloral hydrate, hyoscyamus, lactucarium (obtained from *Lactuca virosa*, the strong-scented lettuce), and preparations of *Humulus Lupulus* (the common hop), such as inhalations of the steam of infusions, or hop-pillows. In addition we may group as narcotics certain substances which cause not only narcotism, but also the specific effect

Name of Substance.	Name of Plant.	Common Names.	Alkaloids.	Physiological Action.	Poisonous Dose.	Treatment of Case of Poisoning.
Opium.	Inspissated juice of *Papaver somniferum*, or poppy.	Opium.	In 100 parts of fine opium 10 parts of morphia, 6 of narcotina, 1 of papaverina, ·15 of thebaia or paramorphia, ·03 of codeia, ·01 of meconia, ·02 of narceia, and 4 of meconic acid.	Described in text. Acts on all classes of animals. May cause convulsions from increased activity of reflex centres in the spinal cord, especially in animals having small brains. Causes slowing of heart's action by stimulation of inhibitory nerves of heart. Destroys the action of the respiratory centres in medulla. Stimulates oculo-motor centres, and hence causes contraction of pupil.	Varies according to habit. Opium eaters can take 20 to 30 grains with impunity. 1 to 3 grains produce well-marked symptoms in ordinary persons. Medicinal dose for adult is $\frac{1}{2}$ to 2 grains.	Evacuate the stomach by an emetic or by the stomach-pump. Give at once a large table-spoonful of mustard in a tumblerful of tepid water, and repeat in a quarter of an hour if necessary; to be followed by a powder containing 30 grains of sulphate of zinc and 20 grains of ipecacuanha powder. Keep up respiration by constantly inducing the patient to breathe voluntarily. Cause the patient to walk about, and endeavour to keep him awake. Give him very strong infusions of coffee or tea, especially green tea. In the last stages use artificial respiration.
Morphia.	From opium. See above.	Morphia.	Morphia, $C_{17}H_{19}NO_3.H_2O$, employed as hydrochlorate of morphia or acetate of morphia.	Similar to opium. Papaverina, narceia, meconia, cryptopia, codeia, and thebaia or paramorphia have all actions of a narcotic character, but codeia and thebaia have more of an exciting action and little of a narcotic action.	Varies according to habit. 2 to 3 grains by stomach dangerous. $\frac{1}{3}$ of a grain for an adult man or $\frac{1}{6}$ for an adult woman is the largest safe dose when injected under the skin.	Same as for opium.
Indian Hemp.	Alcoholic extract of *Cannabis sativa*, as it grows in India and in America.	Indian hemp. *Gunjah* is the dried plant sold in Calcutta bazaars for smoking; *Churrus* is the resinous exudation of the epidermis; *Hashish* is an Arabian preparation.	No alkaloid has been separated. The resin is the active preparation.	Exhilaration; great mental excitement, with pleasant and often gorgeous visions; a state of ecstasy, with loud laughter; loss of sense of time, or a feeling as if pleasurable sensations were infinitely prolonged. Pupils dilated. Loss of strength, drowsiness, sleep, coma.	Varies much with different specimens of resin. $\frac{1}{2}$ of a grain may cause marked effects. 2 to 3 grains dangerous.	Seldom fatal. If a large dose has been taken, use emetic of mustard and water, or stomach-pump; after this keep the patient quiet, allay excitement, and if symptoms of depression come on small doses of alcohol are useful.
Belladonna.	Leaves and roots of *Atropa Belladonna*.	Deadly nightshade.	Atropia.	See Atropia.	... ...	. ...
Atropia.	*Atropa Belladonna*.	Atropine.	Atropine, $C_{17}H_{23}NO_3$, employed as sulphate of atropine.	See description in text. Increased frequency of pulse, with rise of arterial pressure. Fall of blood pressure with very large doses. Paralyses the inhibitory action of the vagus nerve, so that stimulation of this nerve during atropine poisoning does not cause slowing of heart. Small doses cause contraction of capillary vessels, thus acting as a stimulant to vaso-motor centres. Destroys the excitability of motor nerves passing to muscles generally, thus producing inability to move. Weakens and finally abolishes the reflex excitability of the spinal cord. Large doses weaken action of motor nerves concerned in the movements of respiration. Suppresses secretion of the mucous and salivary glands, probably by paralysing secretory nerves. Large doses lower the temperature of the body. Causes dilatation of pupil, lessened intra-ocular pressure, and paralysis of accommodation.	80 grains of root have caused death. Sometimes the medicinal extract of belladonna is so weak that a dose of 2 drachms may not be fatal. $\frac{1}{16}$ or $\frac{1}{12}$ of a grain of atropine may cause alarming symptoms, and half a grain would almost certainly be fatal	Same treatment as for opium poisoning. The object aimed at is to prevent absorption of the poison by the free use of emetics. External stimulation by bathing the feet in mustard and water, by rubbing or kneading the skin, along with the free use of tannic acid suspended in water, are the best remedial measures. There is often retention of urine. This must be relieved by the catheter.
Stramonium	Leaves and seeds of *Datura Stramonium*.	Jamestown weed, thorn-apple.	Daturia, identical with atropia.	Same as belladonna and atropia.	Not ascertained. Children have been poisoned by eating the seeds.	Treatment the same as for belladonna and atropia.
Hyoscyamus	Leaves and seeds of *Hyoscyamus niger*.	Henbane.	Hyoscyamia. $C_{15}H_{23}NO_3$.	Almost identical with atropia. There is even greater excitement than in cases of belladonna poisoning, indicating a stronger action on the cerebrum. The action of the heart is first stimulated as with atropia, but it is afterwards much depressed, as shown by the lessening number of pulse beats. Pupil dilated. Mouth dry and parched.	$\frac{1}{30}$ of a grain of hyoscyamia will cause appreciable effects. $\frac{1}{20}$ of a grain causes sleepiness, dryness of mouth, and dilatation of pupil. $\frac{1}{16}$ causes quickening of heart's action; and $\frac{1}{12}$ will produce first quickening and then slowing of the heart. The half of a grain would be dangerous.	Treatment the same as for belladonna and atropia.
Hops.	The dried strobiles of the female plant of *Humulus Lupulus*.	The hop or hop-vine.	Lupulina.	A feeble narcotic, causing, when infusions are taken freely heaviness, and perhaps sleep.	Not regarded as a pison.	... ...
Lactucarium	Concrete juice of *Lactuca virosa*.	Juice of lettuce.	Lactucinia.	Very feeble narcotic. In very large doses, say half an ounce, has a soothing sedative effect.	Not regarded as a poison.	... ...

of dilatation of the pupil of the eye, and disorder of the mechanism of focussing the eye for various distances, resulting in dimness and confusion of vision. Such are sometimes called mydriatics (μυδριάσις, dimness of sight); they embrace belladonna, henbane, stramonium, cryptopia (one of the alkaloids in opium), and Indian hemp.

All of these substances act on the nervous system, and, although the physiological action of each is characteristic, there are many symptoms common to the whole group; indeed the course of action of all shows three well-defined stages:—(1) there is first a period of apparent exaltation of function; (2) this is followed by a period of diminution and perversion of functional activity; and (3) there is a time of loss of function, in which there is profound coma and paralysis. This is well illustrated by a description of the symptoms caused by opium. A small dose not unfrequently acts as a stimulant; there is a sense of vigour, a capability of severe exertion, and an endurance of labour without fatigue. A larger dose often exerts a calming influence, with a dreamy state in which images and ideas pass rapidly before the mind without fatigue, and often in disorder and without apparent sequence; time seems to be shortened as one state of consciousness quickly succeeds another, and there is a pleasant feeling of grateful rest. This is succeeded by sleep which, according to the strength of the dose and the idiosyncracy of the person, may be light and dreamy, or like natural profound sleep, or deep and heavy, passing into stupor or coma. From this a person may awaken with a feeling of depression, languor, or wretchedness, often associated with sickness, headache, and vomiting. If a person do not thus awaken, and the dose be large, there is the condition of deep coma. The pupils are strongly contracted, the face usually flushed and often purplish in hue, the skin dry and warm, respiration deep and slow, often with the rattle in the throat called stertorous breathing; the pulse is slow, strong, and compressible under the finger; and there is deep unconsciousness, from which, however, the person may sometimes be aroused by shaking or shouting, and into which he at once relapses when left to himself. This condition is succeeded by one of even deeper prostration. The person cannot be aroused; the pupils may now become somewhat dilated, especially on the approach of death; the countenance has a death-like aspect, and a bluish-white tint; the pulse quickens and becomes smaller, and more and more feeble; and the skin is covered with a cold clammy sweat. The vital functions are reduced to the lowest ebb, and death then occurs from failure of respiration. Such a train of symptoms is called narcotism. These general symptoms are of course largely modified by the amount of the dose. If it be very large, the person may pass very quickly into the deeply comatose stage.

A somewhat different mode of action is illustrated by the physiological effects of belladonna, or of its alkaloid atropine or atropia. A small dose causes dryness of the throat and mouth, dilatation of the pupils, dimness of vision except for distant objects, and often double vision. The pulse becomes quick, rising, in an adult, from 80 to 120 or 160 beats per minute; and there is often a bright red flush over the skin. The intellectual powers are at first acute and strong, but they soon become confused. There is giddiness, confusion of thought, excitement, a peculiar talkative wakeful restiveness, in which the person shows that his mind is occupied by a train of fancies or is haunted by visions and spectres. Often there is violent delirium before sleep comes on. The sleep after a large dose deepens into stupor, with great muscular prostration or paralysis. During all the time the pupils are widely dilated. Death occurs from failure both of the heart's action and of respiration.

The chief facts regarding the true narcotics are briefly summarized in the accompanying table.

Conium or hemlock (the leaves and the fruit of *Conium maculatum*) and its alkaloid conia are sometimes erroneously classed as narcotics. These substances act more in the way of depressing or weakening muscular activity, by influencing the motor nerves, or the nerve-endings in the muscles, and they have no effect on sensory nerves and sensory centres. Neither is aconite a true narcotic (see ACONITE).

Hydrate of chloral has since 1872, when it was introduced as a therapeutic agent by Dr Oscar Liebreich of Berlin, come into great favour as an anodyne and narcotic. It is ethylic aldehyde in which 3 atoms of chlorine are substituted for 3 atoms of hydrogen; thus:—

$$\underset{\text{Aldehyde.}}{C_2H_4O} + \underset{\text{Chlorine.}}{6Cl} = \underset{\text{Chloral.}}{C_2HCl_3O} + \underset{\text{Hydrochloric acid.}}{3HCl.}$$

The formula for the hydrate is $C_2HCl_3O.2HO_2$. In small doses, say 10 to 20 grains, chloral is a pure hypnotic, and the sleep obtained is quiet and refreshing. In larger doses it is narcotic, abolishing thought and motor power, with profound coma. Respiration is much enfeebled, and the pulse becomes small and weak. The pupils are widely dilated. It is not uniform in its action, so that occasionally death may occur after a comparatively small dose, even in persons who have been in the habit of taking the medicine. For this reason, the habit of taking chloral without medical advice, and of taking it frequently, is to be strongly deprecated. An allied substance called croton-chloral hydrate ($C_8H_5Cl_3O_2.2HO$) has no hypnotic properties, but is of use when applied externally for severe neuralgia of the face, due to affections of the fifth cranial nerve (*tic douloureux*).

Narcotics are used in medicine for various purposes. (1) *To relieve pain.* The best one for this purpose is opium, either in the solid form or as laudanum (tincture of opium). It is most useful in cases of spasmodic pain. (2) *To cause sleep.* In some cases opium may be useful for this purpose; but it causes disorder of the digestive functions, and there is the further danger of producing the "opium habit," a vice ruinous alike to body and mind. On the whole hydrate of chloral is the best and safest hypnotic, but it is not without its dangers, and it ought not to be taken except under medical advice. (3) *To allay irritation.* Where there is increased sensibility, with continued irritating though not severe pain in any part, opium or hyoscyamus may be used with benefit. (4) *To cause dilatation of pupil.* For this purpose, solutions of atropine are in constant use by ophthalmic surgeons. A few drops of solution of atropine, or a soluble disk containing atropine, introduced into the eye, cause dilatation of the pupil and diminished tension in the eyeball, at the same time soothing pain. (5) *To arrest secretion.* For this purpose opium, or belladonna, and atropine are especially useful. Small doses of atropine are given to arrest secretion in cases of profuse salivation, and extract of belladonna applied to the skin is used for stopping the secretion of milk from the mammary gland. (J. G. M.)

NARD. See SPIKENARD.

NARSES, an officer in the household of Justinian, who was charged with the reconquest and government of Italy, is one of the most important historical figures of the 6th century. He was a eunuch, but we are nowhere distinctly informed that he was of servile origin. A native of Persarmenia (that is to say, of that portion of Armenia which was allotted to Persia by the partition of 384), he may have been prepared and educated by his parents for service in an Oriental court. If the statement that he died at the age of ninety-five be correct, he was born about the year 478. He was probably brought young to Constantinople, and attained a footing in the *officium* of the grand chamberlain. From a subordinate place he rose in course of time to be one of the three (spectabiles) "chartularii," a position implying some literary attainment, and involving the custody of the archives of the household. Hence, probably in middle life, he became "præpositus sacri cubiculi," an "illustris," and entitled along with the prætorian prefects and the generals to the highest rank at the imperial court. In this capacity, in 530, he received into the emperor's obedience another Narses, a fellow-countryman as well as namesake, together with his two brothers Aratius and Isaac. These Persarmenian generals, having formerly fought under the standard of Persia, now in consequence of the successes of Belisarius transferred their allegiance to the emperor, came to Constantinople, and received costly gifts from the great minister.

In the year 532 the celebrated insurrection known as the Nika broke out in Constantinople, when for some hours the throne of Justinian seemed doomed to overthrow. It was saved partly by the courage of his wife, Theodora, and partly by the timely prodigality of Narses, who stole out into the capital, and with large sums of money bribed the leaders of the "blue" faction (which was aforetime loyal to the emperor) to shout as of old "Justiniane Auguste Tu Vincas."

The African and Italian wars followed (533–534, 535–554; see JUSTINIAN, vol. xiii. p. 797). In the fourth year of the latter war the splendid successes of Belisarius, who with a handful of troops had conquered the better part of Italy, reoccupied Rome, and held it against 150,000 Goths, vainly besieging it for 374 days, had awakened both joy and fear in the heart of his master. Reinforcements amounting to 10,000 men were sent into Italy, and Narses the eunuch was placed at their head. Belisarius understood that Narses came to serve under him like any other officer of distinguished but subordinate rank, and he received a letter from Justinian which seemed to support this conclusion. But the friends of Narses continually plied him with suggestions that he, a great officer of the household, in the secrets of the emperor, had been sent to Italy, not to serve as a subaltern, but to hold independent command and win military glory for himself. The truth probably lay between the two. Justinian could not deprive his great general of the supreme command, yet he wished to have a very powerful emissary of the court constantly at his side. He would have him watched but not hampered.

The two generals met (538 A.D.) at Fermo on the Adriatic coast. The first interference of Narses with the plans of Belisarius was beneficial. John, one of the officers highest in rank under Belisarius, had pressed on to Rimini, contrary to the instructions of his chief, leaving in his rear the difficult fortress of Osimo untaken. His daring march had alarmed the Goths for Ravenna, and induced them to raise the siege of Rome; but he himself was now shut up in Rimini, and on the point of being forced by famine to surrender. Belisarius and his followers were prepared to let him pay the penalty of his rashness and disobedience. But his friend Narses so insisted on the blow to the reputation of the imperial arms which would be produced by the surrender of Rimini that he carried the council of war with him, and Belisarius had to plan a brilliant march across the mountains, in conjunction with a movement by the fleet, whereby Rimini was relieved while Osimo was still untaken. When Belisarius and John met, the latter ostentatiously thanked Narses and Narses alone for his preservation.

His next use of his authority was less fortunate. Milan, which was holding out for the Romans, was also hard pressed by famine. The two generals who were sent to relieve it loitered disgracefully over their march, and when Belisarius wished to despatch further reinforcements the commanders of these new troops refused to stir till Narses gave them orders. Belisarius wrote to the eunuch pointing out the necessity of unity of purpose in the imperial army. At length, grudgingly, Narses gave his consent, and issued the required orders; but it was too late. Milan had been compelled by extremity of famine to surrender, and with it the whole province of Liguria fell into the hands of the enemy. This event forced Justinian to recognize the dangers of even a partially divided command, and he recalled Narses to Constantinople.

Twelve years elapsed before Narses returned to Italy. Meanwhile there had been great vicissitudes of fortune both for the Romans and the Goths. Italy, which appeared to have been won by the sword of Belisarius, had been lost again by the exactions and misgovernment of Alexander. The young and gallant Totila had raised up a new army, had more than kept Belisarius at bay in five difficult campaigns (544–548), and now held nearly all the country. Belisarius, however, in this his second series of campaigns, had never been properly seconded by his master. In the spring of 552 Narses set sail from Salona on the Dalmatian coast with a large and well-appointed army. It was a Roman army only in name. Lombards, Heruli, Huns, Gepidæ, and even Persians followed the standard of Narses, men equal in physical strength and valour to the Goths, and inspired by the liberal pay which they received and by the hope of plunder.

The eunuch seems to have led his army round the head of the Adriatic Gulf. By skilfully co-operating with his fleet he was able to cross the rivers of Venetia without fighting the Gothic general Teias, who intended to dispute their passage. Having mustered all his forces at Ravenna, he marched southward. He refused to be detained before Rimini, being determined to meet the Gothic king as soon as possible with his army undiminished. The occupation of the pass of Furlo (Petra Pertusa) by the Goths prevented his marching by the Via Flaminia, but, taking a short circuit, he rejoined the great road near Cagli. A little further on, upon the crest of the Apennines, he was met by Totila, who had advanced as far as Tadini (which Procopius calls Taginas). Parleys, messages, and harangues by each general followed. At length the line of battle was formed, and the Gothic army (probably greatly inferior in number to the Byzantine) was hopelessly routed, the king receiving a mortal wound as he was hurrying from the battlefield.

With Totila fell the last hopes of the Gothic kingdom of Italy. The brave young Teias, who was proclaimed his successor, protracted for a few months a desperate resistance in the rocky peninsula of Castellamare, overlooking the Bay of Naples. At length want of provisions forced him into the plain, and there by the river Sarno, almost in sight of Pompeii, was fought (553) a battle which is generally named from the overlooking range of Mons Lactorius (Monte Lettere). The actual site of the battle, however, is about half a mile from the little town of Angri, and its memory is still vaguely preserved by the name *Pozzo dei Goti* (Well of the Goths). In this battle Teias was killed. He was the last king of the Ostrogoths.

The task of Narses, however, was not yet ended. By the invitation of the Goths an army of 75,000 warlike Alemanni and Franks, the subjects of King Theudibert, crossed the Alps under the command of two Alemannic nobles, the brothers Leuthar and Butilin (553). The great strategic talents of Narses were shown even more conspicuously in this than in his previous and more brilliant campaigns. Against the small but gallant bands of Totila and Teias he had adopted the policy of rapid marches and imperative challenges to battle. His strategy in dealing with the great host from Gaul was of the Fabian kind. He kept them as long as he could north of the Apennines, while he completed the reduction of the fortresses of Tuscany. At the approach of winter he gathered his troops into the chief cities and declined operations in the field, while the Alemannic brothers marched through Italy killing and plundering. When the spring of 554 appeared, Leuthar with his half of the army insisted on marching back to Gaul, there to deposit in safety the plunder which they had reaped. In an unimportant engagement near Pesaro he was worsted by the Roman generals, and this hastened his northward march. At Ceneda in Venetia he died of a raging fever. Pestilence broke out in his army, which if not absolutely annihilated thereby was so wasted as to be incapable of further operations in Italy. Meanwhile his brother Butilin, whose army was also suffering grievously from disease, partly induced by too free indulgence in the grapes of Campania, encamped at Casilinum, the site of modern Capua. Here, after a time, Narses accepted the offered battle. The barbarians, whose army was in the form of a wedge, pierced the Roman centre. But by a most skilful manœuvre Narses contrived to draw his lines into a curve, so that his mounted archers on each flank could aim their arrows at the backs of the troops who formed the other side of the Alemannic wedge. They thus fell in whole ranks by the hands of unseen antagonists. Soon the Roman centre, which had been belated in its march, arrived upon the field and completed the work of destruction. Butilin and his whole army were destroyed, though we need not accept the statement of the Greek historian (Agathias, ii. 9) that only five men out of the barbaric host of 30,000 escaped, and only eighty out of the Roman 18,000 perished (554).

The only other important military operation of Narses which is recorded—and that indistinctly—is his defeat of the Herulian king Sindual, who had served under him at Capua, but who subsequently revolted, was defeated, taken captive, and hanged by the eunuch's order (565). In the main the thirteen years after the battle of Capua (554–567) were years of peace, and during them Narses ruled Italy from Ravenna with the title of prefect.[1] He rebuilt Milan and other cities destroyed in the Gothic war; and two inscriptions on the Salarian bridge at Rome have preserved to modern times the record of repairs effected by him in the year 564.[2]

His administration, however, was not popular. The effect of the imperial organization was to wring the last *solidus* out of the emaciated and fever-stricken population of Italy, and the belief of his subjects was that no small portion of their contributions remained in the eunuch's private coffers. At the close of 565 Justinian died, and a deputation of Romans waited upon his successor Justin II., representing that they found "the Greeks" harder taskmasters than the Goths, that Narses the eunuch was determined to reduce them all to slavery, and that unless he were removed they would transfer their allegiance to the barbarians. This deputation led to the recall of Narses, which took place in 567, and was accompanied, according to a somewhat late tradition, by an insulting message from the empress Sophia, who sent him a golden distaff, and bade him, as he was not a man, go and spin wool in the apartments of the women. "I will spin her such a hank," Narses is represented as saying, "that she shall not find the end of it in her lifetime"; and forthwith he sent messengers to the Lombards in Pannonia, bearing some of the fruits of Italy, and inviting them to enter the land which bore such goodly produce. Hence came the invasion of Alboin (568), which wrested the greater part of Italy from the empire, and changed the destinies of the peninsula.[3]

Narses, who had retired to Naples, was persuaded by the pope (John III.) to return to Rome. He died there about 573, and his body, enclosed in a leaden coffin, was carried to Constantinople and buried there. Several years after his death the secret of the hiding-place of his vast stores of wealth is said to have been revealed by an old man to the emperor Tiberius II., for whose charities to the poor and the captives they furnished an opportune supply.

Narses was short in stature and lean in figure. His freehandedness and affability made him very popular with his soldiers. Evagrius tells us that he was very religious, and paid especial reverence to the Virgin, never engaging in battle till he conceived that she had given him the signal. Our best authorities for his life are his contemporaries Procopius and Agathias. For the period after 555 we have to depend chiefly on fragmentary notices in the authors whose names have been mentioned above. (T. H.)

NARSINHPUR,[4] a district in the chief-commissionership of the Central Provinces, India, lying between 22° 45′ and 23° 15′ N. lat. and between 78° 38′ and 79° 38′ E. long., bounded on the N. by Bhópál state and by Ságar, Damoh, and Jabalpur districts, E. by Seoní, S. by Chhindwárá, and W. by Hoshangábád. It forms a portion of the upper part of the Nerbudda valley. The first of those wide alluvial basins which, alternating with rocky gorges, give so varied a character to the river's course opens out just below the famous marble rocks in Jabalpur, and extends westward for 225 miles, including the whole of Narsinhpur, together with the greater part of Hoshangábád. The Sátpurá hills to the south are here a generally regular range, nowhere more than 500 feet above the plain, and running almost parallel to the river, at a distance of 15 or 20 miles. In the intervening valley, the rich level of black wheat land is seldom broken, except by occasional mounds of gravel or nodular limestone, which afford serviceable village sites. Along the foot of the boundary hills the alluvium gives way to belts of red gravelly soil, rice and sugar-cane take the place of wheat, and forest trees that of mango groves.

The population in 1880 was 365,173, the Hindus numbering 305,562, and the Mohammedans only 13,425. The most numerous of the aboriginal tribes are the Gonds (46,645). Only two towns contained upwards of 5000 inhabitants—Narsinhpur (7816) and Gadarwára (6553). Of the area of 1916 square miles, 974 were under cultivation in 1882. Wheat is the staple crop, occupying 280,898 acres; other food grains took up 245,797 acres; cotton, 46,204 acres; and sugar-cane, 2271 acres. Rotation of crops is not practised, but when the soil shows signs of exhaustion gram or some other pulse is substituted for two or three years. Cultivators dare not leave their lands fallow, even for a single year, for the ground would be immediately occupied by rank *káns* grass, which no exertions can eradicate till it has run its course of about ten years. The principal export is cotton. Coal mining is carried on at Mohpání, Sihora, and Setarewa; and iron-ore of excellent quality is smelted in large quantities at Tendúkherá and elsewhere there being 38 mines in operation in 1882.

NARVAEZ, PÁMFILO DE (*c.* 1480–1528), Spanish adventurer, was an hidalgo of Castile, born at Valladolid about 1480. He was one of the subordinates of Velasquez in the reduction of Cuba, and, after having held various posts under his governorship, was put at the head of the force sent to the Aztec coast to compel Cortes to renounce his command; he was surprised and defeated, however, by his abler and more active compatriot at Cempoalla, and made prisoner with the loss of an eye (1520). After his return to Spain he obtained from Charles V. a grant of Florida as far as the River of Palms; sailing in 1527 with five ships and a force of about 600 men, he landed, probably near Tampa Bay, in April 1528, and, striking inland with some 300 of his followers, reached "Apalache" on June 25. The prospects of fabulous wealth which had sustained them in their difficult and perilous journey having proved illusory, a return to the coast was determined, and the Bahia de los Caballos, at or near St Mark's, was reached in the following month. Having built rude boats, the much reduced company sailed hence for Mexico on September 22, but the vessel which carried Narvaez was driven to sea in a storm and perished. His lieutenant, Cabeza de Vaca, with three others who ultimately reached land, made his way across Texas to the Gulf of California.

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[1] Gibbon's statement that Narses was "the first and most powerful of the exarchs of Ravenna" is more correct in substance than in form. The title of exarch does not appear to be given to Narses by any contemporary writer. He is always "Præfectus Italiæ," "Patricius," or "Dux Italiæ," except when he bears the style of his former offices in the imperial household, "Ex-Præpositus [Cubiculi]" or "Chartularius" (compare Rubeus, *Historiæ Ravennates*, p. 175).

[2] See Gruter, p. 161.

[3] This celebrated story seems to be unknown to strictly contemporary authors. We find no hint of it in Agathias (who wrote between 566 and 582), Marius (532–596), or Gregory of Tours (540–594). The possibly contemporary *Liber Pontificalis* and Isidore of Seville (560–636) hint at the invitation to the Lombards. Fredegarius (so-called), who probably wrote in the middle of the 7th century, and Paulus Diaconus, towards the close of the 8th, supply the saga-like details, which become more minute the further the narrators are from the action. On the whole, the transaction, though it is too well vouched for to allow us to dismiss it as entirely fabulous, cannot take its place among the undoubted facts of history.

[4] Narsinhpur is also the name of a petty native state in Orissa.

NARVAEZ, RAMON MARIA (1800–1868), Spanish soldier and statesman, was born at Loja, Granada, on August 4, 1800, entered the army at an early age, and saw active service under Mina in Catalonia in 1822. In 1823 the French invasion caused him to retire into private life, whence he re-emerged in 1832, speedily attaining the rank of colonel. He achieved great popularity by his victory over Gomez, the Carlist general, near Arcos, in November 1836, and after clearing La Mancha of brigands by a vigorous policy of suppression in 1838 he was appointed captain-general of Old Castile, and commander-in-chief of the army of reserve. In 1840, for the part he had taken at Seville in the insurrection against Espartero, he was compelled to take refuge in France, where, in conjunction with Maria Christina, he planned the expedition of 1843 which led to the overthrow of his adversary. In 1844 he became prime minister, and was created field-marshal and duke of Valencia, but his policy was too reactionary to be tolerated long, and he was compelled to quit office in February 1846. He now held the post of ambassador at Paris, until again called to preside over the council of ministers in 1847; but misunderstandings with Maria Christina led to his resignation in the following year. His ministry succeeded that of O'Donnell for a short time in 1856–57, and he again returned to power for a few months in 1864–65. He once more replaced O'Donnell in July 1866, and was still in office when he died at Madrid on April 23, 1868.

NARWHAL, an animal of the order *Cetacea* (see MAMMALIA, vol. xv. p. 398), belonging to the genus *Monodon*, of which there is but one species known, *M. monoceros* of Linnæus. It is included in the family *Delphinidæ* or Dolphins, and closely resembles the *Beluga* or White Whale in all points of its structure except its dentition, which presents most anomalous characters. In the adult there are but two teeth present, both in the upper jaw. They lie horizontally side by side, and in the female they remain throughout life concealed in cavities of the bone, so that this sex is practically toothless. In the male the right tooth usually remains similarly concealed and abortive, but the left is immensely developed, attaining a length equal to more than half that of the entire animal. In a narwhal 12 feet long, from snout to end of tail, the exserted portion of the tusk may measure 6 or 7 and occasionally 8 feet in length. It projects horizontally forwards from the head in the form of a cylindrical or slightly tapering, pointed tusk, composed of ivory, with a central cavity reaching almost to the apex, without enamel, and with the surface marked by spiral grooves and ridges, running in a sinistral direction. Occasionally both left and right tusks are developed, in which case the direction of the grooves is not reversed, but the same in both. No instance has ever been met with of the complete development of the right tusk associated with a rudimentary condition of the left. In very young animals several small additional teeth, irregular in number and position, are present, but these usually disappear soon after birth.

The head is rather short and rounded; the fore limbs or paddles are small and broad compared with those of most dolphins; and (as in *Beluga*) the median dorsal fin, found in nearly all other members of the group, is wanting or replaced by a low ridge. The general colour of the surface is dark grey above and white below, but variously marbled and spotted with different shades of grey.

The narwhal is essentially an Arctic animal, frequenting the icy circumpolar seas, and but rarely seen south of 65° N. lat. Three instances have, however, been recorded of its occurrence on the British coasts, one in the Firth of Forth in 1648, one near Boston in Lincolnshire in 1800, while a third, which entangled itself among rocks in the Sound of Weesdale, Shetland, in September 1808, is described by Fleming in the *Memoirs of the Wernerian Society*, vol. i. Like most other cetaceans it is gregarious in its habits, being usually met with in "schools" or herds of fifteen or twenty individuals. Its food appears to be various species of cephalopods, small fishes, and crustaceans. The purpose served in the animal's economy by the wonderfully developed asymmetrical tusk—or "horn," as it is commonly but erroneously called—is not known. As it is present only in the male sex, no function essential to the wellbeing of the individual, such as the procuring of sustenance, can be assigned to it, but it must be looked upon as belonging to the same category of organs as the antlers of deer, and perhaps may be applied to similar purposes. Very little is, however, known of the habits of narwhals. Scoresby describes them as "extremely playful, frequently elevating their horns and crossing them with each other as in fencing." They have never been known to charge and pierce the bottom of ships with their weapons, as the swordfish, a totally different animal, often does. The name "Sea Unicorn," sometimes applied to the narwhal, refers to the resemblance of its tusk to the horn represented as projecting from the forehead of the fabled unicorn. The ivory of which the tusk is composed is of very good quality, but, owing to the central cavity, is only fitted for the manufacture of objects of small size. The entire tusks are sometimes used for decorative purposes, and are of considerable, though very fluctuating, commercial value. (W. H. F.)

NASH, RICHARD (1674–1761), better known as "Beau Nash," was born at Swansea, 18th October 1674. He was descended from an old family of good position, but his father from straitened means had become partner in a glass business. Young Nash was educated at Caermarthen grammar school and at Jesus College, Oxford. He obtained a commission in the army, which, however, he soon exchanged for the study of law at the Middle Temple. "Here," it is said, "he went to the very summit of second-class luxury," and among "wits and men of pleasure" he came to be accepted as an authority in regard to dress, manners, and style. When the members of the Inns of Court entertained William III. after his accession, Nash was chosen to conduct the pageant. This duty he performed so much to the satisfaction of the king that he was offered knighthood, but he declined the honour, unless accompanied by a pension. As the king did not take the hint, Nash found it necessary to turn gamester. The pursuit of his calling led him in 1704 to Bath, where he had the good fortune almost immediately to succeed Captain Webster as master of the ceremonies. His qualifications for such a position were unique, and under his conventional authority reforms were introduced which rapidly secured to Bath a leading position as a fashionable watering-place. He drew up a new code of rules for the regulation of balls and assemblies, abolished the habit of wearing swords in places of public amusement, induced gentlemen to adopt shoes and stockings in parades and assemblies instead of boots, reduced refractory chairmen to submission and civility, and introduced a tariff for lodgings. Through his exertions a handsome assembly-room was also erected, and the streets and public buildings were greatly improved. Nash adopted an outward state corresponding to his nominal dignity. He wore an immense white hat as a sign of office, and a dress adorned with rich embroidery, and drove in a chariot with six greys, laced lackeys, and French horns. Notwithstanding his vanity and impertinence, the tact, energy, and superficial cleverness of Nash won him the patronage and notice of the great, while the success of his ceremonial rule, as shown in the increasing prosperity of the town, secured him the gratitude of the corporation and the people generally. When the Act of Parliament against gambling deprived him of an easy though uncertain means of subsistence, the corporation granted him a pension of six score guineas a year, which, with the sale of his snuff boxes and other trinkets, enabled him to support a certain faded splendour till his death on February 3, 1761. He was honoured with a public funeral at the expense of the town.

A *Life of Richard Nash*, by Goldsmith, was published anonymously at London in 1762, has been frequently reprinted, and is now included in the editions of Goldsmith's collected works. See also *London Magazine*, vol. xxxi., and a paper on "The Monarch of Bath" in *Blackwood's Magazine*, vol. xlviii.

NASH, THOMAS (*c.* 1564–1601), poet, playwright, and pamphleteer, was one of the most notable literary celebrities in the brilliant last decade of the reign of Elizabeth. The exact years of his birth and death have not been ascertained; but from the fact that he proceeded B.A. (St John's, Cambridge) in 1585 it has been conjectured that he was born about 1564, and his death was lamented in an epigram by Fitzgeoffrey in 1601. He tells us himself that his birthplace was Lowestoft. It would seem from a passage in one of his pamphlets that he travelled in Italy after leaving Cambridge, and then he followed the example of Greene and Marlowe, his fellow Cantabs, in trying to make a living by literature in London. Nash was really a journalist born out of due time; he frequently boasts of his power of writing "as fast as his hand can trot"; his style was brilliant and picturesque; he had a keen sense of the ridiculous, was quick in argument, and not without abundance of miscellaneous learning. In the circumstances, there being no market for his gifts, he fared like the other university wits who made the same premature venture at the time to "distil ink into gold," struggled brilliantly for some years, and succumbed. It was as a "notable railer" both against individuals and against the vices and the absurdities of the time, as a man than whom none "used better or more bitter gall in ink," that Nash made his reputation. His first effort was a preface to Greene's *Menaphon*, in 1587. In this he made boisterous ridicule, with the arrogance of youth and high spirits, of current literature, laughing especially at the bombast of Marlowe's *Tamburlaine*, and promised to follow up his attack with an *Anatomy of Absurditie*, which appeared in 1589. Meantime the Marprelate tracts gave him another opening for ridicule, into which he rushed joyously, publishing in quick succession *Plaine Percevall*, *Martin's Month's Mind*, *Pasquil in England*, *An Almond for a Parrot*, *Pasquil's Apology*. Then he edited Sidney's poems, with a preface, in 1591. *Pierce Penilesse, His Supplication to the Devill*, published in 1592, at once shows his power as a gaily humorous critic of national manners and lets us into the secret of the hardness of his struggle to live by the pen. It seems to Pierce a monstrous thing that cautious brainless drudges and knaves wax fat "when as the seven liberal sciences and a good leg will scarce get a scholar bread and cheese." A patron was what the man of letters wanted, and Pierce humorously begs for a trial, undertaking to make it worth a patron's while. Nash's complaints of destitution in this tract are sometimes taken too literally; it would seem that he had found a noble patron, and was living at his country seat in 1592, away from the plague in London, and writing his satirical masque *Summer's Last Will and Testament*. In 1593 he tried his hand at a sermon, *Christes Tears over Jerusalem*, a really eloquent composition. In the preface to this, "not basely fear-blasted, or constraintively overruled, but purely pacificatory," he holds out the hand of friendship to Gabriel Harvey, with whom he had begun a match in personal abuse, recorded in D'Israeli's *Quarrels of Authors*. The overture was not accepted, and Nash resumed his "humorous objurgation" of the enemy. After Marlowe's death he put the unfinished tragedy of *Dido* in shape for the stage, but he had no portion of Marlowe's genius. In 1597 he was in trouble with the authorities for a play called the *Isle of Dogs*, which has not been preserved. The author retired to Yarmouth, and there wrote his last work *Lenten Stuff* (1599), nominally "in praise of a red herring," but really a description of Yarmouth which would now make the fortune of a special correspondent.

NASHUA, a city of the United States, in Hillsborough county, New Hampshire, on hilly ground at the confluence of the Merrimac and the Nashua, 40 miles north-north-west of Boston by the Boston, Lowell, and Nashua Railroads. In 1803 the site was "a sandy plain covered with pine trees"; but after the formation of the Nashua Manufacturing Company in 1823 the village rapidly grew up, and by 1853 it was incorporated as a city. Its population increased from 10,543 in 1870 to 13,397 in 1880. The water-power of the Nashua river being rendered easily available by means of a canal 3 miles long and 8 feet deep, constructed in 1825–26, a great variety of industrial establishments are situated in the city. Besides the sheetings, shirtings, prints, and flannels manufactured by the original Nashua company and its younger rivals, iron goods, locks, edge tools, bedsteads, carpets, shuttles, bobbins, shoes, cards, glazed paper, are all produced on a large scale.

NASHVILLE, a city of the United States, capital and largest city of Tennessee, and seat of justice of Davidson county, stands on the Cumberland River (spanned there by a suspension bridge and a truss railway bridge with a "draw" 200 feet long), 200 miles above its junction with the Ohio, in 36° 10′ N. lat. and 86° 49′ W. long. Occupying a site of considerable irregularity, and dominated by the hill (558 feet above the sea) on which the capitol is built, Nashville on the whole presents a picturesque and attractive appearance. The capitol is an imposing stone edifice, erected in 1845 at a cost of nearly $1,000,000, and surmounted by a central tower 206 feet in height. Other public buildings deserving mention are the court-house (1857), the market-house and city-hall (1855), the State penitentiary (1830), the State blind asylum (1850), the four universities, and two large female seminaries. Nashville University, incorporated as Davidson College in 1785, as Cumberland College in 1806, and under its present name in 1825, now embraces three distinct schools,—Montgomery Bell Academy, Nashville Medical College, one of the largest in the Southern States, and the Normal College, established and endowed by the trustees of the Peabody Fund. Vanderbilt University was founded in 1872 by six conferences of the Methodist Episcopal Church, South, and in 1873 was named after Cornelius Vanderbilt of New York, who gave it $1,000,000. His son has given it about $250,000 additional. It has a fine group of buildings and 75 acres of land west of the city. In 1882 it had 51 instructors and 603 students. Fisk University, established in 1866 for the education of men of colour, and widely known through the Jubilee Singers, had 18 teachers and 424 students in 1882. The Tennessee Central (Methodist) College, likewise dating from 1866, is intended for coloured students, as is also the Roger Williams University (Baptist). The State library in the capitol had 27,000 volumes in 1882; and the Watkins

Institute library occupies a building erected in 1882 at a cost of $130,000. Being the natural centre of a wide productive region, and well served by river and rail, Nashville has an extensive and rapidly growing trade, especially in cotton and tobacco. Its manufacturing establishments comprise three large cotton factories (34,000 spindles, 700 hands in 1882), saw-mills, grist-mills, planing factories, carriage factories, extensive furniture factories, distilleries, paper-mills, cotton-seed-oil mills, and stove foundries. The population was 5566 in 1830, 10,165 in 1850, 16,988 in 1860, 25,865 in 1870, and 43,350 in 1880.

Settled in 1780, Nashville received incorporation as a town in 1784 and as a city in 1806. It was not till 1843 that it became the capital of the State, though, with the exception of the period from 1815 to 1826, the legislature had met there from 1812. In February 1862 Nashville was evacuated by the Confederate General A. S. Johnston, and was held from that time by the Federal forces. The attempt made in December 1864 by the Confederate General Hood to recover the now strongly-fortified town resulted in the "battle of Nashville," in which his army was completely routed by that of General G. H. Thomas.

NÁSIK, or NASSICK, a district in the Bombay presidency, India, between 19° 34′ and 20° 52′ N. lat., and between 73° 21′ and 75° 2′ E. long., bounded on the N. by Khándesh, E. by the Nizám's Dominions, S. by Ahmednagar, and W. by Thána (Tanna), with an area of 5940 square miles. With the exception of a few villages in the west, the whole district is situated on a table-land from 1300 to 2000 feet above sea-level. The western portion is hilly, and intersected by ravines, and only the simplest kind of cultivation is possible. The eastern tract is open, fertile, and well cultivated. The Sahyádri range stretches from north to south; the watershed is formed by the Chánder range, which runs east and west. All the streams to the south of that range are tributaries of the Godávari. To the north of the watershed, the Girna and its tributary the Mosam flow through fertile valleys into the Tápti. The district generally is destitute of trees, and the forests which formerly clothed the Sahyádri hills have nearly disappeared; efforts are now being made to prevent further destruction, and to reclothe some of the slopes. The district contains several old hill forts, the scenes of many engagements during the Mahratta wars. Násik district became British territory in 1818 on the overthrow of the peshwá. The population in 1881 was 781,206 (Hindus 683,579, Mohammedans 35,294).

NÁSIK, the chief town of the district (population 22,436), is situated on the Godávari, and is considered a place of great sanctity by Hindus, who make pilgrimages to its temples from all parts of India. Places of worship fringe both banks of the river, and even the bed of the stream is thickly dotted with temples and shrines. Násik has brass and copper works, but commercially is of little more than local importance.

NASIR KHOSRAU. Abú Mu'ín-ed-dín Násir b. Khosrau, the first great didactic poet of Persia, was a descendant of the imám 'Alí Ridá, and was born, according to his own statement in one of his kasídas, 394 A.H. (1004 A.D.), at Kubádiyán, near Balkh in Khorásán. The first forty-two years of his life are obscure; we learn from incidental remarks of his that he was a Sunnite, probably according to the Hanafite rite, well versed in all the branches of natural science, in medicine, mathematics, astronomy, and astrology, in Greek philosophy, and the interpretation of the Koran; that he had a comprehensive knowledge of many other philosophic systems and religious creeds professed in the East; and that he was, withal, much addicted to worldly pleasures, especially to excessive wine drinking, the renunciation of which forms a prominent topic in his later odes. He had studied Arabic, Turkish, Greek, the vernacular languages of India and Sind, and perhaps even Hebrew; he had visited Multán and Lahore, and been—probably in an official capacity—an eye-witness of the splendid Ghaznavide court under Sultán Mahmúd, Firdousí's patron, and his son Mas'úd. Later on he had chosen Merv for his residence, and was the owner of a house and garden there. When he first steps into the full light of history, in 437 A.H. (1045 A.D.), we see him in the position of a financial secretary and revenue collector of the Seljúk sultan Toghrulbeg, or rather of his brother Jághirbeg, the emír of Khorásán, who had conquered Merv in 1037. The introductory passages of the *Safarnáma*, together with a number of verses in the above-mentioned kasída, which belongs to the same period, clearly manifest the peculiar state of mind in which Násir was at that time. Like Faust he had fathomed the depth of all human knowledge, like him he had passed through the whirlpool of passions and sensual pleasures, he had tried to drown his doubts and troubles in the wine cup, and yet he had only grown more and more dissatisfied with himself; nothing could quench his ever-increasing thirst for a higher intelligence, for a more profound comprehension of the Godhead, and the manifestations of the divine power in the universe. He had evidently reached the turning-point of his life, and, inspired by a heavenly voice (which he pretends to have heard in a dream), he abjured all the luxuries of life, and resolved upon a pilgrimage to the holy shrines of Mecca and Medina, hoping to find there the solution of all enigmas, and to return a thoroughly reformed man. The graphic description of this journey is contained in the *Safarnáma*, a book that, quite apart from the personal interest we feel in the author, ranks high among the memoirs of travel as giving us the most authentic account of the state of the Mussulman world and the condition of Persia, Arabia, Syria, Palestine, and Egypt in the middle of the 11th century. The minute sketches of Jerusalem and its environs, moreover, are of the highest practical value, even at the present day, for our explorations in the Holy Land. During the seven years of his journey (1045–52 A.D.) Násir visited Mecca four times, and performed all the rites and observances of a zealous pilgrim; but the fascinating influence of the Holy City upon his mind was greatly outweighed by that of Cairo, the capital of Egypt, and the residence of the Fátimite sultan Mostansir billáh, the great champion of the Shí'a, and the spiritual as well as political head of the house of 'Alí, which was just then waging a deadly war against the 'Abbáside caliph of Baghdád, and the great defender of the Sunnite creed, Toghrulbeg the Seljúk. At the very time of Násir's visit to Cairo, the power of the Egyptian Fátimites was in its zenith; Syria, the Hijáz, Africa, and Sicily obeyed Mostansir's sway, and the utmost order, security, and prosperity reigned in Egypt. Cairo appeared as an earthly paradise in Násir's eyes; he became, as his poems clearly indicate, thoroughly imbued there with Shí'a doctrines, and their successful introduction into his native country was henceforth the sole aim and object of his life. The hostilities he encountered in the propagation of these new religious ideas after his return to Khorásán in 1052 and Sunnite fanaticism compelled him at last to flee, and after many wanderings he found a refuge in Yumgán, in the mountains of Badakhshán, where he spent as a hermit the last decades of his life, and gathered round him a considerable number of devoted adherents, who have handed down his doctrines to many following generations. The Dábistán (translated by Shea and Troyer, Paris, 1843, vol. ii. p. 419 *sq.*) fixes his flight from Khorásán in 456 A.H. (1064 A.D.), but there is strong evidence in some of his kasídas that this event took place some four or five years before that date; and as his death occurred in 481 A.H. (1088 A.D.) he must have lived in his exile from twenty-five to thirty years. His "nom de plume" was "Hujjat."

Most of Násir's lyrical poems were composed in his retirement, and their chief topics are—an enthusiastic praise of 'Alí, his descendants, and Mostansir in particular; passionate outcries against Khorásán and its rulers, who had driven him from house and home; the highest satisfaction with the quiet solitude of Yumgán; and utter despondency again in seeing himself despised by his former associates, and for ever excluded from participation in the glorious contest of life. But scattered through all these alternate outbursts of hope and despair we find precious lessons of purest morality, and solemn warnings against the tricks and perfidy of the world, the vanity of all earthly splendour and greatness, the folly and injustice of men, and the hypocrisy, frivolity, and viciousness of fashionable society and princely courts in particular. It is the same strain which runs, although in a somewhat lower key, through his two larger mathnawís or double-rhymed poems, the *Rushanáinâma*, or "book of enlightenment," and the *Sa'ádat-náma*, or "book of felicity." The former is divided into two sections: the first, of a metaphysical character, contains a sort of practical cosmography, chiefly based on Avicenna's theories, but frequently intermixed both with the freer speculations of the well-known philosophical brotherhood of Basra, the Ikhwán-es-safá,[1] and purely Shí'itic or Isma'ílitic ideas; the second, or ethical section of the poem, abounds in moral maxims and ingenious thoughts on man's good and bad qualities, on the necessity of shunning the company of fools and double-faced friends, on the deceptive allurements of the world and the secret snares of ambitious craving for rank and wealth. It concludes with an imaginary vision of a beautiful world of spirits who have stripped off the fetters of earthly cares and sorrows and revel in the pure light of divine wisdom and love. If we compare this with a similar allegory in Násir's díwán, which culminates in the praise of Mostansir, we are fairly entitled to look upon it as a covert allusion to the eminent men who revealed to the poet in Cairo the secrets of the Isma'ílitic faith, and showed him what he considered the "heavenly ladder" to superior knowledge and spiritual bliss. The passage, thus interpreted, lends additional weight to the correctness of Dr Ethé's reconstruction of the date of the *Rushanáinâma*, viz., 440 A.H. (1049 A.D.), which, notwithstanding M. Schefer's objections, is warranted both by the astronomical details and by the metrical requirements of the respective verses. That of course does not exclude the possibility of the bulk of the poem having been composed at an earlier period; it only ascribes its completion or perhaps final revision to Násir's sojourn in Egypt.

A similar series of excellent teachings on practical wisdom and the blessings of a virtuous life, only of a severer and more uncompromising character, is contained in the *Sa'ádatnáma*; and, judging from the extreme bitterness of tone manifested in the "reproaches of kings and emírs," we should be inclined to consider it a protest against the vile aspersions poured out upon Násir's moral and religious attitude during those persecutions which drove him at last to Yumgán. Of all the other works of our author mentioned by Oriental writers there has as yet been found only one, the Zâd-elmusâ-firín (in the private possession of M. Schefer, Paris); and we can very well dismiss the rest as being probably just as apocryphal as Násir's famous autobiography (found in several Persian tadhkiras or biographies of poets), a mere forgery of the most extravagant description, which is mainly responsible for the confusion in names and dates in older accounts of our author.

See Sprenger's *Catalogue of the Libraries of the King of Oudh*, 1854; H. Ethé, "Násir Chusrau's *Rushanáinâma*," in *Z. D. M. G.*, xxxiii., xxxiv., 1879-80; E Fagnan, "Le livre de la félicité," in vol. xxxiv. of the same journal, 643-674; Ch. Schefer, *Sefer Nameh, publié, traduit, et annoté*, Paris, 1881; H. Ethé, in *Göttinger Nachrichten*, 1882, pp. 124-152, and *Z. D. M. G.*, 1882, pp. 478-508. Fagnan in *Journ. As.*, 7th ser., vol. xiii. p. 164 *sq.*, and Rieu, *Cat. Pers. MSS. in Br. Mus.*, concluded that the poet and the pilgrim were different persons. The opposite view was developed by Ethé. (H. E.)

NASMYTH, ALEXANDER (1758–1840), portrait and landscape painter, was born in Edinburgh on September 9, 1758. He studied at the Trustees' Academy under Runciman, and, having been apprenticed as an heraldic painter to a coachbuilder, he, at the age of sixteen, attracted the attention of Allan Ramsay, who took the youth with him to London, and employed him upon the subordinate portions of his works. Nasmyth returned to Edinburgh in 1778, and was soon largely patronised as a portrait painter. He also assisted Mr Miller of Dalswinton, as draughtsman, in his mechanical researches and experiments; and, this gentleman having generously offered the painter a loan to enable him to pursue his studies abroad, he left in 1782 for Italy, where he remained two years. On his return he painted the excellent portrait of Burns, now in the Scottish National Gallery, so well known through Walker's engraving. Political feeling at that time ran high in Edinburgh, and Nasmyth's pronounced Liberal opinions, which he was too outspoken and sincere to disguise, gave offence to many of his aristocratic patrons, and led to the diminution of his practice as a portraitist. In his later years, accordingly, he devoted himself mainly to landscape work, and did not disdain on occasion to set his hand to scene-painting for the theatres. He has been styled, not unjustly, the "father of Scottish landscape art." His subjects are carefully finished and coloured, but are wanting in boldness and freedom. Nasmyth was also largely employed by noblemen throughout the country in the improving and beautifying of their estates, in which his fine taste rendered him especially skilful; and he was known as an architect, having designed the Dean Bridge, Edinburgh, and the graceful circular temple covering St Bernard's Well, which stands near it. Nasmyth died in his native city on 10th April 1840. His youngest son, James, is the well-known inventor of the steam-hammer. His six daughters all attained a certain local reputation as artists, but it was in his eldest son, Patrick, that the artistic skill of his family was most powerfully developed. For an interesting account of the Nasmyth family see James Nasmyth's *Autobiography*, 1883.

NASMYTH, PATRICK (1787–1831), the eldest son of Alexander Nasmyth, was born at Edinburgh on January 7, 1787. Having studied under his father, he went to London at the age of twenty, and soon attracted attention as a clever landscapist. He was a diligent student of the works of Claude and Richard Wilson, and of Ruysdael and Hobbema, upon whom his own practice was mainly founded. His most characteristic paintings are of English domestic scenery, full of quiet tone and colour, and detailed and minute expression of foliage, and with considerable brilliancy of sky effect. They were executed with his left hand, his right having in early life been injured by an accident. He died at Lambeth, August 17, 1831, during a thunderstorm, which at his own request he had been raised in bed to contemplate.

NASSAU, now forming the bulk of the government district of Wiesbaden, in the Prussian province of Hesse-Nassau, was till 1866 an independent and sovereign duchy of Germany, consisting of a compact mass of territory, 1830 square miles in area, bounded on the S. and W. by the Main and Rhine, on the N. by Westphalia, and on the E. by Hesse. This territory is divided into two nearly equal parts by the river Lahn, which flows from east to west into the Rhine. The southern half is almost entirely occupied by the Taunus Mountains, which attain a height of 2900 feet in the Great Feldberg, while to the north of the Lahn is the barren Westerwald, culminating in the Salzburgerkopf (2000 feet). The valleys and low-lying districts, especially the Rheingau, are very fertile, producing abundance of grain, flax, hemp, and fruit; but by far the most valuable product of the soil is its wine, which includes several of the choicest Rhenish varieties (Johannisberger, Marcobrunner, Assmahnshauser, &c.). Nassau is one of the most thickly wooded regions in Germany, about 42 per cent. of its surface being occupied by forests, which yield good timber and harbour large quantities of game. The rivers abound in fish,—the salmon fisheries on the Rhine being especially important. There are upwards of a hundred mineral springs in the district, most of which formerly belonged to the duke, and afforded him a considerable part of his revenue. The best-known are those of Wiesbaden, Ems, Soden, Schwalbach, Schlangenbad, Geilnau, and Fachingen. The other mineral wealth of Nassau includes iron, lead, copper, building stone, coals, slate, a little silver, and a bed of malachite. Its manufactures, including cotton and woollen goods, are unimportant, but a brisk trade is carried on by rail and river in wine, timber, grain, and fruit. There are few places of importance besides the above-named spas; Höchst is the only manufacturing town. Wiesbaden, with 50,238 inhabitants, is the capital of the government district as it was of the duchy. In 1864 the duchy contained 468,311 inhabitants, of whom 242,000 were Protestants (including the reigning house), 215,000 Roman Catholics, and 7000 Jews. The ecclesiastical jurisdiction was in the hands of the Protestant bishop of Wiesbaden and the Roman Catholic bishop of Limburg. Education was amply provided for in numerous higher and lower schools. The annual revenue of the dukedom was about 4,000,000 guldens (£400,000). It furnished a contingent of 6000 men to the army of the German Confederation.

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[1] Compare the *Journal of the Asiatic Society of Bengal*, 1848, vol. xvii., part 1, p. 501 *sq.*, and part 2, p. 183 *sq.*

During the Roman period the district enclosed by the Lahn, the Main, and the Rhine was at first occupied by the Mattiaci and then by the Alemanni. The latter were subdued by the Franks under Clovis in 496, and at the partition of Verdun in 843 the country became part of the Eastern or German empire. Christianity seems to have been introduced in the 4th century. The founder of the house of Nassau is usually recognized in Count Otho of Laurenburg, brother of King Conrad I., who flourished on the banks of the Lahn in the 10th century. His successors afterwards took the title of counts of Nassau, from a castle which they erected on a steep hill overlooking the Lahn, and in 1192 transferred their allegiance from the archbishop of Treves to the emperor of Germany. In 1255 Walram and Otho, the two sons of Count Henry the Rich, divided between them their paternal inheritance, which had in the meantime been steadily increasing, and founded the two Nassovian dynasties which have flourished down to our own times.

The fortunes of the Othonian or younger branch have been the more brilliant, but belong properly to the history of Holland. In 1564 Count William of Nassau, the hero of the Dutch war of independence, succeeded to the principality of Orange, which furnished the historical title of himself and his descendants. The house is now represented by the king of the Netherlands.

Adolf of Nassau, the son of the founder of the elder or Walram line, and progenitor of the dukes of Nassau, became emperor of Germany in 1292, but was defeated and slain in 1298 by his rival Albert of Austria. In 1366 the head of the house was created a prince of the empire, and the Reformation was introduced in the second half of the 16th century. The territories of the house of Walram were frequently partitioned among various branch lines, few of which perpetuated themselves beyond a few generations. At the beginning of the 19th century we find two lines still flourishing—Nassau-Ufingen and Nassau-Weilburg. Both these joined the Rhenish Confederation in 1806, and the prince of Nassau-Ufingen, as head of his family, received the ducal title from the hands of Napoleon. After the battle of Leipsic both princes threw in their lot with the allies. In 1816 the duke of Nassau-Ufingen died, and the prince of Weilburg succeeded to the whole of the Nassovian territory, with the title of duke of Nassau.

This prince had already, in 1814, granted his subjects a limited constitution, providing for two representative chambers on a landed-property basis, and this came into force in 1818. The estates, however, came almost at once into collision with the duke on the question of the ducal domains and the dissensions arising from this source were not compromised till 1834. In 1835 the duchy took an important step in the development of its material prosperity by joining the Zollverein. In 1848 Duke Adolf was compelled to yield to the temper of the times and grant a more liberal constitution, with a single chamber elected by universal suffrage; but the following years witnessed a series of reactionary measures which reduced matters to their former unsatisfactory condition. The duke adhered steadfastly to his Conservative principles, while his people showed their sympathies by returning one Liberal chamber after another. In 1866, though the chambers refused a vote of credit for military purposes, the duke espoused the cause of Austria, and in doing so sealed the fate of his duchy. A little later he was a fugitive before the Prussian troops, and on October 3d, 1866, Nassau was formally incorporated with the kingdom of Prussia.

The little town of Nassau, on the right bank of the Lahn, 15 miles above Coblenz, is interesting as the birthplace of the celebrated Prussian statesman, Baron Stein. Adjacent are Burg Stein, his ancestral seat, and Burg Nassau, the cradle of the Nassovian dukes. Nassau is said to have existed as early as the 8th century under the name of Nasonga. Population (1880) 1786.

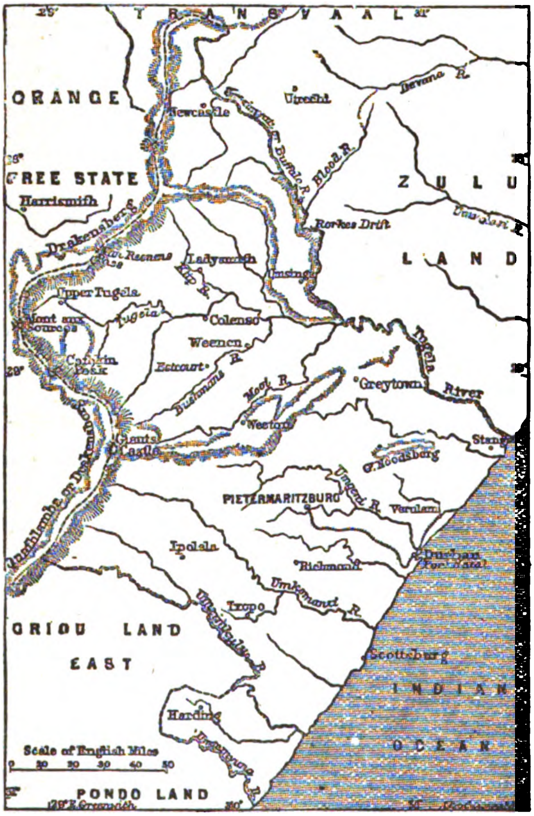
See Schliephake, *Geschichte von Nassau*, 1866-76; Arnoldi, *Geschichte von Nassau-Oranien*; the *Annals* of the "Verein für Nassauische Alterthumskunde u. Geschichtsforschung"; Daniel, *Handbuch der Geographie*, 5th ed., 1881.

NASSAU, the capital of New Providence, and seat of government of the Bahama Islands, 25° 5′ 36″ N. lat., 77° 21′ 15″ W. long. At one time the town was noted as a great rendezvous for pirates. Its harbour, admitting vessels drawing 12 feet, acquired much importance during the blockade of the southern ports in the American War. The population of Nassau, principally negroes and coloured people, is about 8000, out of the total island population of 11,653. Nassau extends for 3½ miles along the north shore. It is a very pretty town, celebrated for its healthy climate, and resorted to for sea-bathing by visitors from America. It has a Government house, a plain stone cathedral, and several churches and chapels, and is a military station and a bishop's see. Numbers of the inhabitants support themselves by looking after wrecks. Preserved fruit in tins is exported, also woods, fruit, sponges, salt, &c.

NASTURTIUM. The common water-cress (*N. officinale*), so largely used as a salad, may be taken as a representative of this genus of *Cruciferæ*,—a genus characterized, for the most part, by pinnately divided foliage, white or yellow cruciform flowers, and long pods with a double row of seeds. The embryo root is folded up along the edges of the cotyledons, accumbent. Four species are British, but the only one cultivated is the *N. officinale*. Its flavour is due to an essential oil containing sulphur, its antiscorbutic properties to the presence of iodine, iron, and phosphates. Although now so largely consumed, it does not appear to have been cultivated in England prior to the present century, though in Germany, especially near Erfurt, it had been grown long previously. The plants are grown in shallow water in rows parallel to the direction of the current, and from 5 to 7 feet apart. It is essential that the water be free from impurity, especially sewage. To avoid this latter contingency cresses are sometimes grown in a north border, the soil being kept constantly moist; or they may be grown in pots in a frame or greenhouse, the pots being placed in a saucer of water, and the plants frequently watered. This plan was introduced by Mr Shirley Hibberd, and when the requisite attention is given is highly successful when commercial considerations are not a matter of primary importance. The name *Nasturtium* is also applied in gardens, but incorrectly, to the species of *Tropæolum*.

NATAL, a British colony on the south-east coast of Africa, situated nearly between 29° and 31° S. lat. and 29° and 32° E. long., is bounded on the N.E. by Zululand and the Transvaal, on the S.E. by the Indian Ocean, on the N.W. by the Orange Free State and the Transvaal, and on the S.W. by Basutoland, Griqualand East, and the country of the Pondas. It is of an irregular diamond shape, with a length of about 270 miles from north to south, and a breadth of 170 miles from east to west. The extent of sea-coast is about 150 miles, and its area is about 17,000 square miles, or 11,000,000 acres (one-third of the size of England).

For several miles northward from the Bluff at Durban the coast is low, but well wooded, and broken in several places by the mouths of rivers and streams; to the south of the Bluff it is of moderate elevation near the sea, the hills rising inland to a considerable height. Rich in verdure, and in the wet season clothed with bright green grass and clumps of trees and bushes, and diversified by numerous streams, the landscape indicates a country of great fertility of soil. From the coast to the western boundary of the colony the land rises by terraces or plateaus to an elevation of at least 4000 feet above the sea-level. For about 15 miles inland it is broken and hilly, and thickly covered with long grass, and in some parts studded with jungly bush and clumps of palm, euphorbia, and mimosa. For some 30 miles farther inland the more elevated but less broken land loses all tropical character, and presents large tracts of good pasturage, but with scarcely any bush or wood. Beyond this district, at an ever-increasing elevation, the country, still hilly and undulating, opens out in many places into more extensive grass plains, generally denuded of bush or wood, although in some localities and in the "kloofs" with a south-eastern aspect are dense clumps of forest trees netted over in many instances with ferns; the western boundary of these rising lands is the Drakensberg mountain-range, which has an altitude of some 3000 or 4000 feet above the country at its base, and an absolute maximum altitude of 10,350 feet above sea-level. Apart from the Drakensberg range, the country, though hilly and much broken, has no mountains of note; many large hills, however, with flattened tops (table mountains) stand out singularly high above the surrounding country, presenting a peculiar appearance to one unaccustomed to South-African scenery.



Map of Natal.

The colony is well watered throughout, but none of the streams are navigable, and all have bars at their entrances; attempts are being made to form harbours at the mouths of the Umkomanzi and the Umzimkulu to the south of Durban. The Umgeni, about 12 miles from Pietermaritzburg, has a sheer fall of about 360 feet, and when it is flooded the rush of its waters is a magnificent spectacle. The harbour or port of Natal at Durban (strictly D'Urban), the only natural one in the colony, consists of an outer bay or roadstead, which has a fair anchorage, and an inner bay; at the entrance of the latter is a deepwater channel, where ships of large tonnage can be safely moored, but a sand bar at its entrance restricts the passage of large ships to the highest tides, and in rough weather renders communication with the outer bay quite impracticable. This bar varies constantly throughout the year, and probably is influenced by the Agulhas stream and other oceanic currents. Much money has been spent on works for the removal of the bar, without any good result, but other plans are now being adopted, with every hope of success. When this obstacle is removed Natal will possess one of the best harbours on the south-east coast of Africa.

Climate.—The summer or hot rainy season lasts from October to March inclusive, and the six remaining months form the winter or cold dry season. The following are the average temperatures for the three hottest and three coldest months of the year, taken from observations at Durban, Pietermaritzburg, and Byrne extending over ten years:—

	Highest.	Lowest.	Mean.
December, January, and February.....	97·5	53·3	71·2
June, July, and August	83·4	31·9	56·7

In the summer months cloudy afternoons with thunderstorms are frequent, and the accompanying rains are very cool and refreshing. Within 30 miles of the coast fires in dwellings are seldom required throughout the coldest months of the year. The rainfall averages 33·50 inches; it is heaviest in the summer months, but in June and July it frequently happens that there is no rain at all over a large portion of the colony. From July to December the upper districts are occasionally subject to hot winds, during which all vegetation droops as if dying, and languor and depression affect all animal life; but these seldom reach to within 20 miles of the coast. Violent hailstorms are not frequent, but hailstones have occasionally killed fowls, dogs, and goats, and in some instances have cut through iron roofing.

Geology.—Along the coast belt there are evidences of comparatively recent upheaval. The high land of the colony rests on granite, trap, and sandstone, the last of the Old Silurian type. Sandstone of a more recent epoch, well suited for building purposes, is sometimes met with. As a rule these fundamental rocks are found under thick beds of shale, the surface being of the most varied description, and never of the same quality over any very extensive area. The soil on the coast is mostly sandy loam, except where the valleys have alluvial deposits from disintegrated shales and erupted rocks. In the uplands the deep light, heavy black, and fine red loams are distributed over beds of clay, ironstone, or granite in areas of varying extent. Ironstone is to be met with in great quantities. Coal of several qualities exists in the Klip River county, with seams varying from 4 to 10 feet in thickness; analysis and experiment have shown it to be very suitable for locomotive and general steam purposes. Some descriptions of it are well suited for gas, and nearly all of it will make good household coal. The area of the available coal-field is some 1350 square miles, and at a moderate computation the mines contain 2,000,000,000 tons of serviceable coal. In association with these seams of coal very valuable iron ore has been discovered. Vast deposits of fine white and yellow crystalline marbles have recently been found about 6 miles inland from the mouth of the Umzimkulu river. Slight indications of copper have been met with. In the extreme north are some mineral springs, which have a temperature of about 130° Fahr., and are considered to possess medicinal qualities.

Flora.—The chief forms of plants peculiar to Natal are the liane and mimosa along the coast, and the orchid, aloe, pothos, liliaceous, and fern forms in the upland districts. The heaths and proteads common at the Cape of Good Hope are seldom if ever found in Natal, but almost any varieties of the flora of semi-tropical and temperate countries that are introduced attain perfection. The indigenous timber trees, mostly found in isolated clumps and in somewhat inaccessible situations, are principally the yellow wood (*Podocarpus elongatus*), sneezewood (*Pteroxylon utile*), stinkwood (*Oreodaphne* *bullata*), black ironwood (*Olea laurifolia*), white ironwood (*Vepris lanceolata*), and the mangrove (*Rhizophora*); all are very useful woods, and the yellow wood, sneezewood, stinkwood, and ironwood when polished have grain and colour equal to maple, walnut, and ebony. The "rooibeaje," red pear, and milkwood trees are used for boatbuilding. The Australian *Eucalyptus* and *Casuarina* in great variety, and many other imported trees, including syringas, wattles, acacias, willows, pines, cypress, cork, and oak all thrive when properly planted and protected from grass fires.

Fauna.—The herds of elephants which roamed in the coast bushes in 1837 have disappeared, and the roar of the lion is no longer to be heard in the uplands. The hippopotamus is very scarce, and nearly all, if not all, the buffalo and quagga have crossed over into Zululand. Leopards or tigers and tiger cats (all called by the natives "ingwe"), and hyænas and wild dogs (*Canis pictus*) of different species, are still found in or about bush jungles and forest clumps; elands (*Antilope oreas*) are preserved on some estates, and there are at least ten distinct species of antelope. Ant-eaters (*Orycteropus capensis*), porcupines, rock rabbits, hares, and cane rats are common in different localities. Baboons (*Cynocephalus porcarius*) and monkeys of different kinds frequent the mountains and rocky kloofs and bush and timber lands. The birds of Natal are of many species; some have beautiful plumage, but none of them, with the exception of the canary, are to be considered as songsters. The crocodile is to be found at the mouths of all rivers, and for a certain distance inland from the sea. Of snakes there are about forty distinct species or varieties. The most dreaded by the natives are called "imamba," of which there are at least eight different kinds; these snakes elevate and throw themselves forward, and have been known to pursue a horseman. One sort of imamba, named by the natives "indhlondhlo," is crested, and its body is of a bright flame colour. The sluggish puff-adder (*Clotho arietans*) is common and very dangerous. A hooded snake (*Naja hæmachates*), the "imfezi" of the natives, is dangerous, and spits or ejects its poison; and besides this there are a few other varieties of the cobra species. The largest of the serpent tribe, however, is the python (*Hortulia natalensis*), called "inhlwati" by the natives; its usual haunts are by streams amongst rocky boulders and in jungles, and instances are recorded of its strangling and crushing adult natives. Insects abound in great numbers, the most troublesome and destructive being the tick (*Ixodes natalensis*), which infests the pasturage, and the white ant (*Termes mordax*). Occasionally vast armies of caterpillars make a sudden appearance and advance over large tracts of country, devouring all vegetation in their line of march. The fish moth, a steel-grey slimy active fish-shaped insect, is found in every house, and is very destructive in the wardrobe and library. Fish of excellent quality and in great quantities abound on the coast. Prawns, crayfish, and oysters are also obtainable, and turtle (*Chelonia mydas*) are frequently captured. Little attention, however, has been given to deep-sea fishing, and the only fishermen are the coolies, who use nets along the beach. The natives (Zulus) as a rule will not touch fish. Freshwater scale-fish are mostly full of bones, but fine eels and barbel are plentiful in the rivers.

Agriculture.—The chief crop is maize, known in South Africa as "meallies," its grain constituting the principal food of about seven-eighths of the population. Maize, indeed, and Kaffre corn (*Sorghum Caffrorum*), with pumpkins and sweet potatoes (*Convolvulus Batatas*), "imphee" or "imfi" (*Sorghum saccharatum*), and tobacco are about the only crops raised by the natives. The European farmers in the uplands, by irrigating the land in the winter months, produce wheat of very fair quality, but not in sufficient quantity to supply the demands of the colony. Oats, barley, and other grains grow readily; and nearly all European vegetables yield fair crops in suitable localities. Arrowroot succeeds well on the coast, and is an article of export. Some years ago coffee and cotton had the attention of the planter, but both are now neglected. Rice has been cultivated by some farmers, but not to any great extent. Tobacco flourishes luxuriantly wherever there is good soil, but the difficulties in the way of curing and manufacturing it prevent its being at present an article of export. The cultivation and manufacture of sugar have attracted most attention of late; sugar, indeed, with its products is the principal staple produced in and exported from Natal. The capsicum for cayenne pepper, and ground-nuts (*Arachis hypogæa*) for oil, are also grown for exportation. Tea has been cultivated of late by some few planters on the coast, and promises ere long to be grown on a much larger scale. There are but few indigenous fruits, the principal being the Natal orange (a species of *Strychnos*), the Natal plum or "amatangula" (*Arduinia grandiflora*), the Kei apple (*Aberia caffra*), Cape gooseberry (*Physalis pubescens*), and the Kaffre fig, the fruit of the *Urostigma natalensis*. Many subtropical fruits, however, and fruits of European culture thrive well in Natal.

Stock.—Previous to 1855 large and numerous herds of cattle pastured over the whole country, but in that year "lung-sickness," an epidemic of the nature of pleuro-pneumonia, broke out with great virulence, and scarcely 4 per cent. of the animals attacked recovered. Lung-sickness and "red water" still claim many victims annually, and are the constant dread of the stock farmer. "Horse sickness," a form of anthrax, is very fatal to horses, especially in wet summers. The following figures give approximately the number of the several kinds of stock belonging to Europeans and natives respectively in 1880:—

Stock.	Europeans.	Natives.
Horned cattle	140,716	379,569
Horses	17,261	15,915
Mules and donkeys	1,121	*nil.*
Angora goats	70,589	*nil.*
Other goats	6,159	166,477
Pigs	10,809	5,554
Sheep (wool-bearing)	410,358	600
Sheep (not wool-bearing)	1,821	24,509

The cattle consist principally of the Zulu, Africander, and Fatherland breeds, but recently some English shorthorns and other improved stock have been introduced. Ostriches also are farmed for the sake of their feathers, but as yet this industry has not succeeded so well in Natal as in the Cape Colony.

Commerce.—The staple productions of Natal have increased with the introduction of the sugar-cane, and sugar and rum are the principal articles of native produce exported. Wool, arrowroot, and feathers are also the outcome of local industry, but the exports of greatest value and importance are the wool and hides of the Transvaal and the Orange Free State, and feathers, ivory, and skins from the interior, which are shipped at Durban. The value of Natal sugar produced in 1856 was stated at £483, and in 1881 at £172,237. The principal imports in 1882 (total value £2,218,538) were clothing, cotton and woollen goods, haberdashery, leather manufactures, iron and ironmongery, spirits, oilman's stores, and flour, and the chief exports (£781,809) were wool, sugar, hides, ostrich feathers, and Angora hair,—by far the greater part of the imports (£1,784,345) and exports (£595,744) being received from and shipped for the United Kingdom.

Revenue and Expenditure.—The increase in the revenue and expenditure in thirty years is shown as follows:—

Year.	Revenue.	Expenditure.
1852	£27,158	£24,876
1862	98,066	83,886
1872	180,498	132,978
1882	496,783	489,113

The revenue is principally derived from customs duties, native hut taxes, transfer dues on land sales, and excise. The public debt of the colony on the 31st December 1882 was £2,101,500, with a sinking fund towards its redemption of £153,597.

Roads and Telegraphs.—Until very recently all goods and produce were conveyed in ox-waggons carrying from 3 to 5 tons weight. These had to travel on roads sometimes little better than tracks worn by traffic, and frequently impassable during wet weather; and for some years before the breaking out of the Zulu War (1879) the average cost of carriage was as high as eighteenpence per ton per mile. Now, however, three lines of railway have been opened,—one of 78 miles from the port at Durban to Pietermaritzburg, another from Durban 20 miles north to Verulam through the sugar lands in that district, and a third 7 miles southward to the sugar estates by the Isipingo river. These alone have cost the colony about £1,250,000. An additional line, of 118 miles, to cost about £1,180,000, is in process of construction from Pietermaritzburg to Ladysmith, and will no doubt be at once carried on to connect with the railways of the Orange Free State. The telegraph between Natal and the Cape Colony was opened in 1878, and in the following year telegraphic communication by way of Lorenzo Marques was extended to England. Branches of telegraph are also carried direct from Natal into the Transvaal and the Orange Free State.

Government.—The colony was annexed as a district to the Cape Colony in August 1845, but in November of the same year it was made a separate government, to be administered by a lieutenant-governor under the general control of the governor of the Cape Colony. At first the lieutenant-governor and an assistant council of four chief officials formed the executive, while the legislative council consisted of the lieutenant-governor and three principal officers. In 1856 Natal became wholly independent of the Cape, and the legislative council was made to consist of sixteen members, twelve elective and four non-elective. In 1869 the lieutenant-governor was empowered to nominate two elective members of the legislative council as members of the executive council. In 1878 the number of members was increased to twenty, fifteen being elective and five non-elective, and in 1875 eight nominee members were added. The colony is now administered by a governor, the promotion from lieutenant-governor being made 28th January 1882; and by law No. 1, 1883, the legislative council consists of thirty members, twenty-three of whom are elective and seven non-elective, two of the latter holding office during the royal pleasure. The executive council has been further increased by two nominees not officers of the Government. The qualification for voters is the possession of freehold property worth £50, the occupation of property at an annual rental of £10, or an income of £96 per annum after three years' colonial residence. All voters are legally eligible as members. Boroughs or towns having 1000 inhabitants or upwards can form themselves into corporations for the supervision of their own municipal affairs, and townships or villages under certain conditions can frame local bye-laws.

Law and Justice.—The Roman-Dutch law by special enactment prevails within the colony, in addition to which are a number of ordinances and laws enacted by the local legislature, mostly founded upon imperial statute law. The law of evidence is the same as that of the courts of England. It has not been thought practicable as yet to bring the native population under the same laws as govern the colonists of European descent; but in 1848 the natives had their own laws confirmed by letters patent, except so far as these might be repugnant to the general principles of humanity as recognized throughout the civilized world; and they were codified and reduced into writing in 1878. Crimes amongst natives, with some few exceptions, are, however, tried by the ordinary courts. Special laws also have been passed for the benefit of the coolie immigrants. The administration of justice is conducted by a supreme court, and by the courts of the resident magistrates. The three judges of the supreme court, one of whom is chief-justice, sit in Pietermaritzburg *in banco* every alternate month, and during the other months circuit courts are held at Durban and in other towns. There is a vice-admiralty court, of which the chief-justice of the supreme court is judge and commissary. In addition to these are courts for the adjudication of cases under native law with right of appeal to the native high court, which sits under its own special judge assisted by assessors if need be; and from this high court appeal can be had to a court of which the chief-justice of the colony, the secretary for native affairs, and the judge of the native high court are judges. An appeal lies from all inferior courts to the supreme court, and in suits where the subject-matter in dispute is of the value of £500 an appeal can be had from any final judgment of the supreme court to the privy council.

Education and Religion.—In 1861 there were two collegiate institutions endowed in Natal, the one for Pietermaritzburg and the other for Durban, but little more was done as regards education until the education laws came into force in 1878, when a council of education was created to administer funds voted by the legislative council for scholastic purposes and to control all matters connected with the establishment and working of the public schools of the colony. Most of the religious bodies have good schools in their several parishes or districts; and public libraries and other literary institutions are to be found not only in Pietermaritzburg and Durban but in the principal towns and villages. Natal was erected into a see in 1853, with its cathedral in Pietermaritzburg. Proceedings were taken against Bishop Colenso (who died June 20, 1883) on certain charges of heresy, and judgment given against him by the South-African bishops in 1863; and this led eventually to the formation of a separate see in the colony. On the 25th January 1869 the bishop of Maritzburg was consecrated at Cape Town; he is a suffragan of the bishop of Cape Town, and has his cathedral church also in Pietermaritzburg. The Wesleyan Church has a very strong staff of clergy and local preachers in the colony, whilst the Congregational Church, the Dutch Reformed Church, the Presbyterian Church, and the Roman Catholic Church are all represented. At the stations of the Berlin, Free Church of Scotland, American Zulu, Hanoverian, Norwegian, and Trappist missions, great efforts are made to evangelize and train the natives and coolies.

Population.—The total population is about 380,000, of whom about 30,000 are whites, 20,000 Indian coolies, and 330,000 natives, mostly descendants of early refugees from Zululand. Of the white population about one-fifth are of Dutch extraction, and are chiefly resident in the Umvoti, Weenen, Klip River, and Newcastle divisions. Most of the coolies are located on the coast lands amongst the planters, who without their assistance would find all field and manufacturing operations impossible, as the natives cannot be depended on for continuous or skilled work.

History.—The country was discovered by Vasco da Gama, who sighted the Bluff headland at the entrance to the bay forming the present port at Durban on Christmas Day in 1497, and so named the country Terra Natalis. From that date little is recorded until the survivors of the crew of the Dutch ship "Stavenisse," wrecked on the coast in 1686, gave their report of the country and its inhabitant. In 1721 the Dutch formed a settlement, but it was soon abandoned. Subsequently, about 1810, it would seem that Chaka, chief of the Amazulu, swept with his warriors through the whole of Natal and the adjoining territories, destroying all males, and making booty of the cattle and women. One tribe, the Amatuli, however, after offering resistance to the invader, retreated into the dense bush near the Bluff and were amongst the few aborigines when the British took possession of the country. In 1824 Lieutenant Farewell and about twenty companions landed in Natal with the view of colonizing it, and for that purpose entered into a treaty with Chaka. Some four years after their arrival, however, Chaka was murdered by his brother Dingaan, and the settlement was broken up. In 1835 another British officer, Captain Allen Gardner, got permission from Dingaan to introduce missionaries into the country, and at once formed the township of Durban, at the port where there were still a few English settlers. In 1837 several Dutch farmers made an exodus from the Cape Colony, and one of their leaders, Pieter Retief, with the assistance of the Rev. Mr Owen, who had been for some time a resident missionary at Dingaan's own head kraal, obtained from Dingaan a cession of the whole territory of Natal. Immediately after the conclusion of the treaty Retief and his followers were treacherously murdered, and the attempt was made to extirpate the Boers throughout the length and breadth of the land. The latter with their firearms eventually proved more than a match for their numerous assailants, and joining Mpanda, who had rebelled against his brother Dingaan, utterly routed Dingaan's army on the banks of the White Umvolozi in 1840, and drove him to the Amaswazi country, where he was shortly after assassinated. Natal became a British colony on 8th August 1843, and, owing no doubt to the fame of the security and protection to be found under the British flag, large accessions were at once made to the native population by refugees from the several surrounding tribes. Since 1843 the colony has made rapid progress; the native tribes as a rule have been loyal, and, although occasional reports from Zululand have alarmed the colonists, it has very seldom been found necessary to send out the volunteer forces on *commando*. Any tendency to insubordination on the part of the resident natives has always been quickly suppressed, and a spirit of disaffection has never become general. In 1879 the colony became the base of operations against the Zulu king Cetywayo, and in 1881 it was for a short time invaded by the Transvaal Boers in connexion with the fighting which arose out of the annexation of the Transvaal in 1877.

Authorities.—Holden, *History of Natal*; *Reports of Grout and Fynn to Native Commission*, 1853; Cloete, *Lectures*, 1856; Shepstone, *Historic Sketch of Natal*, 1864; Brook, *History of Natal*, edited by Mann; Johnston, *Health and Disease, Natal*, 1860; Harvey and Sonder, *Flora Capensis*; Layard, *Birds of South Africa*; Smith, *Zoology of South Africa*; Drummond, *Large Game of South Africa*; *African Pilot for South and East Coasts of Africa*; Cadiz, *Laws of Natal*; Colenso, *The Zulu War*; Statham, *Boers, Blacks, and British*; Bird, *Form of Government (Natal)*, 1890; Carter, *Narrative of the Boer War*. (J. W. T.)

NATAL, a city of Brazil, the capital of the province of Rio Grande do Norte, is situated on the eastern bank of the river of that name, 2 miles above the mouth, with its fort in 5° 45′ S. lat. and 35° 13′ 12″ W. long. Though the water on the bar is only 14 feet at low tide, Natal is the first port of any note to the south of Cape Roque, and trades in cotton, sugar, dye-wood, and other local produce. It was founded in 1597. The population is about 11,000.

NATCHEZ, a city and port of entry of the United States, capital of Adams county, Mississippi, lies on the east bank of the Mississippi, 272 miles above New Orleans. Natchez-under-the-Hill, lying on a low alluvial bank, contains the steamboat landing and a few business houses. The main city, Natchez-on-the-Hill, occupies the summit of a bluff which rises nearly 200 feet above the river, and affords a wide view over the cotton plantations of Louisiana. Among the more conspicuous buildings are the city-hall, the court-house, the market-house, the Roman Catholic cathedral, the Jewish synagogue, and a number of handsome churches. There are two large cotton factories and other manufacturing establishments. Cotton dealing is the staple trade. The inhabitants numbered 4454 in 1850, 6612 in 1860, 9057 in 1870, and 7058 in 1880,—the city being in population the second in the State.

Fort Rosalie, erected on Natchez Bluff in 1716 by Bienville, and rebuilt in 1729 after its destruction by the Natchez Indians, continued to be a French trading and military post till 1763, when it passed into British hands and received the name of Fort Panmure. Occupied by the Spaniards from 1779 till 1798, Natchez became at the latter date the capital of the new Territory of Mississippi, retaining that rank till 1820. Its city charter dates from 1803.

NATHANAEL (נְתַנְאֵל, "he whom God gave," equivalent to Nethaniah or the Greek Theodore), a common name in later Old Testament times. It appears in the Gospel of John (i. 45 *sq.*, xxi. 2) as the name of a man of Cana of Galilee, one of the first disciples of Jesus. He is not named in the synoptical Gospels, and the fathers (Chrysostom, Augustine, &c.) do not number him among the apostles;

but his position in the Fourth Gospel has given rise to a prevalent conjecture that Nathanael is the true name of the apostle whose patronymic was Bartholomew (son of Ptolemy). This indeed is mere conjecture, and recent writers have advanced rival hypotheses, *e.g.*, that the name is another form for Mattaniah or Matthew (Hilgenfeld), or that Nathanael is identical with the beloved disciple of the Fourth Gospel (Späth) or even a mere symbol of Paulinism (Holtzmann).

NATICK, a town of the United States, in Middlesex county, Massachusetts, near the left bank of the Charles River, a few miles to the south-east of Cochituate Lake, and about 18 miles west-south-west of Boston by the railway between that city and Worcester. It is mainly engaged in the manufacture of boots and shoes, but also produces clothing, boxes, and carriages. The population in 1880 was 8480.

Natick ("our land") was in 1650 granted to John Eliot, the Indian "Apostle," for the occupancy of Indians converted to Christianity; and until 1721 the community was governed by a constitution modelled on that of Exodus xviii. Portions of the records, written in the Indian language, are extant. The site of the first Indian church is now occupied by the Unitarian church. Of the Natick Indians only four or five remain, all of mixed blood. The incorporation of the town dates from 1781.

NATIONAL DEBT. Details as to the national debts of individual countries are given under their respective headings, and for the economical principles of the subject the reader is referred to the articles FINANCE and POLITICAL ECONOMY. In the present article the subject will be considered briefly in what may be regarded as its technical aspects,—including the special character of the institution, the different classes of debt, the various methods of raising loans, interest, funding systems, comparative statistics of national debts, methods of estimating the burden of debt, and other points.

National debt is so universal an institution that it has been described as the first stage of a nation towards civilization. A nation, so far as its finances are concerned, may be regarded as a corporate body or even as an individual. Like the one or the other it may borrow money at rates of interest, and with securities, general or special, proportionate to its resources, credit, and stability. But, while in this respect there are certain points of analogy between a state and an individual, there are important points of difference so far as the question of debt is concerned. A state, for example, may be regarded as imperishable, and its debt as a permanent institution which it is not bound to liquidate at any definite period, the interest, unless specially stipulated, being thus of the nature of transferrible permanent annuities. While an individual who borrows engages to pay interest to the lender personally, and to reimburse the entire debt within a certain date, a state may have an entirely different set of creditors every six months, and may make no stipulation whatever with regard to the principal. A state, moreover, is the sole judge of its own solvency, and is not only at liberty either to repudiate its debts or compound with its creditors, but even when perfectly solvent may materially alter the conditions on which it originally borrowed. These distinctions explain many of the peculiarities of national debts as contrasted with those of individuals,—though a nation, like an individual, may by reckless bad faith utterly destroy its credit and exhaust its borrowing powers.

A well-organized state ought to have within itself the means of meeting all its ordinary expenses; where this is not the case, either through insufficiency of resources or maladministration, and where borrowing is resorted to for what may be regarded as current expenses, a state imperils, not only its credit, but, when any crisis occurs, its very existence; in illustration of this we need only refer to the cases of Turkey in Europe and some of the states of Central and South America. Even for meeting emergencies it is not always inevitable that a state should incur debt; its ordinary resources, from taxation or from state property, may so exceed its ordinary expenses as to enable it to accumulate a fund for extraordinary contingencies. This, it would seem, was a method commonly adopted in ancient states. The Athenians, for example, amassed 10,000 talents in the interval between the Persian and the Peloponnesian wars, and the Lacedæmonians are said to have done the same. At Susa and Ecbatana Alexander found a great treasure which had been accumulated by Cyrus. In the early days of Rome the revenue from certain sources was accumulated as a sacred treasure in the temple of Saturn; and we know that when Pompey left Italy he made the mistake of leaving behind him the public treasury, which fell into the hands of Cæsar. In later times, also, the more prudent emperors were in the habit of amassing a hoard. We find that the method of accumulating reserves prevailed among some of the early French kings, even down to the time of Henry IV. This system has long prevailed in Prussia, and even at the present day exists to some extent in reconstituted Germany. Frederick II., when he ascended the throne, found in the treasury a sum of 8,700,000 thalers, and it is estimated that at his death he left behind him a hoard of from 60 to 70 million thalers. And similarly, in our own time, of the five milliards of indemnity paid by France as a result of the Franco-German War, 150 millions were set apart to reconstitute the traditional war-treasury. The German empire, apart from the individual states which comprise it, had in 1882 a debt of about £24,000,000, while its invested funds amounted to £37,390,000, including a war-treasure of £6,000,000. The majority of economists disapprove of such an accumulation of funds by a state as a bad financial policy, maintaining that the remission of a proportionate amount of taxation would be much more for the real good of the nation. At the same time the possession of a moderate war-fund, it must be admitted, could not but give a state a great advantage in the case of a sudden war. In the case of England, apart from the private hoardings of a few sovereigns, there does not seem to have existed any deliberately accumulated public treasure; before the time of William and Mary English monarchs borrowed money occasionally from Jews and from the city of London, but emergencies were generally met by "benevolences" and increased imposts.

All modern states, it may be said, have been compelled to have recourse to loans, either to meet war expenses, to carry out great public undertakings, or to make up the recurrent deficits of a mismanaged revenue. Resources obtained in this way are what constitute national debt proper. Loans have been divided into forced and voluntary. Forced loans can, of course, only be raised within the bounds of the borrowing country; and, apart from the injustice which is sure to attend such an impost, it is always economically mischievous. The loans which the kings of England were wont to exact from the Jews were really of the character of forced loans, though the method has never been used in England in modern times so extensively as on the Continent. There the sum sought to be obtained in this way has never been anything like realized. In 1793, for example, a loan of this class was imposed in France, on the basis of income; and of the milliard (francs) which it was sought to raise only 100 millions were realized. In Austria and Spain, also, recourse has been had at various times to forced loans, but invariably with unsatisfactory results. Other methods of a more or less compulsory character have been and are made use of in various states for obtaining money, which, as they involve the payment of interest, may be regarded as of the nature of loans; but the debt incurred by such methods is comparatively insignificant, and some of the methods adopted are peculiarly irritating and mischievous. On the other hand, it has occasionally been attempted to raise voluntary loans by appeals to a nation's patriotism; the method has been confined almost exclusively to France. After the revolutions of 1830 and 1848 appeals were thus made to the patriotism of French capitalists to buy 5 per cents direct from the Government at par, at a time when the French 5 per cents were selling at 80: but the results were quite insignificant. Even if the amount sought for by a Government could be obtained on the voluntary principle, the method itself is vicious, withdrawing as it does from the general working capital of the country a sum of serious dimensions. In short, the only economically sound method of meeting expenses which the ordinary resources of a state cannot meet is by borrowing in the open market on the most advantageous terms obtainable. On this normal method of borrowing, loans are divided into different categories, though there are really only two main classes, which may be designated perpetual and terminable. Borrowing in quasi-perpetuity has hitherto been the mode adopted by most states in the creation of the bulk of their debt. Not that any state ever borrows with the avowed intention of never paying off debts; but either no definite period for reimbursement is fixed, or the limit has been so extended as to be practically perpetual, or in actual practice the debt has been got rid of by the creation of another of equal amount under similar or slightly differing conditions as to interest. Of course a state is not bound to retain any part of its debt as a perpetual burden; it is at liberty to liquidate whenever it suits its convenience. This quasi-perpetuity of debt in the case of a state in a sound financial condition involves no hardship upon its creditors, who may at any moment realize their invested capital by selling their titles as creditors in the open money market, it may be at the price they paid, or it may be a little below or a little above it, according to the state of the market at the time. Loans, again, contracted on the terminable principle are of various classes; the chief of these are (1) life annuities, (2) terminable annuities, (3) loans repayable by instalments at certain intervals, (4) loans repayable entirely at a fixed date.

From the time of William III. life and terminable annuities have been a favourite mode in England either of borrowing money or of commuting, and thus gradually paying off, the existing funded debt. At first, and indeed until comparatively recent times, the system of life annuities resulted in serious loss to the country, owing to the calculation of the rate of annuity on too high a scale, a result arising from imperfect data on which to base estimates of the average duration of life. The system of life annuities was sometimes combined in England with that of perpetual annuities, or interest on the permanent debt,—the life annuity forming a sort of additional inducement to lenders of limited means to invest their money. At one time the form of life annuities known as tontine was much in vogue both in England and France, the principle of the tontine being that the proceeds of the total amount invested by the contributors should be divided among the survivors, the last survivor receiving the whole interest or annuity. The results of this system were not, however, encouraging to the state. In England, at least, the terminable annuity has been a favourite mode of borrowing from the time of William III.; it has been generally conjoined with a low rate of permanent interest on the sum borrowed. Thus in 1700 the interest on the consolidated debt amounted to only £260 000, while the terminable annuities payable amounted to £308,407. In 1780 a loan of 12 millions was raised at 4 per cent. at par, with the additional benefit of an annuity of £1, 16s. 3d. per cent. for eighty years. Even so late as the Crimean War in 1855, a loan of 16 millions at 3 per cent. at par was contracted, the contributors receiving in addition an annuity of 14s. 6d. per cent. for thirty years. Latterly, however, this beneficiary system has been abandoned, though the system of terminable annuities has received increased favour, especially as a means of reducing the funded debt. Of the total debt of England in 1882, upwards of 35½ millions were in terminable annuities, while in 1883 the sum was only £29,492,125.

The third method of contracting terminable loans, that of gradual repayment or amortization within a certain limit of years, has been a favourite one among certain nations, and specially commends itself to those whose credit is at a low ebb—as Turkey, Russia, and Egypt. When the final term of repayment is fixed upon, a calculation is easily made as to how much is to be paid half-yearly until the expiry of the term, so that at the end the whole, principal and interest, will have been paid. At first, of course, the amount paid will largely represent interest, but, as at each half-yearly drawing of the numbers of the bonds to be finally paid off the principal will be gradually reduced, there will be more and more money set free from interest for the reduction of the actual debt. This method, as we have said, has its advantages, and when conjoined with stipulations as to liberty of conversion to debt bearing a lower rate of interest than that originally offered, and when the bonds are not issued at a figure much below par, might be the most satisfactory method of raising money for a state under certain emergencies. What is known as the "Morgan loan" of France in 1870 was contracted on such conditions.

The last form of temporary loan, that repayable in bulk at a fixed date, is one which, when the sum is of considerable amount, is apt to be attended with serious disadvantages. The repayment may have to be made at a time when a state may not be in a position to meet it, and so to keep faith with its creditors may have to borrow at a higher rate in order to pay their claims. It has, however, worked well in the United States, most of the debt of which has been contracted on the principle of optional payment at the end of a short period, say five years, and compulsory payment at the end of a longer period, say twenty years. Thus the loan of 515 millions of dollars contracted in 1862 was issued on this principle, at 6 per cent., and so with other loans between that year and 1868. In European states, however, the risks of embarrassment are too great to permit of the application of this method on an extensive scale; and for loans of great amount the methods most likely to yield satisfactory results are loans bearing quasi-perpetual interest, or those repayable by instalments on the basis of half-yearly drawings within a certain period.

What are known as lottery loans are greatly favoured on the Continent, either as an independent means of raising money, or as an adjunct to any of the methods referred to above. These must not be confounded with the lottery pure and simple, in which the contributors run the risk of losing the whole of their investment. The lottery loan has been found to work well for small sums, when the interest is but little below what it would have been in an ordinary loan, and when the percentage thus set aside to form prizes of varying amounts forms but a small fraction of the whole interest payable. The principle is that each contributor to such a loan has a greater or less chance of drawing a prize of varying amount, over and above the repayment of his capital with interest.

What are known as exchequer bills and treasury bills may be regarded as loans payable at a fixed period of short duration, from three months upwards, and bearing very insignificant interest, even so low as ½ per cent. They are a useful means of raising money for immediate wants and for local loans, and form handy investments for capitalists who are reserving their funds for a special purpose. Exchequer bonds are simply a special form of the funded debt, to be paid off generally within a certain period of years.

There are two principal methods of issuing or effecting a loan. Either the state may appeal directly to capitalists and invite subscriptions, or it may delegate the negotiation to one or more bankers. The former method has been occasionally followed in France and Russia, but in practice it has been found to be attended with so many disadvantages to the borrowing state or city that the best financial authorities consider it unsound. The great banking-houses have such a command over the money-market that it is difficult to keep even a direct loan out of their hands. The majority of loans, therefore, are negotiated by one or more of these houses, and the name of Rothschild is familiar to every one in connexion with such transactions. By this method a borrowing state can assure itself of having the proceeds of the loan with the least possible delay and with the minimum of trouble. A loan may be issued at, above, or below par, though generally it is either at or below par,—"par" being the normal or theoretical price of a single share in the loan, the sum which the borrowing Government undertakes to pay back for each share on reimbursement, without discount or premium. Very generally, as an inducement to investors, a loan is offered at a greater or less discount, according to the credit of the borrowing Government. England, for example, may borrow at any time at par or at a mere fraction below it, while a Central-American state might find difficulty in raising a small loan at 50 per cent. discount. Sometimes a state may offer a loan to the highest bidders; for example, the city of Auckland in 1875 invited subscriptions through the Bank of New Zealand to a loan of £100,000 at 6 per cent.; offers were made of six times the amount, but only those were accepted which were at the rate of 98 per cent. or above. The rate of interest offered generally depends on the credit of the state issuing the loan. England, for example, would have no difficulty in raising any amount at 3 per cent. or even less, while less stable states may have to pay 8 or 9 per cent. The nominal percentage is by no means, however, always an index of the cost of a loan to a state, as the history of the debt of England disastrously shows. During last century various expedients were employed, besides that of terminable annuities already referred to, to raise money for the great wars of the period, at an apparently low percentage. For example, from 3 to 5 per cent. would be offered for a loan, the actual amount of stock per cent. allotted being sometimes 107½ or even 111; so that between 1776 and 1785, for the £91,763,842 actually borrowed by the Government, £115,267,993 was to be paid back. In 1797 a loan of £1,620,000 was contracted, for every £100 of which actually subscribed, at 3 per cent., the sum of £219 was allotted to the lender. In 1793 a 3 per cent. loan of 4½ millions was offered at the price of £72 per cent., the Government thus making itself liable for £6,250,000. Greatly owing to this reckless method the debt of Great Britain in 1815 amounted to over 900 millions. France in this respect has been quite as extravagant as England; many of her loans during the present century have been issued at from 52½ to 84 per cent., one indeed (1848) so low as 45 per cent.,—as a rule with 5 per cent. interest. The enormous and embarrassing increase of the French debt during the present century is doubtless greatly due to this disastrous system. Nearly every European state and most of the Central and South American states have aggravated their debts by this method of borrowing, and got themselves into difficulty with their creditors. Both Turkey and Egypt are notable examples, while states such as Austria and Italy have been compelled to resort to various expedients to reduce their enormous liabilities. Financiers almost unanimously maintain that in the long run it is much better for a state to borrow at high interest at or near par, than at an apparently low interest much below par. A state of even the highest rank may find itself in the midst of a crisis that will for a time shake its credit; but when the crisis is past and its credit revives it will be in a much more sound position with a high interest for a debt contracted at par than with a comparatively low interest on a debt much in excess of what it really received. If a state, for example, borrows at par at 6 per cent. when its credit is low, it may easily when again in a flourishing condition reduce the interest on its debt to 4 or even 3 per cent. The United States Government has actually done so with the debt it had to contract at the time of the civil war. This method of reducing the burden of a debt is evidently no injustice to the creditors of a Government, when used in a legitimate way. A state is at liberty at any time to pay off its debts, and, if it can borrow at 3 per cent. to pay off a 6 per cent. debt, it may with perfect justice offer its creditors the option of payment of the principal or of holding it at a reduced interest. Government debts are, however, sometimes reduced after a fashion by no means so legitimate as this; we need only refer to Turkey, where both principal and interest have been enormously reduced on a debt on which little or no interest was ever paid. Other states have been even more unprincipled, and have got rid of their debts at one sweep by the simple method of repudiation; some of the States of the American Union are notorious examples of this easy method.

When a state has a variety of loans at varying rates of interest, it may consolidate them into a single debt at a uniform interest. For example, in 1751 several descriptions of English debt were consolidated into one fund bearing a uniform interest of 3 per cent., an operation which gave origin to the familiar term "consols" ("consolidated funds"). In the early days of the English national debt, a special tax or fund was appropriated to the payment of the interest on each particular loan. This was the original meaning of "funds," a term which has now come to signify the national debt generally. So also the origin of the term "funded" as applied to a debt which has been recognized as at least quasi-permanent, and for the payment of the interest on which regular provision is made. Unfunded or floating debt, on the other hand, means strictly loans for which no permanent provision requires to be made, which have been obtained for temporary purposes with the intention of paying them off within a brief period. Exchequer and treasury bills are included in this category, and such other moneys in the hands of a Government as it may be required to reimburse at any moment. Where a Government is the recipient of savings banks deposits, these may be included in its floating debt, and so also may the paper-money which is issued so largely by some Governments. The unfunded debt of England is comparatively small, while in Austria and some other states it has attained formidable and embarrassing dimensions. A state with an excessive floating debt must be regarded as in a very critical financial condition.

National debt, again, is divided into external and internal, according as the loans have been raised within or without the country,—some states, generally the smaller ones, having a considerable amount of exclusively internal debt, though it is obvious that the bulk of national debts are both external and internal.

We referred above to various ways of reducing the burden of a debt, and also to methods of contracting loans by which within a certain period they are amortised or extinguished. Most states, however, are burdened with enormous quasi-permanent debts, the reduction or extinction of which gives ample scope for the financial skill of statesmen. A favourite method of accomplishing this is by the establishment of what is known as a sinking-fund, formed by the setting aside of a certain amount of national revenue for the reduction of the principal of the debt. Unless carefully managed, a sinking fund is likely to prove a snare. Where it is the genuine result of surplus revenue, and not of money which is in reality borrowed, the only sure method of making it accomplish its purpose is to sink it yearly in the discharge of debt. Where it is allowed to accumulate "at compound interest," as in Pitt's famous experiment, there is great danger of its being diverted from its purpose, and the debt increased instead of diminished. In 1786 a "new sinking fund" was established in England, and certain commissioners appointed to carry its object into effect. With certain modifications in 1829, the fund continued in force till 1875, when another "new sinking fund" was established by which ultimately almost 29 millions were set aside for the annual service of the debt, the difference between the sum actually required and this fixed amount being applied to purchase of stock. This fund was to continue in operation for ten years. Meantime Mr Childers, chancellor of the exchequer, has had an Act passed (1883) for the creation of a large amount of terminable annuities (from five to twenty years), by the operation of which £173,000,000 of stock will be cancelled in twenty years. The existing 28 millions (over 29 millions in 1883–4) will continue to be the yearly charge of the debt, but, as the annuities into which it is proposed to convert a large portion of the debt fall in, more and more of this sum will be set free for the reduction of the principal of the debt. In the United States the large surplus of revenue over expenditure is regularly applied to the reduction of the debt, so that the enormous liabilities incurred owing to the civil war are being reduced with unprecedented rapidity. The sinking fund also plays a prominent part in the new arrangements which have been made with the creditors of Turkey and Egypt.

Questions as to the policy of a state contracting debt belong properly to the general subjects of finance and political economy; here we shall briefly deal with actual facts, the progress of the leading national debts, and their present comparative magnitudes.

The debt of the United Kingdom at the Revolution in 1688 amounted to only £664,263, with an annual charge of £39,855. During the reign of William III. this increased to the comparatively large sum of £12,767,000, with an annual charge of £1,215,324, which at the accession of George I. had grown to £36,000,000 and

£3,063,135 respectively. In 1727 the capital had increased to £53,979,000, while by reduction of interest the annual charge had diminished to £2,360,930. Partly by the operation of the sinking fund, the debt in 1739 had decreased by upwards of 7 millions, but the wars which followed left it at the treaty of Aix-la-Chapelle in 1748 at the sum of £77,488,940. By the end of the Seven Years' War, however, in 1763, the debt had risen to £133,287,940, besides terminable annuities, and the annual charge to £5,032,732. At the commencement of the American War, 1775, the debt had fallen to £126,842,800, but as a result of that war this was more than doubled, and the burden had grown to £273,000,000, including the capitalized value of terminable annuities. After a diminution of about 10 millions during the nine years' peace, the long French wars, which terminated in 1815, left the country burdened with a debt of over 900 millions, at an annual charge of £32,645,618. With various fluctuations during the next forty years, the debt gradually diminished to a little over 800 millions. The two years of war with Russia cost upwards of 30 millions, and in 1857 the capital sum had risen to £838,900,000 and the annual charge to £28,681,177. In 1870 it had fallen again to 800 millions, which in 1883 had diminished to £756,376,519, with an annual charge of £29,678,672, including terminable annuities and the charge thereon, as well as the sinking fund. As we have already pointed out, the actual capital of the British debt does not represent by any means the sums actually received by the state. During the past and the early years of the present century enormous sums were borrowed at a price far below par, the difference adding many millions to the actual burden of the debt. At the same time some relief has been obtained from this burden by judicious conversions into lower-priced stock and the creation of terminable annuities. For the relations between the South Sea Company and the Bank of England and the British national debt, we must refer to the articles BANKING and FINANCE. In the above estimates we have taken no account of the indebtednesses of cities, counties, and other local divisions, which can scarcely be regarded as included in the debt of the nation as a whole. Were these sums added they would increase the total amount of the debt by about 150 millions.

One peculiarity of the national debt of France is that it is reckoned, not according to capital, but according to rente or interest; so that any estimates based on rente must be regarded as approximate. Another peculiarity is the minute distribution of the consolidated debt among a multitude of creditors, most of whom are French; this arises from the fact that the shares in French debt may be subdivided into minute parts, and an investor may thus purchase a few francs' worth of rente. Thus in 1883 the number of holders of rente was over 4,000,000. The debt of France can be traced as far back as 1375, and at the death of Louis XIV. in 1715 it is estimated to have amounted to a capital of £124,000,000, though this was arbitrarily reduced in the following year to 80 millions. The republican Government of 1798 cancelled nearly the whole of the then existing debt, reducing it to a capital of £32,000,000, with a rente of £1,600,000. During the empire, notwithstanding Napoleon's extensive wars, the debt had only grown to £70,645,000, including a floating debt of 20 millions. Under the Bourbons, what with war-levies and constant deficits, it grew rapidly, and in 1830 stood at £141,770,000. To this the Orleans dynasty added 40 millions, leaving the debt in 1848 at 182 millions. During the four years of the republic this grew to £245,250,000, while the enormous deficits and the wars of the second empire raised it to £550,000,000 in December 1870. The further cost of the German war, with its enormous indemnity and the foreign occupation of 1870–73, added upwards of 300 millions to this. Since then the French debt has steadily grown, and in 1883 stood (capitalizing all classes of debt) at about £1,000,000,000, with an annual charge of £52,722,300,—the largest in the world.

In 1763, at the end of the Seven Years' War, Austria had a debt of only £15,000,000; but, as it is a country of almost constant deficits, this sum has rapidly increased. In 1815 it was £82,500,000; in 1830, 108 millions; in 1848, 125 millions; in 1862, after the French war, £252,671,860, to which the war with Prussia added 40 millions in 1866. Since then it has grown apace, and in 1883 stood at £380,000,000, including floating debt, paper-money, and Austria's special liabilities, amounting to £105,700,000, but excluding the special debt of Hungary, which amounted to over 104 millions; Hungary, besides, contributes three-tenths to the interest of the common debt, this interest in 1883 amounting to £12,024,070, in addition to over 2 millions for Austria's special debt.

The debt of Prussia in 1800 was only £5,250,000, which as a result of the French wars grew by 1820 to 31 millions. By 1842 10 millions were paid off, but in 1866 it had risen to 42 millions, partly from deficits, partly from war preparations, and partly from money sunk in the construction of railways. The war with Austria, and the annexations in 1866, raised it by 1870 to £56,400,000. Since then it has nearly doubled, and in 1882 had reached the sum of £102,984,071, with an annual charge of £4,881,032. Much of the debt of Prussia has, however, been contracted for railways and the development of the resources of the country, and is in fact nearly covered by the revenue of the state-railways, domains, and mines. The German empire, as such, had no debt at the time of its re-establishment in 1870, though one has since been created; in 1883 the total funded debt was £18,500,000 at 4 per cent. interest. There was also an unfunded debt consisting of state treasury bills amounting to £7,698,210. The expenses of the French war were far more than covered by the indemnity, while the various invested funds of the empire amounted to £37,390,523. Besides Prussia, each of the German states has its own special debt. In all these amounted to about 170 millions, most of this sum having been borrowed for the construction of railways, so that the actual burden is comparatively small. Thus the total debt of the empire and of the states composing it is only a little over 300 millions.

It is difficult to obtain any trustworthy figures as to the debt of Russia. The history of its finance is a history of almost continual deficits, largely covered since the time of Catherine II. by the issue of paper roubles, which at her death amounted to about 30 million pounds sterling, and in 1817 to 125 millions. The total debt was first stated for 1853, when it was given as 125 millions, including paper-money. In 1858, after the Crimean War, it was 240 millions, and in 1869, including the floating debt, 300 millions. In 1880 it was estimated at 640 millions, one-third of which was paper roubles. Were the depreciated rouble taken at par, the sum would be nearly half as much again. The interest on the debt in 1880 amounted to 17 millions, and in the budget for 1882 the total charge of the debt was set down at over 28 millions.

In 1876 the debt of Turkey stood at 296 millions, but since then, by a process of reduction, it has been brought down to 150 millions, besides an internal debt estimated at 20 millions.

The united kingdom of Italy began in 1860 with a debt of 97½ million pounds sterling, which, mainly through continual deficits, but partly by the construction of railways, had grown to 446½ millions in 1881, with a net interest of 17 millions, a heavy burden on one of the poorest countries of Europe.

Like Austria, Spain has been a country of constant deficits, combined with frequent repudiations and chronic inability to meet the claims of creditors. Spain was deeply in debt so long ago as the 16th century; the amount in 1745 was 9 millions sterling, which was repudiated by Ferdinand VI. A commission in 1822 reported the debt at 140 millions, but in 1822 a second junta reduced it to 52 millions. In 1851, with the floating debt, the amount was 113 millions, one half of which was declared passive, bearing no interest. In twenty years this had more than doubled, being in 1870 £237,400,000, with an annual charge of £6,735,000. In 1881 the capital sum had increased to 512 millions, but by a process of conversion this was to be reduced to 240 millions, according to official statement, bearing an annual charge of £9,500,000.

Portugal has for its size a large debt, the result also of vicious financial administration. It began in 1796 with £900,000, which in 1854 rose to 20 millions, in 1866 to 43 millions, in 1871 to £64,333,000, and in 1881 to £97,512,000, with an annual charge of £3,065,285.

Greece began her independence by becoming a debtor in 1824 for £800,000, and her borrowings since have loaded the little kingdom with a debt of 15 millions, the interest on which has never been regularly and fully paid. Part of the debt is guaranteed by England, France, and Russia.

The debt of Holland began in the 16th and 17th centuries in her struggle with Spain and wars with England, and in 1778 the Dutch were oppressed with a debt of 62 millions, which by 1814 had risen to 144 millions, the annual charge per head of population being over 30s. By 1851 the capital was reduced to 102½ millions, which has gone on steadily decreasing, and in 1882 the capital sum was £78,442,370, with an annual interest of £2,419,222, being about 12s. per head, though the revenue of the state railways makes it somewhat less. A sinking fund of £833,000 is annually devoted to the redemption of the debt. The debt of Belgium began with 10 millions taken over from Holland after 1830, which, after growing to 39 millions and again falling by the operation of the sinking fund to £24,400,000 in 1865, has since steadily grown to about 72 millions in 1882, including the railway purchases, the annuities granted for which represent about 13 millions. Most of the remainder of the debt is covered by the proceeds of the various public works for which it has been raised.

The debt of Denmark was £4,150,000 in 1821. Partly through deficits, partly through war with Prussia, and partly owing to the construction of state railways, this grew to £14,862,465 in 1865. This declined to £9,629,257 in 1880, but subsequent loans raised it to over 11 millions in 1882, the annual charge being £554,400. So much of the debt, however, is caused by productive investments that the annual burden is only 2s. a head. Only £700,000 of the debt is external.

The existing debt of Sweden began with a railway loan of £1,228,575 in 1858, and nearly all her subsequent loans have been contracted for similar purposes, the total debt in 1882 being 12½ millions. So much of this is covered by the proceeds of the railways that the annual burden is less than 9d. per head of population.

The debt of Norway, which has grown from £1,656,315 in 1871 to £5,806,222 in 1882, has also been largely contracted for railways, though the net annual charge per head is 2s. 6d.

Switzerland in 1882 had a nominal debt of £1,477,881, more than covered by the "federal fortune" or property belonging to the state. The separate cantonal debts amounted in all to 12 millions sterling, in most cases also covered by the proceeds of cantonal property.

Outside Europe we can only refer to the progress of the debts of the United States and India. The former began their career as a federal republic with a debt of 15 millions sterling (1791), on which there was little increase till 1816, when it reached 25 millions, which in 1835 was almost extinguished. The debt, however, rose again, but never exceeded 14 millions till 1860, the year before the civil war, when it reached 18 millions. During the next four years the debt rose rapidly, and after the conclusion of the war in 1866 the country was saddled with a debt of £556,685,175. This has gone on decreasing since with wonderful rapidity, on account of the systematic application of the large surplus revenue to its reduction, and in 1882 it had sunk to £383,662,598, being at the rate of over 10 millions a year. At this rate the debt would be extinguished within forty years. Each of the States has, besides, a debt of its own, these amounting to about 57 millions sterling in 1882.

The debt of India, as might be expected from its peculiar conditions, far exceeds that of any other British dependency. During the early years of the century there were considerable deficits in the revenue owing to the various wars, and these by 1820 had reached over 5 millions. In 1834, taking the nominal value of the rupee as 2s., there was a total debt of £41,350,952. When the administration was taken over by the imperial Government there was a debt of 81 millions (1859), which, with slight fluctuations, has gone on increasing, until in 1882 it had reached £156,820,614, with interest of about 4½ millions. Were the Government guarantees of railway and other undertakings added, this would raise the liabilities of the country to about 250 millions. The large receipts from productive investments, however, considerably reduce the net burden of the debt, which has fallen from 9½d. a head in 1871 to about 5d. at the present time.

In the following table we give a list of the leading national debts (1882 and 1883), with various other items, by which some idea may be formed of their comparative burdensomeness:—

Table of Leading National Debts.

	Debt	Per Head of Population.	Annual Charges.	Per Head of Population.	Revenue per Head.	Expenditure per Head.	Imports per Head.	Exports per Head.	Imports and Exports per Head.
	£	£ s. d.	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
United Kingdom	756,376,519	21 9 0	28,678,672	0 17 0	2 9 0	2 8 10	11 7 0	8 8 0	19 15 0
British Possessions—									
India	156,820,614	0 15 9	4,588,100	0 0 5½	0 7 4	0 7 8	0 6 8	0 7 8	0 14 0
Australasia	95,988,682	33 17 7	4,552,000	1 11 9	7 9 8	6 14 1	19 0 0	17 8 0	36 8 0
Canada	32,040,627	7 8 2	1,867,078	0 8 8	1 7 5	1 3 7	4 17 5	4 6 11	9 4 4
Cape Colony	15,441,700	10 6 0	818,700	0 10 11	3 4 5	3 16 6	6 3 0	2 16 3	8 19 3
Natal	1,631,700	4 0 0	76,741	0 3 9	1 5 5	1 4 1	5 14 3	2 3 7	7 17 10
France	1000,000,000	26 12 0	52,722,800	1 8 0	3 0 0	3 10 4	5 5 0	3 16 8	9 1 8
Russia	640,000,000	6 13 0	28,000,000	0 5 10	0 19 4	1 2 8	0 14 9	0 15 9	1 10 6
Austria-Hungary	474,759,955	12 10 11	22,027,805	0 11 8	2 0 0	2 3 0	1 14 8	1 17 10	3 12 6
Italy	446,502,440	15 14 0	19 748,071	0 13 10	2 0 4	2 0 1	1 14 5	1 13 6	3 7 11
United States	383,662,598	7 12 0	17,778,482	0 7 6	1 12 0	1 0 5	2 19 0	3 1 7	6 0 7
Spain	240,000,000	14 9 0	9,500,000	0 11 4	1 17 8	1 17 8	1 7 8	1 8 5	2 16 1
Turkey	149,687,434	7 2 7	2,000,000 (?)	0 2 0	0 14 0 (?)	0 14 0 (?)	1 2 0	1 0 0	2 2 0
Egypt	109,016,350	19 15 0	4,948,028	0 18 4	1 9 0	1 9 0	1 5 9	2 8 0	3 13 9
Prussia	102,984,071	3 15 6	4,281,082	0 3 11	1 14 3	1 14 3	3 2 8	3 7 4	6 10 0
Portugal	97,512,000	20 11 0	3,065,285	0 12 11	1 6 9	1 8 8	1 12 3	0 19 5	2 11 8
Brazil	85,355,660	8 10 8	4,850,000	0 9 9	1 5 2	1 4 6	1 16 0	2 6 2	4 2 2
Holland	78,442,370	19 1 3	2,419,222	0 11 9	2 3 6	2 12 8	16 15 5	12 13 0	29 8 5
Belgium	72,222,665	13 0 9	3,512,115	0 12 9	2 3 0	2 5 6	11 16 2	9 8 9	21 4 11
Japan	70,168,418	1 19 0	5,494,860	0 3 0	0 7 7	0 7 7	0 3 8	0 3 6	0 7 2
Argentine Republic	29,427,000	11 11 8	2,594,000	1 0 0	2 8 8	2 8 3	4 5 3	4 18 8	9 3 11

The total debt of the British empire may be set down at about 1080 millions sterling, or at the rate of about £4, 6s. per head of the population of the empire. The gross debt of all the states of the world is estimated at about 5200 millions in 1882, or about £6 per head. In some of the Central and South American states it is scarcely possible to obtain the actual amount and burden of the debt, as the interest has remained unpaid for years. For example, the debt of Costa Rica is equal to £22, 8s. per head, but as no interest has been paid for years, the actual burden is nil. In the case of Honduras, if the overdue interest were added to the outstanding debt, the burden per head would be something like £38. Most of those states, however, have been defaulters, and have sought to escape the burden of their liabilities by not meeting them. The classification given by Mr Dudley Baxter in 1874 (*Jour. Stat. Soc.*) is still (except as regards the United States) essentially correct. He classified the borrowing states into four categories, according to the rate of interest on the market-price of their stocks:—(1) low interest states, 3 and 4 per cent.—United Kingdom, Denmark, Holland, Belgium, Germany, India, Canada, Australasia, Sweden; (2) moderate interest, 5 to 6½ per cent.—Morocco, United States, Brazil, Russia, France, British African colonies, Chili, Argentine Republic (3) high interest states, 6½ to 10 per cent.—Portugal, Japan, Hungary, Austria, Colombia, Roumania, Uruguay, Italy, Cuba, Egypt, Peru, Ecuador, Turkey (states whose expenditure exceeds their income, and whose other circumstances show some risk to lenders); (4) excessive interest, 14 to 66 per cent.—Guatemala, Bolivia, Spain, Mexico, Costa Rica, Paraguay, Venezuela, San Domingo, Greece, Honduras (states of unsettled governments and finances, and threatened or actual default of interest). Most of the last class have been or are defaulting states, and among them, in this respect, should be classed Peru and Ecuador.

The above table cannot be said to represent the real relative amounts and burdens of the various national debts. For example, the interest per head of the British debt is 17s., while that of Russia is 5s. 10d., of the United States 7s., of Australasia 31s. 9d., and of Egypt 18s. 4d. But it is evident that these figures give no adequate idea of the real burden,—that the average Englishman can more easily afford to pay his 17s. a year, the Australasian his 31s. 9d., and much more the average American his 7s., than the average Russian his 5s. 10d., or the poor Egyptian his 18s. 4d. It has been sought (Fenn's *Compendium*) to show the real comparative indebtedness by readjusting the capital sums on a 5 per cent. basis. In this way the British debt would be represented by about 460 millions; that of France by 780 millions; Austria, 226 millions; Russia, 485½ millions; Italy, 432½ millions; United States, 225 millions; India, 118½ millions; Belgium, 53½ millions; Holland, 50 millions; Japan, 93 millions; Egypt, 99 millions. If, moreover, from these sums be deducted the amount covered by the net earnings of reproductive investments, a considerable reduction would have to be made in some cases in the amounts to be provided for by taxation. In the case of Prussia, for example, the whole of the debt in 1882 was met by the proceeds of reproductive investments. The Cape Colony, on the 5 per cent. basis, had only half her nominal debt to provide for by taxation, and so more or less with the Australian colonies; the debt of India would thus be reduced by one-third, of Belgium by about one-half, Norway the same, Sweden by about nine-tenths. Perhaps the most satisfactory test, according to the above table, of the relative burden of the various debts, is a comparison between the interest per head and the annual value per head of exports. Compare, for example, Great Britain with 17s. per head of interest and £8, 8s. of exports, Australasia 31s. 9d. and £17, 8s., Canada 8s. 8d. and £4, 6s. 11d., the United States 7s. and £3, 1s. 7d., and Holland 11s. 9d. and £12, 13s. with France and its £1, 8s. of interest per head and £3, 16s. 8d. of exports, Russia 5s. 10d. and 15s. 9d., Austria-Hungary 11s. 8d. and £1, 17s. 10d., Spain 11s. and £1, 8s. 5d., Egypt 18s. 4d. and £2, 8s., Portugal 12s. 11d. and 19s. 5d., Japan 3s. and 3s. 6d.,—and some idea will be obtained of the different conditions of the countries to meet their national liabilities. But even this comparison does not give anything like a complete idea of the real burden of national debt, and should be supplemented by reference to the total income of each nation from all sources and the total amount of its capital, supposing all its assets were realized. Estimates, which can only be regarded as roughly approximate, have been made of the value of national capital of the leading states and the amount of their national income. Taking, then, the capital of the United Kingdom at 10,000 millions sterling, we find that the national debt, 756 millions, bears to this the proportion of only a little over 7½ per cent.; and even if we added the local debts the proportion would be only about 9 per cent. Taking again the national income at 1200 millions, we find that the annual charge of the debt is only 2½ per cent. of this sum, and even if we added the charges of the local debts the percentage would scarcely be above 3. The whole national and local debt could be paid off by about two-thirds of a year's income; as they could be also by the produce of three years' exports.

The national capital of France may be roughly estimated at 7500 millions sterling, to which the debt, 960 millions, bears the large proportion of 12·8 per cent., while if the local debts be included the proportion rises to 14½ per cent. The income of France may be taken at 950 millions, to which the annual charge of the debt bears the proportion of 3·65 per cent., and that of the local debts would raise it to 4 at least. It would take nearly five years even of the proceeds of the "general exports" of France to pay off the national debt.

The national capital and income of the United States increase with unexampled rapidity. The former cannot be less at present than 7000 millions, and the latter 1500 millions (more than even that of the United Kingdom). The national debt is 5 per cent. of the former, and the total federal and State debts only 6 per cent., while the interest (including that of the Pacific Railway loans, for which there are reimbursements), £17,775,000, is only 1·2 per cent. of the rapidly increasing income. One-fourth of a year's income would pay off the whole of the debt.

If we take the total debts of the German empire and all the states at 300 millions, and the national capital at 4500 millions, we find the former only 6 per cent. of the latter. Belgium and Holland are equally favourably situated in this respect, while in the Scandinavian countries the proportion of debt to national capital is only about 2 per cent. Coming to Russia, we find the debt bears the enormous proportion of 23 per cent. to the approximate national capital, while the interest is 5 per cent. of the national income. Estimating the latter at 560 millions, we see that one year would not suffice to pay off the 640 millions of debt. Austria-Hungary is not quite so bad, as the debt is only 17 per cent. of the capital, and it could be nearly paid off by a year's income. Italy seems even in a worse state than Russia, as her debt is estimated at 27 per cent. of her capital, which it would take two years' income to pay off, while Spain and Portugal (even with the greatly reduced principal of the former) have a combined debt amounting to 29 per cent. of their united national capitals. India and the British colonies are nearly as favourably situated in this respect as the mother-country, while the rapid development of the enormous resources of Canada and the Australian colonies tends constantly to diminish the proportion of debt to capital.

Other elements which ought to be taken into consideration in estimating the real burden of national debt, besides the above and the increased development of the world's resources, are the increase of population and the depreciation of the precious metals. Thus, while the annual charge of the British debt per head was 34s. 8d. in 1815, it was only 16s. 10d. in 1882, and this not solely from the decrease of the debt, but even more largely by the increase of the population. Moreover, owing to the decreased value of money, 16s. 10d. in 1882 is in reality very considerably less than the half of 34s. 8d. in 1815. Thus even by the operation of the unearned increment, not to speak of the increasing value of reproductive investment, the natural tendency is for the actual burden of national debt to decrease every year, unless it is recklessly increased by fresh loans.

See Leroy-Beaulieu, *Traité de la Science des Finances*; Rau, *Finanzwissenschaft*; M'Culloch, *On Taxation and the Funding System*; Hamilton, *Inquiry concerning the Rise and Progress of the English Debt*; Taylor, *History of Taxation in England*; Fenn, *Compendium of English and Foreign Funds*; A. Johnstone Wilson, *The National Budget*; Dudley Baxter, *National Debts*, and his paper in the *Stat. Soc. Jour.*, 1874; *The Statesman's Year-Book*, 1883; M. Block, *Annuaire de l'Economie Politique et de la Statistique*, 1863; *Dictionnaire Général de Politique*; and *Statistique de la France comparée avec les divers pays de l'Europe*; Cohen, *Compendium of Finances*; J. Garnier, *Traité de Finances*; papers by Leone Levi (1862), Hyde Clarke, and R. Giffen (1878), and others in *Jour. of Stat. Soc.*; paper by Ernest Seyd, in *Soc. of Arts Jour.*, 1878; the parliamentary reports on *Public Income and Expenditure*, 1688–1869. (J. S. K.)

NATOLIA, or **ANATOLIA**. See **ASIA MINOR**.

NATRON. See **SODA**.

NATURALIZATION. See **ALIEN**.

NAUDÉ, GABRIEL (1600–1653), French librarian and scholar, was born at Paris in February 1600. An intense love for books caused him to accept, when only twenty years of age, the appointment of librarian to the president De Mesmes, whom he left in 1626 to finish his medical studies at Padua. On returning to Paris in 1628 he was chosen to deliver a panegyrical discourse on the medical school. The credit thus acquired brought him under the notice of Cardinal Bagni, who took him to Rome and gave him charge of his collection. On Bagni's death in 1641 he became librarian to Cardinal Barberini, under whose patronage he commenced a wearisome controversy with the Benedictines concerning the authorship of *De Imitatione Christi*. Richelieu, wishing to secure the services of Naudé, recalled him to Paris in 1642, but, the great minister dying a few months later, Naudé accepted a similar offer on the part of Mazarin, and for the next ten years his unwearied energy was directed to the task of bringing together that noble assemblage of books since known as the Bibliothèque Mazarine (see LIBRARIES, vol. xiv. p. 525), making for the purpose expeditions to all parts of Europe. The troubles of the Fronde caused him to assent to the wish of Queen Christina that he should become her librarian at Stockholm. He was not happy in Sweden, however, and on Mazarin's appeal that he should reform his scattered library Naudé returned at once. But his health was altogether broken, and he died on the journey at Abbeville in July 1653. The friend of Gui Patin, Gassendi, and all the liberal thinkers of his time, Naudé was no mere bookworm; each of his books shows traces of the critical spirit which made him a worthy member of the company of humorists and scholars who prepared the way for the better known writers of the "siècle de Louis XIV."

Including works edited by him, a list of ninety-two pieces is given in the *Naudæana*. The chief are *Le Marfore, ou discours contre les libelles*, Paris, 1620, very rare, reprinted 1868; *Instruction à la France sur la vérité de l'histoire des Frères de la Rose-Croix*, 1623, 1624, displaying their impostures; *Apologie pour tous les grands personnages faussement soupçonnes de magie*, 1625, 1652, 1669, 1712,—Pythagoras, Socrates, Thomas Aquinas, and Solomon are among those defended; *Advis pour dresser une bibliothèque*, 1627, 1644, 1676, translated by J. Evelyn, 1661, full of sound and liberal views on librarianship; *Addition a l'histoire de Louys XI.*, 1630 (this includes an account of the origin of printing); *Bibliographia politica*, Venice, 1633, &c., in French 1642, a mere essay of no bibliographical value; *De studio liberali syntagma*, 1632, 1645, a practical treatise found in most collections of directions for studies; *De studio militari syntagma*, 1637, esteemed in its day; *Considérations politiques sur les coups d'état*, Rome [Paris], 1639, first edition rare, augmented by Dumay, 1752 (this contains an apology for the massacre of St Bartholomew); *Biblioth. Cordesianæ Catalogus*, 1643, classified; *Jugement de tout ce que a été imprimé contre le Card. Mazarin* [1649], Naudé's best work, and one of the ablest defences of Mazarin; it is written in the form of a dialogue between Saint-Ange and Mascurat, and is usually known under the name of the latter.

Authorities.—L. Jacob, *G. Naudæi tumulus*, 1659; P. Hallé, *Elogium Naudæi*, 1661; Niceron, *Mémoires*, vol. ix.; L. Jacob, *Traicté des plus belles bibliothèques*, 1644; Gui Patin, *Lettres*, 1846; *Naudæana et Patiniana*, 1703; Sainte-Beuve, *Portraits Litt.*, vol. ii.; *Revue des Deux Mondes*, 1836; A. Franklin, *Histoire de la Bibl. Mazarine*, 1860.

NAUMACHIA, the Greek word denoting a naval battle, was used by the Romans as the name for mimic sea-fights which were shown as a spectacle to the public. The first that is recorded was given by Julius Cæsar on an artificial lake which he constructed in the Campus Martius. After this naumachiæ became a favourite spectacle for the emperors to give to the people. Claudius made a great one on the Lacus Fucinus, Nero another in the amphitheatre at Rome. Gladiators or condemned criminals fought in these battles; in later times even volunteers took part in them. The combatants were often dressed in costume: Augustus showed a naumachia of Athenians and Persians; Titus acted a sea-fight between Corinth and Corcyra.

NAUMBURG, the chief town of a circle in the district of Merseburg, Prussian Saxony, and the seat of the provincial law courts, is pleasantly situated on the Saale, near its junction with the Unstrut, in the centre of an amphitheatre of vine-clad hills. The cathedral, an imposing building in the Romanesque Transition style (1207–42), has a Gothic choir at each end, and contains some interesting mediæval sculptures. There are also three other Protestant churches, a Roman Catholic church, a gymnasium, a real-school, an orphanage, and two or three hospitals. The town-hall was originally the residence of the bishop. The inhabitants, who in 1880 numbered 17,868, are chiefly employed in producing wine (12,000 gallons yearly), but also manufacture cotton and woollen fabrics, chemicals, combs, and leather. Trade, facilitated by the navigable river, is mainly concerned with wine, grain, vegetables, and dried fruit. An annual fair, founded by the emperor Maximilian in 1514, is still held here, but is now of little importance. Near Naumburg are Kösen, a favourite watering-place, and the celebrated school of Schulpforta, which has perhaps the strongest claim to the title of a German Eton.

In the 10th century Naumburg was a stronghold of the margraves of Meissen, who in 1029 transferred to it the bishopric of Zeitz for protection against the Wends. In Saxon history Naumburg is memorable as the scene of various treaties; and in 1561 an assembly of Protestant princes was held there, which made a futile attempt to cement the dissensions of the Protestants on doctrinal points. In 1564 the last bishop died, and the bishopric fell to the elector of Saxony. In 1631 the town was taken by Tilly, and in 1632 by Gustavus Adolphus. It became Prussian in 1814. An annual festival, with a procession of children, is referred to an apocryphal siege of the town by the Hussites in 1432, but is probably connected with an incident in the Brothers' War, between elector Frederick of Saxony and his brother Duke William (1447–51). Lepsius the antiquary and his more distinguished son the Egyptologist were born at Naumburg.

NAUPACTUS. See LEPANTO.

NAUPLIA, a town in the Peloponnesus, at the head of the Argolic Gulf. In the classical period it was a place of no importance, and when Pausanias lived, about 150 A.D., it was deserted. At a very early time, however, it seems to have been of greater note, being the seaport of the plain in which Argos and Mycenæ are situated. A hero Nauplius took part in the Argonautic expedition; another was king of Eubœa. The mythic importance of the town revived in the Middle Ages, when it became one of the chief cities of the Morea. It was captured in 1211 by Godfrey Villehardouin with the help of Venetian ships; a French dynasty ruled in it for some time, and established the feudal system in the country. In 1388 the Venetians bought Argos and Nauplia. In the wars between Venice and the Turks it often changed masters. It was given to the Turks at the peace concluded in 1540; it was recaptured by Venice in 1686, and Palamidhi on the hill overhanging the town was made a great fortress. In 1715 it was taken by the Turks; in 1770 the Russians occupied it for a short time. The Greeks captured it during the war of independence on December 12, 1822, and it was the seat of the Greek administration till 1833, when Athens became the capital of the country. The population in 1879 was 4598.

NAUTILUS. For the Paper Nautilus (*Argonauta argo*) see vol. vi. p. 736; and for the Pearly Nautilus (*N. pompilius*) see vol. xvi. p. 670 *sq.*

NAVARINO, or NEOCASTRO, a seaport of the Morea, Greece, in the nomarchy of Messenia, stands on the south shore of the Bay of Navarino, in 36° 54′ N. lat. and 21° 41′ E. long. It consists of a citadel, situated on a high rock, and a lower town,—the whole being surrounded by a wall. The population is under 2000. The bay, one of the best harbours in Greece, about 4 miles in length by 2 in breadth, with a depth ranging from 12 to 26 fathoms, is protected towards the west by the long and narrow island of Sphagia, the ancient Sphacteria, to the south-east of which lies the entrance, now nearly a mile wide, but anciently much narrower (Thucyd. iv. 8).

The word Navarino is explained as equivalent to Avarino, and is said to record an Avar settlement made here in the 6th century. The name Neocastro distinguishes the place from Palæocastro, the alleged site of the ancient Pylus, on the northern shore of the bay. Sphacteria was the scene of the famous blockade and defeat of the Spartans in 425 B.C.: and it was by the victory of the combined fleets of Great Britain, France, and Russia over those of Turkey and Egypt in the Bay of Navarino on October 27, 1827, that the independence of Greece was virtually secured.

NAVARRA, an inland province of northern Spain, lies between 41° 57′ and 43° 18′ N. lat., and between 40′ and 1° 15′ 50″ W. long.,—its greatest length from north to south being 90 miles, its breadth from east to west 86 miles, and its area 4046 square miles. The population in 1877 was 304,184. It is bounded on the N. by France (Basses Pyrénées), on the E. by Huesca and Zaragoza, on the S. by Zaragoza and Logroño, and on the W. by Alava and Guipuzcoa. It is traversed from east to west by the Pyrenees and by the Cantabrian mountains, their continuation in the west; and almost the whole of the province is overrun by the ramifications of this great central cordillera, which on the north-east especially presents an almost impassable barrier, and encloses numberless secluded pasteral valleys. From Navarra there are only three practicable roads for carriages into France,—those by the Puerta de Vera, the Puerta de Maya, and Roncesvalles. The highest summits in the province are those of Altoviscar (5380 feet) and Adi (5220 feet). Southward of a line drawn from Sanguesa by Tafalla to Estella the country presents a series of descending but comparatively level terraces, until the Ebro is reached. The chief river flowing towards the Atlantic is the Bidasoa, which rises near the Puerta de Maya, and after flowing southwards through the valley of Baztan takes a north-easterly course, and for a short distance above its outfall at Fuenterrabia constitutes the frontier between France and Spain (Guipuzcoa); by far the larger portion of the province has its drainage to the Mediterranean through the Ebro, whose main feeders there are the Ega and the Aragon with its tributary the Arga. The geology of the province will be best explained in connexion with that of the Pyrenæan system and of the country as a whole. Gypsum, limestone, freestone, and marble are quarried; there are also mines of copper (near Leiza), lead (Leiza and Vera), and iron (Goizueta and the valley of Aezcoa), employing a considerable population; and rock-salt is mined at Funes and Valtierra. There are numerous mineral and thermal springs, but none of more than local fame. The hilly districts are almost entirely appropriated to forests and pasture, the most common trees being the pine, beech, oak, and chestnut. Much of the lower part of the province is well adapted for agriculture, producing the various cereals in remunerative abundance; the principal fruit grown is the apple, from which cider is made in some districts; hemp, flax, and oil also occur, and the cultivation of the mulberry for the silkworm is not unknown. Game, both large and small, is abundant in the mountains, not even the bear being wholly extinct; and the streams abound with trout and other fish. The manufactures of the province, which are not important, include cloth and paper; wool, iron, salt, hides, and liquorice are the chief exports. Administratively Navarra is divided into five "merindades" or departments,—those of Pamplona, Tafalla, Olite, Estella, and Sanguesa. The capital is Pamplona, with a population of 25,630. It is connected by rail on the west with Alsasua on the trunk line between Madrid and San Sebastian, and with the Ebro valley in the south. There are no other railways in the province. Besides Pamplona, the only ayuntamiento with a population exceeding 10,000 is Tudela (10,086); Baztan comes next with 9931.

Navarra, or Navarre, along with Guipuzcoa, at the time of the Roman conquest formed the territory of the Vascones, which afterwards became part of Hispania Tarraconensis. Never thoroughly subjugated by the Romans, the Basques or Navarrese offered considerable resistance to the Visigothic kings in the 5th and 6th centuries, and afterwards in the 8th, with more success, to the Moors. In 778 Charlemagne succeeded in imposing his yoke upon them, but with the assistance of their old enemies they soon afterwards asserted their independence of the Franks. Garcias Ximenez (860) is named as having been their first king. In the beginning of the 11th century Sancho III., el Mayor, had made himself sovereign of Castile and Leon as well as of Sobrarve and Aragon, but before his death in 1035 divided his extensive dominions into four unequal parts, Navarre being assigned to his son Garcia III. Garcia's son Sancho IV. was overthrown in 1076 by a cousin, Sancho I. of Aragon, in whose line the two crowns remained united until the election of Garcia Ramirez on the death of Alphonso I. (VII. of Castile). In 1234 Theobald, third count of Champagne, was crowned at Pamplona as Theobald I., having been adopted as heir by Sancho VII., and through Joanna, the granddaughter of Theobald, who married Philip the Fair of France in 1284, the crowns of France and Navarre became united in the person of Louis X. They were again separated on the death of Charles IV. of France without male issue; Joanna II., the daughter of Louis X. and wife of Philip, count of Evreux, was crowned queen of Navarre at Pamplona in 1329. Her great-granddaughter Blanche was married first to Martin of Sicily and afterwards to John, son of Ferdinand of Aragon; the second after her death made himself king of Navarre in spite of the claims of his son Charles, taking the title of John II. He was followed in 1479 by his daughter Eleanor, the wife of Gaston de Foix, and after her death in the same year Francis Phœbus, her grandson, succeeded, being crowned in 1482. At his death (1483) his sister Catherine, wife of Jean d'Albret, naturally succeeded, but, the latter having fallen under the papal ban, Ferdinand the Catholic in 1512 seized the whole of what is now Spanish Navarra, only the small portion of the kingdom on the French side of the Pyrenees being retained by Henry II., son of D'Albret (1516). Her grandson, Henry III. of Navarre, became king of France (Henry IV.) in 1589, and united non-Spanish Navarre to the French crown in 1607.

NAVARRETE, JUAN FERNANDEZ (1526–1579), surnamed El Mudo (The Mute), an eminent Spanish painter of the Madrid school, was born at Logroño in 1526. The illness which deprived him of his hearing occurred in early infancy, but at a very early age he began, it is said, to express his wants by sketching objects with a piece of charcoal. He received his first instructions in art from Fray Vicente de Santo Domingo, a Hieronymite monk at Estella, and afterwards he visited Naples, Rome, Florence, and Milan. According to the ordinary account he was for a considerable time the pupil of Titian at Venice. In 1568 Philip II. summoned him to Madrid with the title of king's painter and a salary, and employed him to execute pictures for the Escorial. The most celebrated of the works he there produced are a Nativity (in which, as in the well-known work on the same subject by Correggio, the light emanates from the infant Saviour), a Baptism of Christ (now in the Madrid Picture Gallery), and Abraham Receiving the Three Angels (one of his last performances, dated 1576). He executed many other altarpieces, all characterized by boldness and freedom in design, and by the rich warm colouring which has acquired for him the surname of "the Spanish Titian." He died at Toledo in February 1579.

NAVARRETE, MARTIN FERNANDEZ DE (1765–1844), Spanish historian, was born at Abalos, Logroño, in 1765, received his early education at the seminary in Vergara, Guipuzcoa, and entered the navy as a midshipman in 1780. His ship was engaged in the unsuccessful operations against Gibraltar in 1782, and afterwards in the suppression of Algerine pirates. Ill-health compelled him for a time to withdraw from active service, but he was able to devote the leisure thus forced upon him to historical research, and in 1789 he was appointed by the crown to examine the national archives with a view to the publication of a series of documents relating to the maritime history of Spain. Rejoining the navy in 1793, he was present at the siege of Toulon, and afterwards received command of a frigate. From 1797 to 1808 he held in succession various important posts in the office of the minister of marine. In 1808 the French invasion led to his withdrawal to Andalusia, and the rest of his life was entirely devoted to literature. In 1819 appeared, as an appendix to the Academy's edition of *Don Quijote*, his *Vida de Cervantes*, the best biography of the great poet and humorist that has as yet been written, and in 1825 the first two volumes of the *Coleccion de los Viajes y Descubrimientos que hicieron por Mar los Españoles desde fines del Siglo XV.*,—characterized by Humboldt as "one of the most important historical monuments of modern times,"—were published. The third followed in 1829, and the fourth and fifth in 1837. After the publication of his *Life of Cervantes*, Navarrete's literary merits received ample recognition: various public posts were conferred on him, including that of director of the hydrographical institute, and in 1837 he was made a senator and director of the academy of history. At the time of his death, which occurred on October 8, 1844, he was assisting in the preparation of the *Coleccion de Documentos Ineditos para la Historia de España*. The last two volumes of the *Coleccion de Viajes* were published posthumously, as also were a *Disertacion sobre la Historia de la Nautica* (1846) and the *Biblioteca Maritima Española* (1851).

NAVIGATION

NAVIGATION is the art of conducting a ship across the ocean. It is here treated to the exclusion of seamanship, which forms a distinct subject. The present article will give, first, a view of the history of the art from the time of the epoch-making voyages of Columbus and the Portuguese, with special reference to advances made in England, and then a sketch of practical navigation as the art now stands.

Up to the time of the Portuguese exploring expeditions, sent out by Prince Henry, which led to the discovery of the Azores in 1419, and the rediscovery of the Cape Verd Islands in 1447 and of Sierra Leone in 1460, navigation had been conducted in the most rude, uncertain, and dangerous manner it is possible to conceive. Thousands of years had passed without the least improvement being introduced, except the magnetic needle about the beginning of the 14th century (see COMPASS and MAGNETISM). Prince Henry did all in his power to bring together and systematize the knowledge then obtainable upon nautical affairs; he also established an observatory at Sagres (near Cape St Vincent) in order to obtain more accurate tables of the declination of the sun. John II., who ascended the throne in 1481, followed up the good work of his grand-uncle. He employed Roderick and Joseph, his physicians, with Martin de Bohemia, from Fayal, to act as a committee on navigation. They calculated tables of the sun's declination, and invented the astrolabe, or at least recommended it as more convenient than the cross-staff. The king established forts and settlements on the coast of Africa; that at St George de la Mina was on the Gold Coast, showing by the position a great geographical advance.

The backward state of navigation at this time is best understood from a sketch of the few rude appliances which the mariner had. He had a compass, a cross-staff or astrolabe, a moderately good table of the sun's declination, a correction for the altitude of the pole star, and occasionally a very incorrect chart. The first map or sea chart seen in England was brought by Bartholomew Columbus in 1489, and the first map of England was made in 1520. Decimal arithmetic was invented by Simon Stevin about the end of the 16th century. Watches were unknown till 1530, and immediately Gemma Frizon or Frisius seized the idea for the purpose of ascertaining the difference of longitude between two places. They were too rough to be of use, and their advocate proposed to correct them by water-clocks or sand-clocks. Almanacs were first published in Poland in 1470, and in London three years later. These contained tables of the sun's declination and that of many of the stars, and tables for finding the latitude by the pole star and the "pointers." There was not till 1607 any means whatever of measuring a ship's progress through the water, and none in general use till twenty or thirty years later (see Log).

The "cross-staff" appears to have been used by astronomers at a very early period for measuring heights and distances, more recently by seamen for measuring altitudes. It was one of the few instruments possessed by Columbus and Vasco da Gama. The old cross-staff, called by the Spaniards "ballestilla," consisted of two light battens. The part we may call the staff was about an inch and a half square and 36 inches long. The cross was made to fit closely and to slide upon the staff at right angles; its length was a little over 26 inches, so as to allow the "pinules" or sights to be placed exactly 26 inches apart. A sight was also fixed on the end of the staff for the eye to peep through at the other two sights and objects to be measured. It was made by describing the angles on a table, and laying the staff upon it (fig. 1). The scale of degrees was marked on the upper face. Afterwards shorter crosses were introduced, so that smaller angles could be taken by the same instrument. These angles were marked on the sides of the staff.

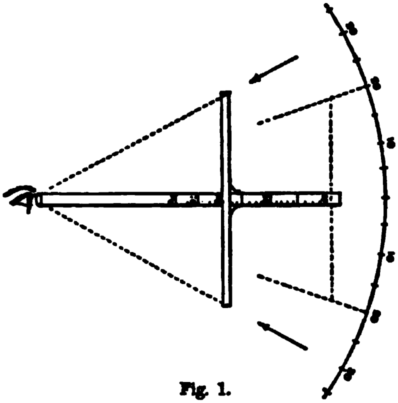


Fig. 1.

Another primitive instrument in common use at the beginning of the 16th century was the astrolabe, which was more convenient than the cross-staff for taking altitudes, but was incapable of measuring distances. Fig. 2 represents an astrolabe as described by Martin Cortes. It was made of copper or tin, about one-fourth of an inch in thickness and 6 or 7 inches in diameter, and was perfectly circular except at one place, where a projection was provided for a hole by which it was suspended. Weight was considered desirable in order to keep it steady when in use. The face of the metal having been well polished, a plumb line from the point of suspension marked the vertical line, which when carefully subdivided gave the horizontal line and centre. The upper left quadrant was divided into degrees. The second part was a pointer *pt* of the same metal and same thickness as the circular plate, about 1½ inches wide, and in length equal to the diameter of the circle. The centre was bored, and a line was drawn across it the full length, which was called the line of confidence. On the ends of that line were fixed plates *s*, *s*, having each a larger and a smaller hole, both exactly over the line of confidence, as sights for the sun or stars. The pointer moved upon a centre the size of a goose quill. When the instrument was suspended the pointer was directed by hand to the object, and the angle read on the one quadrant only. Some years later the other quadrant was also graduated, to give the benefit of a second reading.

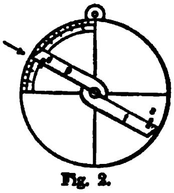


Fig. 2.

Among the earliest writers who touched upon navigation was John Werner of Nuremberg, who in 1514, in his notes upon Ptolemy's geography, describes the cross-staff as a very ancient instrument, but says that it was only then beginning to be introduced among seamen. He recommends measuring the distance between the moon and a star as a means of ascertaining the longitude.

Thirty-eight years after the discovery of America, when long voyages had become comparatively common, Gemma Frisius wrote upon astronomy and cosmogony, with the use of the globes. His book comprehended much valuable information to mariners of that day, and was translated into French fifty years later (1582) by Claude de Bossière. The system adopted is that of Ptolemy. The following are some of the points of interest for the subject before us. There is a good description of the sphere and its circles; the obliquity of the ecliptic is given as 23° 30′. The distance between the meridians is to be measured on the equator, allowing 15° to an hour of time; longitude is to be found by eclipses of the moon and conjunctions, and reckoned from the Fortunate Islands (Azores). Latitude should be measured from the equator, not from the ecliptic, "as Clarean says." The use of globes is very thoroughly and correctly explained. The scale for measuring distances was placed on the equator, and 15 German leagues, or 60 Italian leagues, were to be considered equal to one degree. The Italian league was 8 stadia, or 1000 paces, therefore the degree is taken much too small. We are told that, on plane charts, mariners drew lines from various centres (*i.e.*, compass courses), which were very useful since the virtue of the loadstone had become known; it must be remembered that parallel rulers were unknown. Such a confusion of lines has been continued upon sea charts till very recently. Frisius gives rules for finding the course and distance correctly, except that he treats difference of longitude as departure. For instance, if the difference of latitude and difference of longitude are equal, the course prescribed is between the two principal winds,—that is, 45°. He points out that the courses thus followed are not straight lines, but curved, because they do not follow the great circle, and that distances could be more correctly measured on the globe. The tide is said to rise with the moon, high water being when it is on the meridian and nadir. From a table of latitudes and longitudes a few examples are here selected, by which it appears that even the latitude was much in error. The figures in brackets represent the positions according to modern tables, counting the longitude from the western extremity of St Michael. Flores is 5° 8′ farther west.

Alexandria	31° 0′ N.	(31° 13′)	60° 30′ E.	(55° 55′)
Athens	37 15	(37 58)	52 45	(49 46)
Babylon	35 0	(32 32)	79 0	(70 25)
Dantzic	54 30	(54 21)	44 15	(44 38)
London	52 3	(51 31)	19 15	(25 54)
Malta	34 0	(35 43)	38 45	(40 31)
Rome	41 50	(41 54)	36 20	(38 30)

In 1534 Gemma produced an "astronomical ring," which he dedicated to the secretary of the king of Hungary. He admitted that it was not entirely his own invention, but asserted that it could accomplish all that has been said of quadrants, cylinders, and astrolabes,—also that it was a pretty ornament, worthy of a prince. As it displayed great ingenuity, and was followed by many similar contrivances during two centuries, a sketch is here given (fig. 3). The description must necessarily be brief.

The outer and principal sustaining circle EPQπ represents the meridian, and is about 6 inches in diameter; P, π are the poles. The upper quadrant is divided into degrees. It is suspended by a fine cord or wire placed at the supposed latitude. The second circle EQ is fixed at right angles to the first, and represents the equinoctial line. The upper side is divided into twenty-four parts, representing the hours from noon or midnight. On the inner side of that circle are marked the months and weeks. The third ring CC is attached to the first at the poles, and revolves freely within it. On the interior are marked the months, and on another side the corresponding signs of the zodiac; another is graduated in degrees. It is fitted with a groove which carries two movable sights. On the fourth side are twenty-four unequal divisions (tangents) for measuring heights and distances. Its use is illustrated by twenty problems; it can do roughly all that any instrument for taking angles can. Thus, to find the latitude, set the sights C, C to the place of the sun in the zodiac, and shut the circle till it corresponds with 12 o'clock. Peep through the sights and alter the point of suspension till the greatest elevation is attained; that time will be noon, and the point of suspension will be the latitude. The figure is slung at lat. 40°, either north or south. To find the hour of the day, the latitude and declination being known: the sights C, C being set to the declination as before, and the suspension on the latitude, turn the ring CC freely till it points to the sun, when the index opposite the equinoctial circle will indicate the time, while the meridional circle will coincide with the meridian of the place. In this we may see the germ of the "equatorial" now used in the principal observatories.

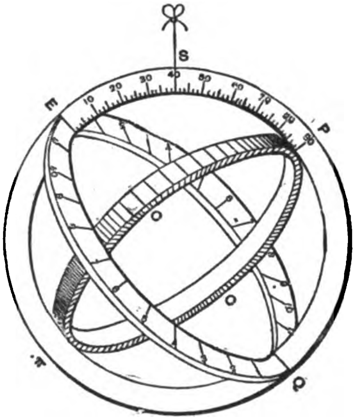


Fig. 3.

There is at present in the museum attached to the Royal Naval College at Greenwich an instrument, ticketed as Sir Francis Drake's astrolabe, prior to 1570. It is not an astrolabe, but may be a combination of astronomical rings as invented by Gemma with other things, probably of a later date. It has the appearance of a large gold watch, about 2½ inches in diameter, and contains several parts which fall back on hinges. One part is a sun-dial, the gnomon being in connexion with a graduated quadrant, by which it could be set to the latitude of the place. There are a small compass and an hour circle. It is very neat, but too small for actual use; it may be simply an ornament representing a larger instrument. There is a table of latitudes engraved inside one lid; that given for London is 51° 34′, about three miles too much.

In 1537 Pedro Nuñes (Nonius), cosmographer to the king of Portugal, published a work on astronomy, charts, and some points of navigation. He recognized the errors in plane charts, and tried to rectify them. Among many astronomical problems is one for finding the latitude of a place by knowing the sun's declination and the altitude when on two bearings, not less than 40° asunder. Gemma did a similar thing with two stars; therefore the problem now known as a "double altitude" is a very old one. They could do it by the globe within a degree. To Nuñez has been erroneously attributed the present mode of reading the exact angle on a sextant, the scale of a barometer, and various other things, the credit of which is due to Vernier nearly a hundred years later. The mode of dividing the scale which Nuñes published in 1542 was the following. The arc of a large quadrant was furnished with forty-five concentric segments, or scales, the outer one graduated to 90°, the others to 89, 88, 87, &c., divisions. As the fine edge of the pointer attached to the sights passed among those numerous divisions it touched one of them, suppose the fifteenth division on the sixth scale, then the angle was $\frac{15}{85}$ of 90° = 15° 52′ 56″. This was a laborious method; Tycho Brahe tried it, but abandoned it in favour of the diagonal lines then in common use, and still found on all scales of equal parts.

In 1545 Dr Pedro de Medina published *The Art of Navigation* at Valladolid, dedicated to Don Philippo, prince of Spain. This appears to be the first book ever published professedly on navigation. It was soon translated into French and Italian, and many years after into English by John Frampton. Though this pretentious work came out two years after the death of Copernicus, the astronomy is still that of Ptolemy. The general appearance of the chart of the Mediterranean, Atlantic, and part of the Pacific is in its favour, but examination shows it to be very incorrect. A scale of equal parts, near the centre of the chart, extends from the equator to what is intended to represent 75° of latitude; by this scale London would be in 55° instead of 51½°, Lisbon in 37½° instead of 38° 42′. The equator is made to pass along the coast of Guinea, instead of being over four degrees farther south. The Gulf of Guinea extends 14 degrees too far east, and Mexico is much too far west. Though there are many vertical lines on the chart at unequal distances they do not represent meridians; there is no indication of longitude. A scale of 600 leagues is given (German leagues, fifteen to a degree). By this scale the distance between Lisbon and the city of Mexico is 1740 leagues, or 6960 miles; by the vertical scale of degrees it would be about the same; whereas the actual distance is 4820 miles. Here two great wants become apparent,—a knowledge of the actual length of any arc, and the means of representing the surface of the globe on flat paper. There is a table of the sun's declination to minutes; on June 12th and December 11th (o.s.) it was 23° 33′. The directions for finding the latitude by the pole star and pointers appear good. For general astronomical information the book is inferior to that of Gemma.

In 1556 Martin Cortes published at Seville *The Art of Navigation*. He gives a good drawing of the cross-staff and astrolabe, also a table of the sun's declination for four years (the greatest being 23° 33′), and a calendar of saints' days. The motions of the heavens are described according to the notions then prevalent, the earth being viewed as fixed. He recommends the height of the pole being found frequently, as the estimated distance run was imperfect. He devised an instrument whereby to tell the hour, the direction of the ship's head, and where the sun would set. A very correct table is given of the distances between the meridians at every degree of latitude, whereby a seaman could easily reduce the difference of longitude to departure. In the rules for finding the latitude by the pole star, the star is supposed to be then 3° from the pole; it is now (1883) 1° 18′ 54″. Martin Cortes attributes the tides entirely to the influence of the moon, and gives instructions for finding the time of high water at Cadiz, when by means of a card with the moon's age on it, revolving within a circle showing the hours and minutes, the time of high water at the place for which it was set would be indicated. He deplores the loss of the earl of Niebla and other valiant captains of Spain, before Gibraltar, in 1436, because the mariners kept no account of the tides. In this instance it was more probably the effect of current. There is a chapter upon the signs which prognosticate fair or foul weather, from Pliny and Aristotle; another upon "shining exhalations," the "fire of St Elmo," and other old superstitions. Directions are given for making a compass similar to those then in common use, also for ascertaining and allowing for the variation. The east is here spoken of as the principal point, and marked by a cross, after that the true north.

There is a table of difference of latitude and departure in proportion to the tangent of the course.

The third part of Martin Cortes's work is upon charts; he laments that wise men do not produce some that are correct, and that pilots and mariners will use plane charts which are not true. In the Mediterranean and Channel of Flanders the want of good charts is (he says) less inconvenient, as there they do not navigate by the altitude of the pole.

As some subsequent writers have attributed to Cortes the credit of first thinking of the enlargement of the degrees of latitude on Mercator's principle, his precise words may be cited. In making a chart, it is recommended to choose a well-known place near the centre of the intended chart, such as Cape St Vincent, which call 37°, "and from thence towards the Arctic pole the degrees increase; and from thence to the equinoctial line they go on decreasing, and from the line to the Antarctic pole increasing."[1] It would appear at first sight that the degrees increased in size as well as being called by a higher number, but a specimen chart in the book does not justify that conclusion. It is from 34° to 40°, and the divisions are unequal, but evidently by accident, as the highest and lowest are the largest. He states that the Spanish scale was formed by counting the Great Berling as 3° from Cape St Vincent (it is under 2½°). Twenty English leagues are equal to 17½ Spanish or 25 French, and to 1° of latitude. Cortes was evidently at a loss to know the size of a degree, and consequently the circumference of the globe. The degrees of longitude are not laid down, but for a first meridian we are told to draw a vertical line "through the Azores, or nearer Spain, where the chart is less occupied." It is impossible under such circumstances to understand or check the longitudes assigned to places at that period. Martin Cortes's work was held in high estimation in England for many years, and appeared in several translations. One by Richard Eden in 1609 gives an improved table of the sun's declination from 1609 to 1625—the greatest declination being 23° 30′. The declinations of the principal stars and the times of their passing the meridian, and other improved tables, are given, with a very poor traverse table for eight points. The cross-staff, he said, was in most common use; but he recommends Wright's sea quadrant.

William Cuningham published in 1559 a book called his *Astronomical Glass*, in which he teaches the making of charts by a central meridional line of latitude in equal parts, with other meridians on each side, distant at top and bottom in proportion to the departure at the highest and lowest latitude, for which purpose a table of departures is given very correctly to the third place of sexagesimals. The chart would be excellent were it not that the parallels are drawn straight instead of being curved. In another example, which is one-fourth of the sphere, the meridians and parallels are all curved; it would be good were it not that the former are too long. The hemisphere is also shown upon a projection approaching the stereographic; but the eighteen meridians cut the equator at equal distances, instead of being smaller towards the primitive. He gives the drawing of an instrument like an astrolabe placed horizontally, divided into 32 points and 360 degrees, and carrying a small magnetic needle to be used as a prismatic compass, or even as a theodolite (fig. 4). A sketch is given of Ptolemy observing the sun with a primitive instrument, likely from its great size to give good results after being correctly fixed, except for the amount of error caused by the shrinkage or expansion of the parts.

Gerhard Mercator's great improvements in charts have been noticed in the article MAP, where a sketch is given of his map of the world, of 1569 (vol. xv. p. 521). From facsimiles of his early charts in Jomard, *Les Monuments de la Géographie*, the following measurements have been made. A general chart of 1569, of North America, 25° to 79°, is 2 feet long north and south, and 20 inches wide. Another of the same date, from the equator to 60° south is 15·8 inches. The charts agree with each other, a slight allowance being made for remeasuring. As compared with Dr Inman's table of meridional parts, the spaces between the parallels are all too small. Between 0° and 10° the error is 8′; at 20° it is 5′; at 30°, 16′; at 40°, 39′; at 50°, 61′; at 60°, 104′; at 70°, 158′; and at 79°, 182′,—that is, over three degrees upon the whole chart. As the measures are always less than the truth it is possible that Mercator was afraid to give the whole. In a chart of Sicily by Romoldus Mercator in 1589, on which two equal degrees of latitude, 36° to 38°, subtend 9½ inches, the degree of longitude is quite correct at one-fourth from the top; the lower part is a mile too large. One of the north of Scotland, published in 1595, by Romoldus, measures 10½ inches from 58° 20′ to 61°; the divisions are quite equal and the lines parallel; it is correct at the centre only. A map of Norway, 1595, lat. 60° to 70° = 9½ inches, has the parallels curved and equidistant, the meridians straight converging lines; the spaces between the meridians at 60° and 70° are quite correct.

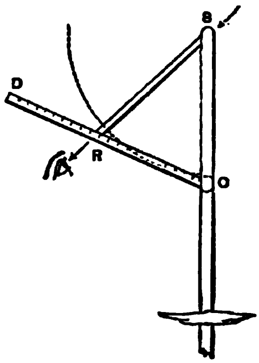


FIG. 4.—ST is the standard; SR the radius bar and pointer, with vanes and pinnules at the side; CD is a scale of chords which is lifted up to touch the pointer and indicate the angle from 90° near C to zero near D. By the size of the observer in the drawing the standard ST was 10 or 12 feet in length.

Norman's discovery of the dip (1576) has been spoken of at vol. xv. p. 221. He mentions and condemns the practice of each country having compass cards set to their variation, and sailors using them indiscriminately in any part of the world.

In 1581 Michael Coignet of Antwerp published sea charts, and also a small treatise in French, wherein he exposes the errors of Medina. He was probably the first who said that rhumb lines form spirals round the pole. He published also tables of declination, and observed the gradual decrease in the obliquity of the ecliptic. He described a cross-staff with three transverse pieces, which was then in common use at sea. Coignet died in 1623.

The Dutch published charts made up as atlases as early as 1584, with a treatise on navigation as an introduction.

In 1585 Roderico Zamorano, who was then the lecturer at the naval college at Seville, published a concise and clearly-written compendium of navigation; he follows Cortes in the desire to obtain better charts. Andres Garcia de Cespedes, the successor of Zamorano at Seville, published a treatise on navigation at Madrid in 1606. In 1592 Petrus Plancius published his universal map, containing the discoveries in the East and West Indies and towards the north pole. It possessed no particular merit; the degrees of latitude are equal, but the distances between the meridians are noted. He made London appear in 51° 32′ N. (which is near enough) and long. 22°, by which his first meridian should have been more than 3° east of St Michael.

In 1594 Blundeville published a description of Mercator's charts and globes; he confesses to not having known upon what rule the meridians were enlarged by Mercator, unless upon such a table as Wright had sent him (see below). Wright's table of meridional parts is here published, also an excellent table of sines, tangents, and secants,—the former to seven places of figures, the latter to eight. These are the tables made originally by Regiomontanus, and improved by the Jesuit Clavius.

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[1] "Y d'alli hasia el polo artico los grados se augmentan: y d'alli a la linea equinocial van diminuyendo: y de la linea al polo antartico augmentando."

In 1594 the celebrated navigator John Davis published a pamphlet of eighty pages, in black letter, entitled *The Seaman's Secrets*, in which he proposes to give all that is necessary for seamen—not for scholars on shore. He defines three kinds of sailing:—horizontal, paradoxical, and great circle. His horizontal sailing consists of short voyages which may be delineated upon a plain sheet of paper. The paradoxical or cosmographical embraces longitude, latitude, and distance,—the getting together many horizontal courses into one "infallible and true," *i.e.*, what is now called traverse and Mercator's sailings. His "paradoxical course" he describes correctly as a rhumb line which is straight on the chart and a curve on the globe. He points out the errors of the common or plane chart, and promises if spared to publish a "paradoxall chart." It is not known whether such a chart appeared or not, but he assisted Wright in producing his chart a few years later. Great circle sailing is clearly described by Davis on a globe; and to render it more practicable he divides a long distance into several short rhumb lines quite correctly. His list of instruments necessary to a skilful seaman comprises the sea compass, cross-staff, chart, quadrant, astrolabe, an "instrument magnetical" for finding the variation of the compass, a horizontal plane sphere, a globe, and a paradoxical compass. The first three are sufficient for use at sea, the astrolabe and quadrant being uncertain for sea observations. The importance of knowing the time of the tides when approaching tidal or barred harbours is clearly pointed out, also the mode of ascertaining it by the moon's age. A table of the sun's declination is given for noon each day during four years, 1593–97, from the ephemerides of Stadius. The greatest is 23° 28′. Several courses and distances, with the resulting difference of latitude and departure, are correctly worked out. A specimen log-book provides one line only for each day, but the columns are arranged similarly to those of a modern log. Under the head of remarks after leaving Brazil, we read, "the compass varied 9°, the south point westward." He states that the first meridian passed through St Michael, because there was no variation at that place; the meridian passed through the magnetic pole as well as the pole of the earth. He makes no mention of Mercator's chart, nor of Cortes or other writers on navigation. Rules are given for finding the latitude by two altitudes of the sun and intermediate azimuth, also by two fixed stars, by the globe. There is a drawing of a quadrant, with a plumb line, for measuring the zenith distance, and one of a curious modification of a cross-staff with which the observer stands with his back to the sun, looking at the horizon through a sight on the end of the staff, while the shadow of the sun, from the top of a movable projection, falls on the sight box. This remained in common use till superseded by Hadley's quadrant. The eighth edition of Davis's work was printed in 1657.

Edward Wright, of Caius College, Cambridge, published in 1599 a valuable work entitled *Certain Errors in Navigation Detected and Corrected*. One part is a translation from Roderico Zamorano; there is a chapter from Cortes, and one from Nuñez. A year after appeared his chart of the world, upon which both capes and the recent discoveries in the East Indies and America are laid down truthfully and scientifically, as well as his knowledge of their latitude and longitude would admit. Just the northern extremity of Australia is shown. Wright said of himself that he had striven beyond his ability to mend the errors in chart, compass, cross-staff, and declination of sun and stars. He considered that the instruments which had then recently come in use "could hardly be amended," as they were growing to "perfection,"—especially the sea chart and the compass, though he expresses a hope that the latter may be "freed from that rude and gross manner of handling in the making." He gives a table of magnetic declinations, and explains its geometrical construction. He states that Medina utterly denied the existence of variation, and attributed it to bad making and bad observations. Wright expresses a hope that a right understanding of the dip of the needle would lead to a knowledge of the latitude, "as the variation did of the longitude." He gives a table of declinations for every minute of the ecliptic, and another for the use of English mariners during four years—the greatest being 23° 31′ 30″. The latitude of London he made 51° 32′. For these determinations a quadrant over 6 feet in radius was used. He also treats of the "dip" of the sea horizon, refraction, parallax, and the sun's motions. With all this knowledge the earth is still considered as stationary,—although Wright alludes to Copernicus, and says that he omitted to allow for parallax. Wright ascertained the declination of thirty-two stars, and made many improvements or additions to the art of navigation, considering that all the problems could be performed arithmetically by the doctrine of triangles, without globe or chart. He devised sea rings for taking observations, and a sea quadrant to be used by two persons, which is in some respects similar to that by Davis. While deploring the neglected state which navigation had been in, he rejoices that the worshipful society at the Trinity House, under the favour of the king (James I.), had removed "many gross and dangerous enormities." He joins the brethren of the Trinity House in the desire that a lectureship should be established on navigation, as at Seville and Cadiz; also that a grand pilot should be appointed, as Sebastian Cabot had been in Spain, who examined pilots (*i.e.*, mates) and navigators. Wright's desire was partially fulfilled in 1845, when an Act of Parliament paved the way for the compulsory qualification of masters and mates of merchant ships; but such was the opposition by shipowners that it was left voluntary for a few years. England was in this respect more than a century behind Holland. It has been said that Wright accompanied the earl of Cumberland to the Azores in 1589, and that he was allowed £50 a year by the East India Company as lecturer on navigation at Gresham College, Tower Street.

The great mark which Wright made in the world was the discovery of a correct and uniform method for dividing the meridional line and making charts which are still called after the name of Mercator. He considered his charts as true as the globe itself; and so they were for all practical purposes. He commenced by constructing a meridional line, upon the proportion of the secants of the latitude, for every ten minutes of the arc, and in the edition of his work published in 1610 his calculations are for every minute. His calculations were based upon the discovery that the radius bears the same proportion to the secant of the latitude as the difference of longitude does to the meridional difference of latitude—a rule strictly correct for small arcs only. One minute is taken as the unit upon the arc and 10,000 as the corresponding secant, 2′ becomes 20,000, 3′ = 30,000, &c., increasing uniformly till 49′, which is equal to 490,001; 1° is 600,012. The secant of 20° is 12,251,192, and for 20° 1′ it will be 12,251,192 + 10,642,—practically the same as that used

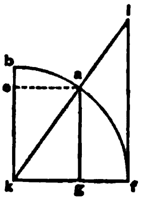

Fig. 5.

in modern tables. The principle is simply explained by fig. 5, where *b* is the pole and *bf* the meridian. At any point *a* a minute of longitude : a min. of lat. : : *ea* (the semi-diameter of the parallel) : *kf* (the radius). Again *ea* : *kf* : : *kf* : *ki* : : radius : sec. *akf* (sec. of lat.). To keep this proportion on the chart, the points of latitude must increase in the same proportion as the secants of the arc contained between those points and the equinoctial, which was then to be done by the "canon of triangles."[1]

Subsequent writers, including Gunter, Norwood, and Bond, give Wright the credit of having been the first to establish a correct proportion between the meridians and parallels for every part of the chart. This great improvement in the principle of constructing charts was adopted slowly by seamen, who, putting it as they supposed to a practical test, found good reason to be disappointed. The positions of most places had been laid down erroneously, by very rough courses and estimated distances upon an entirely false scale, viz., the plane chart; from this they were transferred to the new projection.[2]

When Napier's *Canon Mirificus* appeared in 1614, Wright at once recognized the value of logarithms as an aid to navigation, and undertook a translation of the book, which he did not live to publish (see NAPIER). E. Gunter's tables (1620) made the application of the new discovery to navigation possible, and this was done by T. Addison in his *Arithmetical Navigation* (1625), as well as by Gunter in his tables of 1624 and 1636, which gave artificial sines and tangents, to a radius of 1,000,000, with directions for their use and application to astronomy and navigation, and also logarithms of numbers from 1 to 10,000. Several editions followed, and the work retained its reputation over a century. Gunter invented the sector, and introduced the meridional line upon it, in the just proportion of Mercator's projection.

The third edition of Gunter's work was published in 1653, and the fifth edition in 1673, amended by Henry Bond, a practitioner in the mathematics, in the Bulwark near the Tower—a thick octavo. A table of meridional parts is given, with instructions to construct it by the addition of secants as Wright did. The table has been found upon examination to be very correct. The degree is divided into 1000 parts.

With the latitude left, course steered, and difference of longitude made good, Bond found the latitude of ship, by projection on the chart, by the sector, or by the following rule:—

$$\frac{\text{tan of course} \times \text{proportional diff. of lat.}}{\text{radiu}} = \text{diff. long.}$$

And conversely, suppose latitude left 50°, course 33° 45′, difference of longitude $5\frac{1}{2}° = 330'$; then

$$\frac{\text{cot } 30° \; 45' \times 330'}{\text{radius}} = 493{\cdot}5, \text{ prop. diff. lat.},$$

which, added to the meridional parts corresponding to 50°, will give the number opposite 55°, and 55° is the latitude. Various problems in sailing according to Mercator are solved arithmetically upon the tangents, without the table of meridional parts, which may also be done geometrically upon the tangent line of the cross-staff. The following important proposition is in Bond's own words:—"First we must know that the logarithmic tangents from 45° upwards do increase in the same manner as the secants added together do, if we account every half degree above 45° to be a whole degree of Mercator's meridional line; and so the table of logarithmic tangents is a table of meridional parts to every two minutes of the meridian line, leaving out the radius."

The way of using this proposition is as follows. The table begins at 45°, and every 30 minutes is reckoned a whole degree; therefore, when both latitudes are given, take the half of each increased by 45°, subtract the tangent of the lesser sum from that of the greater, and divide the remainder by the tangent of 45° 30′ (radius omitted); the quotient will be the equal, or equinoctial, degrees contained between the two latitudes. Or multiply the aforesaid remainder by ten and divide by half the tangent of 45° 30′, and the quotient will be equal to the equinoctial leagues contained between the two latitudes. The logarithmic tangents are here treated as natural numbers, and the division done by logarithms. Bond lays no stress on the above solution as being new; it is merely used in lieu of a table of meridional parts.

The subsequent history of the problem of meridional parts may most conveniently be added here rather than in its chronological place. An important letter from Dr Wallis, professor of geometry at Oxford, is given with the *Phil. Trans.* for 1685, No. 176. The writer says that, the old inquiry about the sum or aggregate of secants having been of late renewed, he thought fit to trace it from its original, with such solutions as seemed proper to it. Archimedes and the ancients divided the curvilinear spaces as figs. 6 and 7. If they reckoned the first four it was too large; if the last four, too small. As the segments increased in number the error diminished. The degrees of longitude decrease as the cosine of the latitude (which is the semidiameter of such parallel) to the radius of the globe or equator. By the straight lines "each degree of longitude is increased above its due proportion, at such rate as the equator (or its radius) is greater than such parallel (or the radius thereof)." The old sea charts represented the degrees of latitude and longitude all equal. "Hereby, among other inconveniences (as Mr Edward Wright observed in 1599), the representation of places remote from the equator were distorted." Wright advised that the degrees of latitude should be protracted in like proportion with those of longitude, "that is, everywhere in such proportion as is the respective secant of such latitude to the radius" (see Wright's explanation of this part, and fig. 5). Fig. 8 represents one quarter of the globe, the surface of which is opened out till the parallel LA becomes a straight line as *la*, and each of the four meridians reaches P, P, P, P. The equator is represented by EE; so that the position of each parallel on the chart should b at such distance from the equator "as are all the secants (taken at equal distances in the arc) to so many times the radius, . . . which is equivalent to a projection of the spherical surface on the concave surface of a cylinder, erected at right angles to the plane of the equator," while each division of the meridian is equal to the secant of the latitude answering to such part, as fig. 9. This projection, if expanded into a plane, will be the same as a plane figure whose base is equal to a quadrantal arc extended (or a portion thereof), on which (as ordinates) are erected perpendiculars equal to the secants, answering to the respective points of the arc extended, as fig. 10. The first answers to the equator, the last to the pole infinite. "For finding this distance answering to each degree and minute of latitude, Mr Wright added all the secants from the beginning to the position required. The sum of all except the greatest (answering to the figure inscribed) is too little. The sum of all except the least (answering to the circumscribed) is too great—which latter Mr Wright followed. It will be nearer the truth than either if we take the intermediate spaces; instead of minutes, take ½, 1½, 2½, &c., or the double of these, 1, 3, 5, 7, &c., which yet, because on the convex side of the curve, would be rather too little. Either of these ways will be exact enough for a chart. If we would be more exact, Mr Oughtred directs, as did Mr Wright before him, to divide the arc into parts yet smaller than minutes, and calculate secants thereto." Wallis continued the subject and the doctrine of infinite

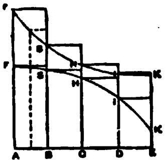

Fig. 6.

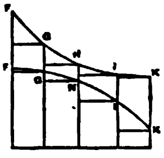

Fig. 7.

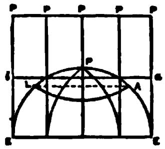

Fig. 8.

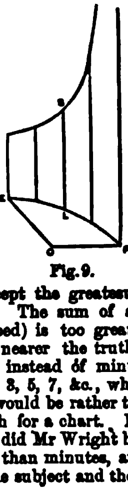

Fig. 9.

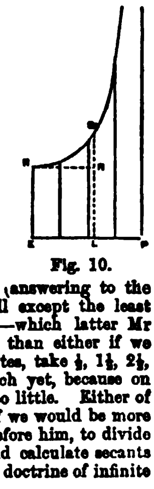

Fig. 10.

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[1] The works of Wright passed through at least ten editions; the last which the writer has seen was edited by Moxon in 1657.

[2] W. Snellius, professor of mathematics at Leyden, published in 1624 a treatise on navigation, after Wright's plan. He mentions the name of Wright with others in the introduction, but, as he did not say what part he took from each, the division of the meridional line to minutes up to 70° was attributed to him, though Wright had done it up to 89° 59′ and published it in 1610. Justice was done to Wright's memory in the *Mémoires* of the Academy of Sciences, Paris, 1753, p. 275.

series; but more than sufficient has been quoted for the purposes of navigation. At the end he adds that the same may be obtained in like manner by taking the versed sines in arithmetical proportion.

The next writer who made his mark upon this problem was Dr E. Halley (*Phil. Trans.*, No. 219, 1695). He states that the tangential proportion between the latitude and the divisions of the meridional line was discovered by chance, and first published by H. Bond, in Norwood's *Epitome of Navigation.* James Gregory furnished a demonstration in 1668; but it was long and tedious. Halley claimed for himself the honour of being the first to give a rule whereby the meridional parts between any two latitudes may be calculated at once by the relation of the logarithmic tangents; but it is practically the same as that published by Bond. Halley said that Wright's table nowhere exceeded the truth by half a mile. Sir Jonas Moore's system, he said, was nearer the truth, but the difference is not appreciable till beyond navigable waters.

A rather curious paper was read before the Royal Society, June 4, 1666, by Nicholas Mercator upon the meridional line; he proposes to divide it into the hundred-thousandth part of a minute. Roger Cotes wrote upon the same subject an exhaustive paper in Latin, called "Logometria," *Phil. Trans.*, No. 388, 1714. He gives an illustrative figure in which the rhumb line crosses the meridians at an angle of 45°. His demonstrations by the ratios arrive at similar conclusions to those clearly expressed by Halley.

All these rules assume the earth to be truly spherical, instead of spheroidal. For the history of inquiry into the exact figure of the earth, see EARTH. It may be mentioned that a pamphlet on this subject by Murdoch, published in 1741, in which meridional parts are adapted to a (very exaggerated) spheroid, shows that plane charts and the roughly-divided Mercator's charts were still used at that date. Plane charts, indeed, are explained even later, as in Robertson's *Navigation*, 1755.

The power of taking observations correctly, either at sea or on shore, was greatly assisted by the invention which bears the name of Pierre Vernier, which was published in Brussels in 1631 (see VERNIER). As Vernier's quadrant was divided into half degrees only, the sector, as he called it, spread over 14½ degrees, and that space carried thirty equal divisions, numbered from 0 to 30. As each division of the sector contained 29 minutes of the arc, the vernier could be read to minutes. The verniers now commonly adapted to sextants can be read to 10 seconds. Shortly after the invention it was recommended by Bouguer and Jorge Juan, who describe it in a treatise entitled *La Construction, &c., du quadrant nouveau.* About this period Gascoigne applied the telescope to the quadrant (see MICROMETER); and Hevelius invented the tangent screw, to give slow and steady motion when near the desired position. In 1635 Henry Gellibrand published his discovery of the change in variation of the needle, which was effected by his comparing the results of his own observations with those of Burrough and Gunter. The latter was his predecessor at Gresham College.

In 1637 Richard Norwood, a sailor, and reader in mathematics, published an account of his most laudable exertions to remove one of the greatest stumbling-blocks in the way of correct navigation, that of not knowing the actual size of a degree or nautical mile, in a pamphlet styled *The Seaman's Practice.* Norwood ascertained the latitude of a position near the Tower of London in June 1633, and of a place in the centre of York in June 1635, with a sextant of more than 5 feet radius, and, having carefully corrected the declination, refraction, and parallax, made the difference 2° 28′. He then measured the distance with a chain, taking horizontal angles of all windings, and he made a special table for correcting elevations and depressions. A few places which he was unable to measure he paced. His conclusion was that a degree contained 367,176 English feet; this gives 2040 yards to a nautical mile,—only about 12 yards too much. Norwood's works went through numerous editions, and retained their popularity over a hundred years; the last which the writer has seen—a good book for the time, free from nonsense—is dated 1732. In it he says that, as there is no means of discovering the longitude, a seaman must trust to his reckoning. He recommends the knots on the log-line to be placed 51 feet apart, as the just proportion to a mile when used with the half-minute glass.

Dr Hooke read a paper at the Royal Society, in 1666, upon deep-sea sounding by means of a weight which became detached on striking the bottom, and allowed a float to ascend to the surface, while the time was carefully noted—basing his calculations upon performances in known depths. He was on the verge of a great success; he required Sir W. Thomson's piano-wire instead of the float.

In the same year a paper was read by Dr Wallis (who had previously published a discourse on tides) showing that the modern theory was not then generally accepted. This was followed by a paper by Sir Robert Moray, who recommended frequent and extended observations, and proposed to form a table which embraced every circumstance that would appear to be desirable even at the present day. Sir Robert also spoke of the irregularities in the tides past the western islands of Scotland. In *Phil. Trans.*, 1683, vol. xiii. No. 143, there is an account of Flamsteed's tide table for London Bridge, which gave each high tide every day in the year. He justly condemns the old almanacs for deriving the moon's age from the epact, and then allowing forty-eight minutes for every day. Brooker was the first to amend this reckoning, but in a rough manner. Henry Philips, well known by his works on navigation, was the first to bring the inequality to a rule, which was found more conformable to experience than was expected; but Flamsteed made corrections on his rule.

The necessity for having correct charts was equalled by the pressing need of obtaining the longitude by some simple and correct means available to seamen; and we have seen how many plans had already been thought of for this purpose. At one time it was hoped that the longitude might be directly discovered by the variation of the compass; in 1674 Charles II. actually appointed a commission to investigate the pretensions of a scheme of this sort devised by Bond,[1] and the same idea appears as late as 1777 in S. Dunn's *Epitome.* But the only real way of ascertaining the longitude is by knowing the difference of time at two meridians; and till the invention and perfecting of chronometers this could only be done by finding at two places the apparent time of the same celestial phenomenon. The most obvious phenomena to select were the motions of the moon among the sun and stars, which as we have seen were suggested as a means of finding the longitude by Werner in 1514, and continued to receive attention from later writers. But to make this idea practical it was necessary on the one hand to have better instruments for observation, and on the other to have such a theory of the moon's motions as should enable its place to be predicted with accuracy, and recorded beforehand in an almanac. The very principles of such a theory were unknown before Newton's great discovery, when the lunar problem begins to have a chief place in the history of navigation; the places of stars were derived from various and widely discrepant sources; and almanacs gave little useful information beyond the declination of the sun, the age of the moon, and the time of high water.[2] Another class of phenomena whose comparative frequency recommended them for longitude observations, viz., the occultations of Jupiter's satellites, became known through Galileo's discovery of these bodies (1610). Tables for these were published by Dominic Cassini at Bologna in 1668, and were repeated in a more correct form at Paris in 1693 by his son, who was followed by Pound, Bradley, Wargentin, and many other astronomers. But this method, though useful on land, is not suited to mariners; when Whiston, for example, in 1737 recommended that the satellites should be observed by a reflecting telescope, he did not sufficiently consider the difficulty of using a telescope at sea, or the infrequency of the occultations, and it is the lunar problem which will chiefly concern us in what follows.

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[1] Bond published in 1676 a quarto volume entitled *The Longitude Found.*

[2] Wharton's *Angelus Britannicus*, 1662–1715, is a fair specimen of the almanacs of the period.

The study of this problem was stimulated by the reward of 1000 crowns offered by Philip III. of Spain in 1598; the states-general followed with an offer of 10,000 florins. But for a long time nothing practical came of this; a proposal by J. Morin, submitted to Richelieu in 1633, was pronounced by commissioners appointed to judge of it to be incomplete through the imperfection of the lunar tables, and in like manner when the question was raised in England in 1674 by a proposal of St Piere to find the longitude by using the altitudes of the moon and two stars to find the time each was from the meridian, and when the king was pressed by St Piere, Sir J. Moore, and Sir C. Wren to establish an observatory for the benefit of navigation, and especially that the moon's exact position might be calculated a year in advance, Flamsteed gave his judgment that the lunar tables then in use were quite useless, and the positions of the stars erroneous. The result was that the king decided upon establishing an observatory in Greenwich Park, and Flamsteed was appointed astronomical observer on March 4, 1675, upon a salary of £100 a year, for which also he was to instruct two boys from Christ's Hospital. While the small building in the Park was in course of erection he resided in the Queen's House (now the central part of the Greenwich Hospital school), and removed to the house on the hill, July 10, 1676, which came to be known as "Flamsteed House." The institution was placed under the surveyor-general of ordnance,—perhaps because that office was then held by Sir Jonas Moore, himself an eminent mathematician. Though this was not the first observatory in Europe, it was destined to become the most useful, and has fulfilled the important duties for which it was established. It was established to meet the exigencies of navigation, as was clearly stated on the appointment of Flamsteed, and on several subsequent occasions; and we see now what an excellent foster-mother it has been to the higher branches of that science. This has been accomplished by much labour and patience; for, though the most suitable man in the kingdom was placed in charge, it was so starved and neglected that it was almost useless during many years. The Government did not provide a single instrument. Flamsteed entered upon his important duties with an iron sextant of 7 feet radius, a quadrant of 3 feet radius, two telescopes, and two clocks, the last given by Sir Jonas Moore. Tycho Brahe's catalogue of about a thousand stars was his only guide. In 1681 he fitted a mural arc which proved a failure. Seven years after another mural arc was erected at a cost of £120, with which he set to work in earnest to verify the latitude, and to determine the equinoctial point, the obliquity of the ecliptic, the right ascension and declination of the stars, till he numbered two or three thousand which appeared in the "British catalogue." See FLAMSTEED and ASTRONOMY.

Flamsteed died in 1720, and was succeeded by Halley, who paid particular attention to the motions of the moon with a view to the longitude problem. A paper which he published in the *Phil. Trans.*, 1731, No. 421, shows what had been accomplished up to that date, and proves that it was still impossible to find the longitude correctly by the moon.[1] He repeats what he had published twenty years before in an appendix to Street's Caroline tables, which contained observations made by him (Halley) in 1683–84 for ascertaining the moon's motion, which he thought to be the only practical method of "attaining" the longitude at sea. He found that it only needed a little patience to be able to manage a 5 or 6 foot telescope, capable of showing the occultations of the fixed stars by the moon, on shipboard in moderately fine weather (ships must have been very steady in his days). The Caroline tables of Street, though better than those before him, as well as those of Tycho, Kepler, Bullialdus, and Horrox, were uncertain; sometimes the equations would compensate one another; at other times when they fell the same way the result might be 100 leagues in error. He hopes that the tables will be so amended that an error may scarce ever exceed 3 minutes of motion (equal to 1¼° of longitude). Sir Isaac Newton's tables, corrected by himself (Halley) and others up to 1713, would admit of errors of 5 minutes, when the moon was in the third and fourth quarters. He blames Flamsteed for neglecting that portion of the work, as he was at the observatory more than two periods of eighteen years. He himself had at this time seen the whole period of the moon's apogee—less than nine years—during which period he observed the right ascension of the moon at her transit, with great exactness, almost fifteen hundred times, or as often as Tycho Brahe, Hevelius, and Flamsteed together. He hoped during 1731 and a few future years to compute the moon's position within 2 minutes of motion with certainty, which will be equal to 20 leagues at the equator and 15 in the Channel; and Hadley's quadrant might be applied to taking distances at sea with the desired accuracy.[2]

The last remark calls us to consider this great improvement in the instrumental means for taking observations at sea. Up to this time all instruments either depended on a plumb line or required the observer to look in two directions at once.

Their imperfections are clearly pointed out in a paper by Pierre Bouguer (1729) which received the prize of the Paris Academy of Sciences for the best method of taking the altitude of stars at sea. Bouguer himself proposes a modification of what he calls the English quadrant, probably the one proposed by Wright and improved by Davis. Fig. 11 represents the instrument as proposed, capable of measuring fully 90° from E to N. A fixed pinule was recommended to be placed at E, through which a ray from the sun would pass to the sight O. The sight F was movable. The observer, standing with his back to the sun,

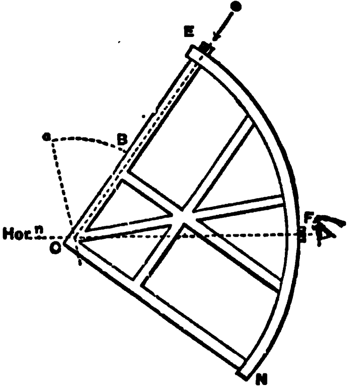

Fig. 11.

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[1] This did not prevent many attempts being made. Thus John Herne's *Longitude Unvailed*, 1678, proposes to find the moon's meridian passage at sea by equal altitudes with the cross-staff, and then compare apparent time at ship with London time. In 1717 Henry Kindon proposed both the magnet and meridional lunar distances; Robert Browne attempted to calculate lunar tables, which he submitted to the board of longitude; while Francis Bodkin proposed the use of telescopes upon the planets and their satellites. The proposals submitted to the board of longitude to find the longitude by the moon's meridian passage are too numerous to be mentioned.

[2] Halley's observations were published posthumously in 1742, and in 1765 the commissioners of longitude paid his daughter £100 for MS. supposed to be useful to navigation.

would look through F and C at the horizon, shifting the former up or down till the ray from the sun coincided with the horizon. The space from E to F would represent the altitude, and the remaining part F to N the zenith distance. The English quadrant which this was to supersede differed in having about half the arc from E towards N, and, instead of the pinule being fixed at E, it was on a smaller arc represented by the dotted line *e*B, and movable. It was placed on an even number of degrees, considerably less than the altitude; the remainder was measured on the larger arc, as described.[1]

Hadley's instrument, on the other hand, described to the Royal Society in May 1731 (*Phil. Trans.*, Nos. 420 and 421), embodies Newton's idea of bringing the reflexion of one object to coincide with the other. He calls it an octant, as the arc is actually 45°, or the eighth part of a circle; but, in consequence of the angles of incidence and reflexion both being changed by a movement of the index, it measures an angle of 90°, and is graduated accordingly; the same instrument has therefore been called a quadrant. It was very slowly adopted, and no doubt there were numerous mechanical difficulties of centring, graduating, &c., to be overcome before it reached perfection.[2] In August 1732, in pursuance of an order from the Admiralty, observations were made with Hadley's quadrant on board the "Chatham" yacht of 60 tons, below Sheerness, in rough weather, by persons—except the master attendant—unaccustomed to the motion; still the results were very satisfactory. Two years later Hadley published (*Phil. Trans.*, 1733) the description of an instrument for taking altitudes when the horizon is not visible. The sketch represents a curved tube or spirit-level, attached to the radius of the quadrant.

From the year 1714 the history of navigation in England is closely associated with that of the "commissioners for the discovery of longitude at sea," a body constituted by Act 13 Anne c. 14 (commonly called 12 Anne c. 15), with power to grant sums not exceeding £2000 to assist experiments and reward minor discoveries, and also to judge on applications for much greater rewards which were offered to open competition. For a method of determining the longitude within 60 geographical miles, to be tested by a voyage to the West Indies and back, the sum of £10,000 was offered; within 40 miles, £15,000; within 30, £20,000. £10,000 was also to be given for a method that came within 80 miles near the shores of greatest danger. No action seems to have been taken before 1737; the first grant made was in that year, and the last in 1815, but the board continued to exist till 1828, having disbursed in the course of its existence £101,000 in all.[3] In the interval a number of other Acts had been passed either dealing with the powers, constitution, and funds of the commissioners or encouraging nautical discovery; thus the Act 18 George II. (1745) offered £20,000 for the discovery by a British ship of the North-West Passage, and the Act 16 George III. (1776) offered the same reward for a passage to the Pacific either north-west or north-east, and £5000 to any one who should approach by sea within one degree of the North Pole. All these Acts were swept away in 1828, when the longitude problem had ceased to attract competitors, and voyages of discovery were nearly over. The suggestions and applications sent in to the commissioners were naturally very numerous and often very trifling; but they sometimes furnish useful illustrations of the state of navigation. Thus, in a memorial by Captain H. Lanoue (1736), which seems to be designed to commend a substitute for the log (a box with something, not fully explained, let into the sea), he records a number of recent casualties, which shows how carelessly the largest ships were then navigated. Several men-of-war off Plymouth in 1691 were wrecked through mistaking the Deadman for Berry Head. Admiral Wheeler's squadron in 1694, leaving the Mediterranean, ran on Gibraltar when they thought they had passed the Strait. Sir Cloudesley Shovel's squadron, in 1707, was lost on the rocks off Scilly, by erring in their latitude. Several transports, in 1711, were lost near the river St Lawrence, having erred 15 leagues in the reckoning during twenty-four hours. Lord Belhaven was lost on the Lizard in 1722, the same day on which he sailed from Plymouth.

One of the first points to which the attention of the commissioners was directed was the survey of the coasts of Great Britain, which was pressed on them by Whiston in 1737. He was appointed surveyor of coasts and headlands, and in 1741 received a grant for instruments. An Act passed in 1740 enabled the commissioners to spend money on the survey of the coasts of Great Britain and the "plantations." At a later date they bore part of the expenses of Cook's scientific voyages, and of the publication of their results. Indeed it is to them that we owe all that was done by England for surveys of coasts, both at home and abroad, prior to the establishment of the hydrographic department of the Admiralty in 1795. But their chief work lay in the encouragement they gave on the one hand to the improvement of timepieces, and on the other to the perfecting of astronomical tables and methods, the latter issuing in the publication of the *Nautical Almanac*. Before we pass on to these two important topics we may with advantage take a view of the state of practical navigation in the middle of last century as shown in two of the principal treatises then current.

Robertson's *Elements of Navigation* passed through six editions between 1755 and 1796. It contains good teaching on arithmetic, geometry, spherics, astronomy, geography, winds and tides, also a small useful table for correcting the middle time between the equal altitudes of the sun,—all good, as is also the remark that "the greater the moon's meridian altitude the greater the tides will be." He states that Lacaille recommends equal altitudes being observed and worked separately, in order to find the time from noon, and the mean of the results taken as the truth. There is a sound article on chronology, the ancient and modern modes of reckoning time. A long list of latitudes, longitudes, and times of high water finishes vol. i. The second volume is said by the author to treat of navigation mechanical and theoretical; by the former he means seamanship. He gives instructions for all imaginary kinds of sailings, for marine surveying and making Mercator's chart. There are two good traverse tables, one to quarter points, the other to every 15 minutes of the arc; the distance to each is 120 miles. There is a table of meridional parts to minutes, which is more minute than customary. Book ix., upon what is now called "the day's work," or dead-reckoning, appears to embrace all that is necessary. A great many methods, we are told, were then used for measuring a ship's rate of sailing, but among the English the log and line with a half-minute glass were generally used. Bouguer and Lacaille proposed a log with a diver to avoid the drift motion (1753 and 1760). Robertson's rule of computing the equation of equal altitudes is as good as any used at the present day. He gives also a description of an equal-altitude instrument, having three horizontal wires, probably such a one as was used at Portsmouth for testing Harrison's timekeeper. The mechanical difficulties must have been great in preserving a perpendicular stem and a truly horizontal sweep for the telescope. It gave place to the improved sextant and artificial horizon. The second edition of Robertson's work in 1764 contains an excellent dissertation on the rise and progress of modern navigation by Dr James Wilson, which has been greatly used by all subsequent writers.

Don Jorge Juan's *Compendio de Navegacion*, for the use of midshipmen, was published at Cadiz in 1757. Chapter i. explains what pilotage is, practical and theoretical. He speaks of the change of variation, "which sailors have not believed and do not believe now." He described the lead, log, and sand-glass, the latter corrected by a pendulum, charts plane and spherical. Supposing his readers to be versed in trigonometry, he will explain what latitude and longitude are, and show a method for finding the latter different from what has been taught. He will show the error of middle latitude sailing, and show that the longitude found by it is always less than the truth. (It is strange that while reckoning was so rough and imperfect in many respects they should strain at such a trifle as that is in low latitudes.) He promised to find the difference of longitude without a departure (a similar rule to that of Bond). After speaking of meridional parts, he offered to explain the English method, which was discovered by Edmund Halley, but omits the principles upon which Halley founded his theory, as it was too embarrassing. (He was not the first.) He gives instructions for currents and leeway, tables of declination, a few stars, meridional parts, &c. It is worthy of remark that, after giving a form for a log-book, he added that this had not been previously kept by any one, but he thought it should not be trusted to memory. He only required the knots, fathoms, course, wind, and leeway to be marked every two hours. Every hour is quite long enough, and that is often divided now. He gave a sketch of Hadley's quadrant, in shape like those in use fifty years back, but without a clamping screw or tangent screw. Back glasses were much valued in those days,—the force of habit, no doubt. The book is quite free from all extraneous rubbish.

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[1] In 1731 M. Bouguer was awarded another prize by the Royal Academy of Sciences for his method of finding the variation of the compass at sea.

[2] Davis's quadrant was in common use till 1740; it is described in Robertson's *Navigation* (1755), and improvements on it are proposed in *Phil. Trans.*, 1731 and 1734.

[3] This total comprises the large sums awarded to Harrison and to the widow of Mayer, the cost of surveys and expeditions in various parts of the globe, large outlays on the *Nautical Almanac* and on subsidiary calculations and tables, rewards for new methods and solutions of problems, and many minor grants to watchmakers or for improvements in instruments. Thus Ramsden received in 1775 and later about £1600 for his improvements in graduation, and Massey in 1804 got £200 for his log (see Log). A good deal of money was wasted, and large sums were paid to certain commissioners for attendance.

The introduction of timekeepers by which Greenwich time can be carried to any part of the world, and the longitude found with ease, simplicity, and certainty, is due to the invention of John Harrison. The idea of keeping time at sea was no novelty. HUYGENS (*q.v.*) made pendulum watches for the purpose prior to 1665, at which date Major Holmes communicated to the Royal Society (*Phil. Trans.*, i. 13) the fact of his having tried two of them on the coast of Guinea. He sailed from St Thomas, set his watches, sailed west 700 or 800 leagues, without changing course, then steered towards the coast of Africa N.N.E. 200 or 300 leagues. The masters of the other ships under his charge, fearing the want of water, wished to steer for Barbados. Holmes, on comparing the calculations, found them to differ from him from 80 to over 100 leagues. He considered that they were only 30 leagues from the Cape Verd Islands, where they arrived next afternoon. The vague manner of estimating distance is worth notice. William Derham published a scientific description of various kinds of timekeepers in *The Artificial Clock-Maker*, in 1700, with a table of equations from Flamsteed to facilitate comparison with the sun-dial. In 1714 Henry Sully, an Englishman, published a treatise at Vienna, on finding time artificially. He went to France, and spent the rest of his life in trying to make a timekeeper for the discovery of the longitude at sea. In 1716 he presented a watch of his own make to the Academy of Sciences, which was approved; and ten years later he went to Bordeaux to try his marine watches, and died before embarking. Julien le Roy was his scholar, and perfected many of his inventions in watchmaking.

Harrison's great invention was the principle of compensation through the unequal contraction of two metals, which he first applied in the invention of the compensation pendulum, still in use, and then modified so as to fit it to a watch, devising at the same time a means by which the watch retains its motion while being wound up. To what has been said in the article HARRISON on his successive attempts, and the success of the trial journey to Jamaica in 1761–62, it may be added that by the journal of the House of Commons we find that the error of the watch (as if there were only one) was ascertained by equal altitudes at Portsmouth and Barbados, the calculations being made by Short. The watch came greatly within the limits of the Act. At Jamaica it was only in error five seconds (assuming that the longitude previously found by the transit of Mercury could be so closely depended on, which as we now know, was not the case; the observations were too few in number, and taken with an untrustworthy instrument). Short found the whole error from November 6, 1761, till April 2, 1762, to be $1^{m}\ 54^{s}{\cdot}5 = 18$ geographical miles in the latitude of Portsmouth. He considered that a position determined by a transit of Mercury was liable to an error of 30^{s} only, and by Jupiter's best satellite to $3^{m}\ 44^{s}$. During the passage home in the "Merlin" sloop-of-war the timekeeper was placed in the after part of the ship, because it was the dryest place, and there it received violent shocks which retarded its motion. It lost on the voyage home $1^{m}\ 49^{s} = 16$ geographical miles.

One might have supposed that Harrison had now secured the prize; but there were powerful competitors who hoped to gain it by lunars, and a bill was passed through the House in 1763 which left an open chance for a lunarian during four years. A second West Indies trial of the watch took place between November 1763 and March 1764, in a voyage to Barbados, which occupied four months; during which time it is said, in the preamble to Act 5 Geo. III. 1765, not to have erred 10 geographical miles in longitude. We only find in the public records the equal altitudes taken at Portsmouth and at Bridgetown, Barbados. William Harrison assumed an average rate of 1^{s} a-day gaining, as he anticipated that it would go slower by 1^{s} for every 10° increase in temperature. The longitude of Bridgetown was determined by Maskelyne and Green by nine emersions of Jupiter's first satellite, against five of Bradley's and two at Greenwich Observatory, to be $3^{h}\ 54^{m}\ 20^{s}$ west of Greenwich. In February 1765 the commissioners of longitude expressed an opinion that the trial was satisfactory, but required the principles to be disclosed and other watches made. Half the great reward was paid to Harrison under Act of Parliament in this year, and he and his son gave full descriptions and drawings, upon oath, to seven persons appointed by the commissioners of longitude.[1] The other half of the great reward was promised to Harrison when he had made other timekeepers to the satisfaction of the commissioners, and provided he gave up everything to them within six months. The second half was not paid till 1773, after trials had been made with five watches. These trials were partly made at Greenwich by Maskelyne, who, as we shall see, was a great advocate of lunars, and was not ready to admit more than a subsidiary value to the watch. A bitter controversy arose, and Harrison in 1767 published a book in which he charges Maskelyne with exposing his watch to unfair treatment. The feud between the astronomer-royal and the watchmakers continued long after this date.

Even after Harrison had received his £20,000, doubts were felt as to the certainty of his achievement, and fresh rewards were offered in 1774 both for timekeepers and for improved lunar tables or other methods. But the tests proposed for timekeepers were very discouraging, and the watchmakers complained that this was due to Maskelyne. A fierce attack on the astronomer's treatment of himself and other watchmakers was made by Mudge in 1792, in *A Narrative of Facts*, addressed to the first lord of the Admiralty, and Maskelyne's reply does not convey the conviction that full justice was done to timekeepers. Maskelyne at this date still says that he would prefer an eclipse of a bright star by the moon and a number of correspondent observations by transits of the moon compared with those of fixed stars, made by two astronomers at remote places, to any timekeeper. The details of these controversies, and of subsequent improvements in timekeepers, need not detain us here. In England the names of Arnold and Earnshaw are prominent, each of whom received, up to 1805, £3000 reward from the commissioners of longitude. It was Arnold who introduced the name chronometer.[1] The French emulated the English efforts for the production of good timekeepers, and favourable trials were made between 1768 and 1772 with watches by Le Roy and Berthoud.

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[1] The explanations and drawings are now at the British Museum; and two of his watches, one of which was used by Captain Cook in the "Resolution," are at Greenwich Observatory. In 1767 Harrison estimates that a watch could be made for £100, and ultimately for £70 or £80.

Meantime the steady progress of astronomy both by the multiplication and increased accuracy of observations, and by corresponding advances in the theory, had made it possible to construct greatly improved tables. In observations of the moon Greenwich still took the lead; and it was here that Halley's successor Bradley made his two grand discoveries of aberration and nutation which have added so much to the precision of modern astronomy. Kepler's Rudolphine tables of 1627 and Street's tables of 1661, which had held their ground for almost a century, were rendered obsolete by the observations of Halley and his successor. At length, in 1753, in the second volume of the *Commentarii* of the Academy of Göttingen, Tobias Mayer printed his new solar and lunar tables, which were to have so great an influence on the history of navigation. Mayer afterwards constructed and submitted to the English Government in 1755 an improved body of MS. tables. Bradley found that the moon's place by these tables was generally correct within 1′, so that the error in a longitude found by them would not be much more than half a degree if the necessary observations could be taken accurately on shipboard. Thus the lunar problem seemed to have at length become a practical one for mariners, and in England it was taken up with great energy by N. Maskelyne—"the father," as he has been called, "of lunar observations."

In 1761 Maskelyne was sent to St Helena to observe the transit of Venus. On his voyage out and home he used Mayer's printed tables for lunar determinations of the longitude, and from St Helena he wrote a letter to the Royal Society (*Phil. Trans.*, vol. lii. p. 558, 1762), in which he described his observations made with Hadley's quadrant of 20 inches radius, made by Bird, and the glasses ground by Dollond. He took the observations both ways to avoid the errors. The arc and index were of brass, the frame mahogany; the vernier was subdivided to minutes. The telescope was 6 inches long, magnified four times, and inverted. Very few seamen in that day possessed so good an instrument. He considered that ship's time should be ascertained within twelve hours, as a good common watch will scarcely vary above a minute in that time. This shows that he must have intended the altitude of sun or star to be calculated—which would lead to new errors. He considered that his observations would each give the longitude within 1½ degrees. On February 11th he took ten; the extremes were a little over one degree apart.

On his return to England Maskelyne prepared the *British Mariner's Guide* (1763), in which he undertakes to furnish complete and easy instructions for finding the longitude at sea or on shore, within a degree, by observing the distance between the moon and sun, or a star, by Hadley's quadrant. How far that promise was fulfilled, and the practicability of the instructions, are points worth consideration, as the book took a prominent place for some years. The errors which he said were inseparable from the dead-reckoning "even in the hands of the ablest and most skilful navigators," amounting at times to 15 degrees, appear to be overestimated. On the other hand, the lunar equations, which were from Mayer's tables, would, he believed, always determine the longitude within a degree, and generally to half a degree, if applied to careful observations. He recommends the two altitudes and distance being taken simultaneously when practicable. The probable error in a meridian altitude he estimated at one or two minutes, and in a lunar distance two minutes (equal to one degree of longitude). He then gave clear rules for finding the moon's position and distance by ten equations, too laborious for seamen to undertake. Admitting the requisite calculations for finding the moon's place to be difficult, he desired to see the moon's longitude and latitude computed for every twelve hours, and hence her distance from the sun and from a proper star on each side of her carefully calculated for every six hours, and published beforehand.

In 1765 Maskelyne became astronomer-royal, and was able to give effect to his own suggestion by organizing the publication of the *Nautical Almanac*. The same Act of 1765 which gave Harrison his first £10,000 gave the commissioners authority and funds for this undertaking. Mayer's tables, with his MS. improvements up to his death in 1762, were bought from his widow for £3000; £300 was granted to the famous mathematician Euler, on whose theory of the moon Mayer's later tables were formed; and the first *Almanac*, that for 1767, was published in the previous year, at the cost and under the authority of the commissioners of longitude. This was not the first almanac in the country, perhaps by a hundred, as that name was applied to small periodical works, frequently of a frivolous character,—though the later and better description gave the sun's declination and moon's meridional passage approximately. In 1696 the French nautical almanac for the following year appeared, an improvement on what had been before issued by private persons, but it did not attempt to give lunar distances.[2] In the English *Nautical Almanac* for 1767 we find everything necessary to render it worthy of confidence, and to satisfy every requirement at sea. The great achievement was that of giving the distance from the moon's centre to the sun, when suitable, and to about seven fixed stars, every three hours. The mariner has only to find the apparent time at ship, and clear his own measured distance from the effects of parallax and refraction (for which at the end of the book are given Lyon's and Dunthorn's methods), and then by simple proportion, or proportional logarithms, find the time at Greenwich. The calculations respecting the sun and moon were made from Mayer's last manuscript tables under the inspection of Maskelyne, and were so continued till 1804.[3] The calculations respecting the planets are from Halley's tables, and those of Jupiter's satellites from tables made by Wargentin and published by Lalande in 1759, except the fourth satellite. It will be seen by the following outline of contents that the first *Almanac* contained all the principal points of information which the seaman required; and greater accuracy at that time was not desirable, or at least would not have been appreciated.

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[1] A letter by Dalrymple in *The Times* (February 13, 1806) gives some interesting details showing how slowly chronometers came into general use.

[2] The French nautical almanac is still published under the title of *Connaissance des Temps*. It appeared under letters patent from the king, dated 24th March 1679—seventeen years before the first issue. The following is a literal translation of its advertisement:—"This little book is a collection of holy days and festivals in each month. The rising and setting of the moon when it is visible, and of the sun every day. The aspects of the planets as with respect to each other, the moon, and the fixed stars. The lunations and eclipses. The difference of longitude between the meridian of Paris and the principal towns in France. The time of the sun's entrance into the twelve signs of the zodiac. The true place of the planets every fifth day, and of the moon every day of the year, in longitude and latitude. The moon's meridian passage, for finding the time of high water, 'as well as for the use of dials by moonlight.' A table of refraction. The equation of time [this table is strangely arranged, as though the clock were to be reset on the first of every month, and the explanation speaks of the 'premier mobile']. The time of twilight at Paris. The sun's right ascension to hours and minutes. The sun's declination at noon each day to seconds. The whole accompanied by necessary instructions."

[3] Mayer's tables were printed at London under Maskelyne's superintendence in 1770.

Page 1 of each month gave the Sundays and holidays, four phases of the moon, and positions of sun, moon, and planets in the signs of the zodiac; page 2, sun's longitude, right ascension in time, declination, and equation for noon each day; page 3, sun's semidiameter, time of passing the meridian, hourly motion of the sun, logarithm of sun's distance, and place of the moon's node, for every sixth day; also eclipses of Jupiter's satellites, time of immersion; page 4, the positions of the four principal planets for every sixth day; page 5, the configuration of Jupiter's satellites at 11 P.M. of every day; page 6, the moon's longitude and latitude for noon and midnight of every day; page 7, the moon's age, passage over the meridian, right ascension, and declination at noon and midnight; page 8, the moon's semidiameter, horizontal parallax, and logistic logarithm—each at noon and midnight; pages 9 to 12, the moon's centre from the sun and seven stars for every three hours, while within about 116 degrees. Then follow tables of refraction, moon's parallax in altitude, a catalogue of stars, with their right ascension and declination, table for the "dip" of the sea horizon, and several other useful things, many of which are omitted in modern *Nautical Almanacs*, as they are included in and more properly belong to the permanent rules and requirements of navigation.

Various useful rules and tables were appended to early volumes of the *Almanac*. Thus the volume for 1771 contains a method and table for determining the latitude by two altitudes and the elapsed time first published by Cornelius Downes of Amsterdam in 1740.[1] At the end of the *Almanac* for 1772 Maskelyne and Whichell gave three special tables for clearing the lunar distance; still their rule is neither short nor easily remembered. An improvement of Dunthorn's solution is also given, and a problem in Mercator's sailing by Halley solved by Israel Lyons,[2] viz., the latitude of the point of departure given, distance sailed, and change of longitude,—required the course steered. In the edition for 1778 a new table for equations of equal altitudes is given by W. Whale. In those for 1797 and 1800 tables are added by John Brinkley for rendering the calculations for double altitudes easier.

From 1777 to 1788 inclusive, the moon's place was calculated from improved tables by Charles Mason, founded on observations by Bradley, which were published in the *Nautical Almanac* for 1774. The difference then only amounted to 1″ in longitude, the apogee 56″, and the ascending node 45″. From 1789 to 1804 the tables were further corrected by Mason, and calculated to tenths of a second. The distances between the moon and the stars were still further corrected by the use of Taylor's logarithms to seconds, and their places by Bradley's observations in 1756 and Maskelyne's in 1809. The places of the planets at that time were from Lalande's *Astronomy* (the 3d edition was published in 1792), more recently from vol. iii. of Professor Vince's *Astronomy*. The places of the moon since the beginning of 1821 were calculated from Burckhardt's tables. They are now taken from Hansen's tables, completed with the aid of the English Government in 1857. The eclipses of Jupiter's satellites for 1824 and following years were from Delambre's new tables. In 1827 the positions of sixty of the principal stars were given for every tenth day, from the tables of Maskelyne and Dr Pearson. Since 1824 the work has been printed three and latterly four years in advance. The price was 5s. till 1855; but the *Almanacs* for that and subsequent years have been issued at 2s. 6d.

A book of *Tables Requisite to be Used with the Nautical Ephemeris* was published by Maskelyne at the same time as the first *Almanac*, and ten thousand copies were quickly sold. A second edition, prepared by W. Wales, appeared in 1781, an octavo of 237 pages, in the preface of which it is stated, with apparent truth, that it contains everything necessary for computing the latitude and longitude by observation. There are in all twenty-three tables, the traverse table and table of meridional parts alone being deficient as compared with modern works of the kind; dead-reckoning Maskelyne did not touch. He gave practical methods for working several problems; the lunar especially is an improvement on those by Lyons and Dunthorn, though a rule there given for clearing the distance, called Dunthorn's improved method, is remarkably short. The half sum of three logarithms gives an arc, and the half sum of other two gives half the true distance. The objection is the use of special logarithms. Maskelyne's rule for finding the latitudes by two altitudes and the elapsed time is also good, but with the same objection. The third edition of the *Tables* was issued in 1802. It has been said that Maskelyne neglected the planets; be that as it may, he established the positions of sixty of the principal stars, and completed many other things. He had but one assistant, whereas there are now eight, and the *Nautical Almanac* is under another department.

As the necessary calculations for clearing the lunar distance from the effects of parallax and refraction were considered difficult to seamen, many efforts were made to shorten the process. Among others Whichell, master of the Royal Naval Academy, Portsmouth, conceived a plan whereby it could be taken from a table by inspection. In October 1765 the commissioners of longitude awarded him £100 to enable him to complete and print 1000 copies of his table. On the following April they gave him £200 more. The work was continued on the same plan by Shepherd, the Plumian professor of astronomy, Cambridge, with some additions by the astronomer-royal. The total cost of the ponderous 4to volume up to the time of publication in June 1772 was £3100, after which £200 more was paid to the Rev. Thomas Parkinson and Israel Lyons for examining the errata. It is a very large and expensive volume,—very ill-adapted for ship's use. Considerable sums were paid by the commissioners from time to time for other tables to facilitate navigation—not always very judiciously. It is sufficient to mention here the tables of Michael Taylor and the still esteemed tables of Mendoza, published in 1815. Here also may be mentioned a useful table by Stevens (1780) for finding the latitude by the altitude of the pole star, and Crosswell's tables for facilitating the computation of lunars—partly new and partly after Maskelyne. These appear to be the first tables in which half the logarithmic sine, &c., is given, to save the trouble of halving a sum of four or more logarithms.

The plan of the *Nautical Almanac* was soon imitated by other nations. In France the Académie Royale de Marine had all the lunar distances translated from the British *Nautical Almanac* for 1773 and following years, retaining the Greenwich time for the three-hourly distances. The tables were considered excellent, and national pride was satisfied by their having been formed on the plan proposed by Lacaille. They did not imitate the mode given for clearing the distance, considering their own better.

Though the Spaniards were leaders in the art of navigation during the 16th and 17th centuries, it was not till November 4, 1791, that their first nautical almanac was printed at Madrid, having been previously calculated at Cadiz for the year 1792. They acknowledge borrowing from the English and French. The lunar distances were reduced from Greenwich meridian to that of Cadiz, by subtracting $25^m\ 9^s$. It is in larger and better print than the French almanac. In the book for 1803 the meridian of the royal observatory at Isla de Leon is placed $24^{m}\ 47^{s}{\cdot}5$ west of Greenwich. In the English almanac for 1883 it is given as $24^{m}\ 49^{s}{\cdot}6$; therefore they were very near the truth in 1791. The almanac for 1810, published at Madrid in 1807, was the first in which the lunar distances were reduced to the meridian of Isla de Leon—that is, giving the distance to the even hours 3, 6, 9, 12, &c. The Spanish almanacs for 1813 to 1816 were published in Fleet Street, the first-named only one year in advance. From 1820 to 1832 they were good octavos and clear type. Soon after that time they appeared in folio, giving nearly all the information found in the English almanac, but not neglecting the saints' days and festivals. The excellent Berlin *Astronomisches Jahrbuch* began to appear in 1776, the *American Ephemeris* in 1849. These two ephemerides and the French *Connaissance des Temps* are independent and valuable works, and for astronomers at least in some respects superior to the English *Almanac*.

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[1] This method, for which the author received £50 from the commissioners of longitude in 1768, used logarithmic solar tables of Downes's own invention. As he also used the latitude by dead reckoning, the calculation involved repetition and was long. Dr Pemberton, in a paper read to the Royal Society (Nov. 20, 1760), showed that the problem could be worked without the new logarithmic solar tables; but he also uses the dead reckoning. The problem was not new; Nuñez had solved it on the globe; and solutions by the globe, disks of talc, or the like, which are useful only as illustrations, have since been repeated from time to time down to our own age. One such by R. Graham (1734) is given in *Phil. Trans.*, xxxviii. 435, with much boasting. The first discussion of double altitudes in which the motion of the ship between the observations was taken into account was in a pamphlet by N. F. Duillier in 1728.

[2] Lyons received £10 for his solution of this problem from the commissioners in 1769; and in 1772 he and Dunthorn each got £50 for their improvements in "clearing the distance."

After Maskelyne's death the correctness and reputation of the *Nautical Almanac* underwent a serious decline. The matter came before parliament in 1818, when the board of longitude was reconstructed, and the old Acts consolidated. Dr T. Young was appointed secretary to the commissioners, and superintendent of the *Almanac*. Ten years later, in 1828, the board was swept away, the *Almanac* was placed under the Admiralty, and Young, with Faraday as a chemist and Sabine as a practical observer, were appointed scientific advisers to the Admiralty, which ever since has spent a certain annual sum on scientific research. The *Almanac* still gave cause for dissatisfaction; a memorial to the House of Commons, dated January 28, 1829, states that the *Nautical Almanac* was for the good of astronomy as well as navigation, and that it is so declared in the first *Almanac* in 1767; that in 1818 fifty-eight errors were discovered, and a similar number in the *Almanac* for 1830, and that it had not kept pace with navigation or astronomy; that it did not give the moon's distance from the four principal planets as the Portuguese and Danish ephemerides did, nor did it give the positions of those planets; that there was no list of the occultating stars which were ascertained to be visible in Halley's time, but were neglected after the invention of Hadley's sextant (they were in the Milan ephemerides); and that the tables of the sun were not correct. This was supported by a paper signed by J. F. W. Herschel, read at the board of longitude April 5, 1827, which stated that the moon's meridian passage was not given at all, that of the sun roughly to the nearest minute. The right ascension and declination of the larger planets were not given with accuracy, as they should have been, as their theory was perfect. The moon's right ascension in time and hourly motion should have been given, also the time of semidiameter passing the meridian, for use with moon-culminating stars. Young replied to this memorial and maintained that the fifty-eight errors were exaggerated; forty of them were in reality only one in the moon's place, which would put a ship out 5 miles, and which was corrected in the next year's book, "which every accurate navigator is bound to consult, to guard against possible minute accident." The errors of 1830 were, he says, of less importance: the French *Connaissance des Temps* of 1821 was corrected by the English *Almanac*; some errors were found in Taylor's logarithms; the error in the solar tables, said to be 15 seconds, was really only one. The ultimate result of these controversies was the appearance of the new and reformed *Nautical Almanac* in 1834. It may be added that the last remnant of the old laws, the protection of the *Almanac* against competition by a penalty was abolished by an Act passed August 6, 1861. The number of copies of the *Nautical Almanac* (for 1851) printed in 1847–48 was 10,000, and the number sold (of various years) 8638, at 5s. each; the gross produce of sale was £2159, and the expense of preparation £3677. In 1882 15,071 copies were sold, of various years, extending to four years in advance; the cost was £3368, and the gross produce of sale at 2s. 6d. each £1900. The sale of the *Nautical Almanac* has lately decreased on account of the amount of information given in private publications.

Prior to 1795 the nautical portion of the British community, including the royal navy, were entirely dependent upon private industry and enterprise for charts and sailing directions. On August 12th of that year an order in council placed all such articles as were then in the possession of the Admiralty in charge of Mr Dalrymple, an eminent publisher of such things, who had long been employed by the East India Company, and whose catalogue in 1786 contained 347 charts between England, the Cape, India, and China;[1] thus the germ of the hydrographic department was established. The expense was then limited to £650 a year, just one-tenth of what was allowed last year for drawing and engraving charts alone, besides £5500 for printing and mounting them. In 1881 there were 118,542 charts sold.

After the close of the long devastating war in 1815 both trade and science revived, and several Governments besides that of Great Britain saw the necessity of surveying the coasts in various parts of the globe; the greater portion of the work fell to the English hydrographical department, which took under its charge nearly every place where the inhabitants were not able to do it for themselves. The parts which received immediate attention were the shores of the United Kingdom, the lakes of Canada, Gulf of St Lawrence and Newfoundland, West India Islands, Sicily and the eastern part of the Mediterranean, west coast of Africa, Australia, Tierra del Fuego and Straits of Magellan, Arabia, Persia, Bay of Bengal from the Hooghly to Malacca Strait, and the Red Sea. Similar good work was carried on by the Governments of France, Norway, Denmark, Sweden, and Russia; Portugal was an exception. Spain had for her own shores the excellent work of Admiral Vincent Tofiño, performed in the latter part of last century. The United States of America have surveyed both shores of that continent since 1832. Since 1837 the British surveyors have been continually employed in Australia and New Zealand, and since 1842 on China and Japan, and the whole west coast of America from Magellan to Behring's Straits. British Columbia has been surveyed in detail, also the great barrier reef of Australia and Torres Strait, the coast of New Guinea and the Fiji group, coast of Arabia, and Persian Gulf. The Gulf of Suez and other parts of the Red Sea have been resurveyed. Fresh requirements are continually springing up, and greater precision is expected in the surveys, which are now continued, with the same zeal and unremitting attention, under the present hydrographer Captain Sir Frederick Evans, K.C.B., to whose paper for the British Association (1881) the reader is referred. The first official catalogue of charts was issued in 1830; the total number was then 962. In 1880 the number had increased to 2699. The greatest increase was on the British coasts, from 51 to 368, the Arctic seas and north-east coast of America, from 57 to 302, and the Pacific Ocean islands, from 11 to 100.

The question of the accuracy with which the sea charts now represent a portion of the globe is entirely set at rest by the possession of a correct knowledge of the figure and size of the earth, as well as the means of ascertaining the latitude and longitude of innumerable places (see EARTH and GEOGRAPHY). They are now made as precisely as possible to represent the actual surface of the globe. The result of each survey is first plotted with the meridian lines inclined towards the pole, by which means all astronomical bearings coincide. It is afterwards opened proportionately to suit Mercator's projection and the sailor's use, as far as 70 or 80 degrees. For the polar regions a circular projection is used, which may comprise a radius of 30 or even 40 degrees. During 1882 sixty-one new plates of charts were engraved, and eighteen improved by the addition of new plans; 2700 plates received corrections by the engraver. The number of charts printed for the royal navy, Government departments, and to meet the requirements of the general public, during 1882 amounted to 229,700. The Admiralty catalogue of charts and sailing directions now contains 2680 of the former and 83 of the latter. The tide table for 1883 gives the time of high water at all the ports in Great Britain and Ireland, also for full and change days all over the globe,—upwards of 3200 in number. The cost of the hydrographic department was £43,145 last year, of which £20,958 was for surveys in various parts of the world, hire of vessels, wages, &c.

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[1] In 1783, in an excellent descriptive work of the nature of sailing directions, Dalrymple with clear prevision gave his opinion that chronometers would so change geography that new charts would be required.

Many of the early writers and teachers of navigation regretted that no national care was bestowed upon the education of navigators; they might be rejoiced could they know that the Royal Naval College at Greenwich is maintained at a cost of £31,800; beside which there is the Naval College at Portsmouth, and the "Britannia" training ship for naval cadets, which latter costs over £17,000 a year, one half being paid by the parents. There is also a school at Greenwich for a thousand boys, the sons of petty officers, seamen, and marines, all of whom (unless physically incapacitated) are destined for the sea. There are also several training vessels connected both with the royal navy and the mercantile marine. There can be no doubt that the educational qualification of seamen of all grades is well provided for, and as little doubt that the kindred qualification "seamanship" is neglected; but the examination for a lieutenant in the navy will in future include a knowledge of Channel pilotage.

A meteorological conference was held in Brussels in 1853 for devising a uniform system of observations at sea, upon winds and currents; and a meteorological department was established in England soon after, under the Board of Trade and Admiral FitzRoy. In 1866 it was placed under a committee selected by the Royal Society. It is hoped that before long much useful information may result from that source. Wind and current charts are now compiled by the Admiralty, which are very valuable aids in long voyages.

At the commencement of the present century all watches designed for the discovery of the longitude were called "chronometers"; they were but slowly coming into general use; the Admiralty only supplied them to flagships, surveying ships, and exploring expeditions. Later every ship of war was allowed one, and an additional one if the captain possessed one of his own. The East India Company allowed their ships one each at an early date. Now flagships are allowed five, and ordinary ships of war three each. Chronometers were soon recognized as a certain and simple means of ascertaining the difference of longitude between two places; Captain Cook and others used them in the last century. Between 1817 and 1824 Captain Smyth used five chronometers in the survey of the Mediterranean. Dr Tiarks, 1822–23, used twenty-six to establish the longitude of Pendennis Castle, and for Funchal, Madeira, seventeen. Schubert in 1833 proceeded round the Baltic in a steam-vessel with fifty-six chronometers, reckoning his longitude from Altona. In 1826 King carried eleven in the "Adventure" and "Beagle"; Foster in 1828, seventeen in the "Chanticleer"; FitzRoy, 1831, twenty-two in the "Beagle." In 1839 Lieutenant Raper proposed that eighteen "secondary meridians" should be established, and, these being well spread over the globe, the minor places should be referred to them, and not to each other as formerly. There are now fifty such secondary meridians, and the electric wire has taken the place of the timekeeper, as the time-signal is the most perfect thing which human ingenuity can devise. The elaborate chronometric expeditions of English, Continental, and American astronomers belong rather to the history of astronomy. When the Atlantic cable was laid to Newfoundland in July 1866, and time-signals received direct from Greenwich Observatory to Heart's Content, the Admiralty chart was found to be quite correct. In a similar manner all the principal places in North and South America and the West India Islands have been connected by time-signals with the United States observatories within the last seven years, and found to be fairly correct, the error seldom amounting to two seconds in time. The observatory at Lisbon was found to differ eight seconds of time. It may now be assumed that there is no place within the ordinary navigable parts of the ocean where an error in position exists of sufficient amount to affect a ship's safety.

A reward was formerly given annually to the maker of the chronometer which stood the best test at the observatory; this was instituted in 1822, and discontinued after 1835; the recipients were Poole, Frodsham, Hutton, Hewett, Eiffe, and Dent. Since that time they are received at the observatory on trial during twenty-eight weeks, and those preserving the most equal rate are chosen for the public service at a price named by an official in charge of the department, and something above the ordinary price. Prior to 1849 as much as £62 was paid for one; in 1883 about six are recommended for purchase at £45 to £38 each. On Dent's catalogue marine chronometers range from 35 to 45 guineas.

The following list of some writers of navigation whose works have not been already mentioned may be found useful:—Thomas Addison, *Arithmetical Navigation*, 1625 (he was the first to apply logarithms); Antonio de Najera (Lisbon, 1628) follows Nuñez and Cespedes, but corrects the declination of sun and stars; Sir R. Dudley, *L'arcano del mare*, 1630–46, 2d ed., Florence, 1661, too ponderous for the use of seamen; Sir Jonas Moore (1681), one of the best books of the period; William Jones (1702), a useful compendium containing trigonometry applied to the various sailings, the use of the log, and tables of logarithms; Pierre Jean Bouguer, *Traité Complet de la Navigation*, folio, 1698, good but too large; Manuel Pimentel, *L'arte de navegar*, Lisbon, 1712; Pierre Bouguer, jun., *Nouveau Traité de Navigation*, 1753 (without tables), published at the request of the minister of marine, improved and shortened in 1769 under the superintendence of the astronomer Lacaille; Nathaniel Colson, *The Mariner's New Calendar*, 1735, a good book; Seller, *Practical Navigation*, a book very popular in its time (there was an edition as late as 1739); Samuel Dunn published good star charts and tables of latitude and longitude (1737), and framed concise rules for many problems on navigation (published by the board of longitude); John H. Moore, *The Practical Navigator and Seaman's New Daily Assistant*, 1772, very popular, and generally used in the British navy,—the 18th and 19th editions (1810, 1814) were improved by J. Dessiou; W. Wilson (Edinburgh, 1773), a treatise of good repute at the time; Samuel Dunn, *New Epitome of Practical Navigation, or Guide to the Indian Seas*, 1777,—for the longitude he depends chiefly on a variation chart from observations on East Indiamen, and he still makes no mention of the *Nautical Almanac* or of parallel rulers; Samuel Dunn (probably a son of the last named), 1781, is the last writer who gives instructions for the use of the astrolabe; he also wrote on "lunars" (1783, 1793), a word which was generally adopted about this time, and published an excellent traverse table (1785), and *Daily Uses of the Nautical Sciences*, 1790; Horsborough, *Directory for East India Voyages*, 1805; A. Mackay, *The Complete Navigator*, about 1791, 2d ed. 1810,—there is no instruction for finding longitude by the timekeeper; Kelly, *Spherical Trigonometry and Nautical Astronomy*, 1796, 4th ed. 1813, clear and simple; N. Bowditch, *Practical Navigator*, 1800, passed through many editions, and is still much used in the United States navy; J. W. Norie, *Epitome of Navigation*, 1803, 21st ed. 1878, long a favourite in the mercantile marine from its simplicity, and because navigation can be learned from it without a teacher; T. Kerigan, *The Young Navigator's Guide to Nautical Astronomy*, 1821; Inman, *Epitome of Navigation*, 1821, with an excellent volume of tables—largely used in the British navy, 9th ed. 1854; E. Riddle, *Navigation and Nautical Astronomy*, 3d ed. 1824, 9th ed., by Escott, 1871, still worthy of its high reputation,—it does not include great circle sailing; J. T. Towson, *Tables for Reduction of Ex-meridian Altitudes*, 4th ed. 1854, very useful; H. Raper, *Practice of Navigation*, 1840, 10th ed. 1870, an excellent book, perhaps the best; H. Evers, *Navigation and Great Circle Sailing*, 1850, other works on the same subject by Merrifield and Evers (1868), and Evers (1875); R. M. Inskip, *Navigation and Nautical Astronomy*, 1865, a useful book, without tables; T. H. Sumner, *A Method of finding a Ship's Position by two Observations and Greenwich Time by Chronometer*,—this is set forth as a novelty, but was published by Captain R. Owen, R.N., early in the century, and practised by many officers; H. W. Jeans, *Navigation and Nautical Astronomy*, 1858, without tables, a good deal used in the British navy,—Jeans revised Inman's tables in 1873; Harbord, *Glossary of Navigation*, 1863, enlarged ed. 1883, a very excellent book of reference; W. C. Bergen, *Practice and Theory of Navigation*, 1872; Sir W. Thomson, *Navigation, a Lecture*, 1876, well worth reading.

PRACTICAL OR MODERN NAVIGATION.

The following outline of navigation, as commonly practised in 1883, is sufficient to enable a person to conduct a ship from one port to another, or at least to show in plain simple terms the principle upon which it is done. There will be no tables or logarithms referred to which are not common to all works on navigation, and in all such books there are instructions for their use. Seamanship forms a separate subject, but there are a few points wherein it is inseparable from this; no man can be a good navigator unless he possesses sound judgment in seamanship.

It is necessary that the ship should be provided with good compasses, in suitable places, an ordinary log and line, as well as any patent log which may be desired, hand leads, deep-sea leads and lines, log-book, work-book, chronometer, tables of logarithms, &c., *Nautical Almanac*, sextant, artificial horizon, large parallel rulers, a box of mathematical instruments, charts of the ocean, and enlarged plans of the places the ship is likely to visit.

Before the ship leaves her anchorage or other security, the helm should be moved hard over each way, to prove that it is clear, and a leadsman stationed on each side of the ship. When clear of the harbour and adjacent headlands, the course is set towards her destination or to obtain an offing. At that time a bearing is taken of one known object and the distance estimated, or, two known objects being in a line, a bearing is taken of a third, or two cross bearings; the result in either case is entered in the log-book, with the exact time. This is called the departure (*i.e.*, from the land), and should be secured before rain or fog intercept the view. Thereafter the rough or deck log-book should be marked every hour after the log has been hove (the hour being subdivided when necessary), and the estimated course steered, distance through the water, wind, and leeway (if there be any) carefully entered in their proper columns. The courses may be steered and expressed by degrees, if this is desired. The ship's reckoning is invariably made up from noon to noon of each day; all the principal events are entered in the ship's log-book, which is a very important document.

That part of a ship's reckoning which is independent of observations of sun, moon, or stars is called dead-reckoning (D.R.), while the position by celestial objects is designated observed (Obs.).

The following illustration of a ship's log and day's reckoning will include all the "sailings" which are usually treated under separate heads. The force of the wind and state of weather are expressed according to a scale, from 1 to 12, and by symbols which have been in general use about fifty years. Variation and local deviation of the compass must be here attended to; the mode of ascertaining the amount will be explained further on. All problems in this part of navigation are solved by plane trigonometry, as if working on a plane, except in finding the proportion between difference of longitude and departure (the latter from the meridian in nautical miles).

The accompanying example of a ship's log represents the greater portion of a page, which would contain the record of what had occurred during two civil days, and therefore embraces one complete astronomical day. While the ship remains on the same course the entry should not be repeated; the open space shows more clearly the amount of distance due to each. The "North Star" is here supposed to have been under way and clear of the harbour at noon, when the departure was taken from the Eddystone, the position of which is 50° 11′ N. and 4° 15′ W. The courses are intended to comprise many varieties of circumstances. If a ship be under steam or has a fair wind, these will be but few; but leeway will always exist according to the strength of the wind, if on the side, though scarcely perceptible by the wake if the ship is going fast. It is supposed that a ship either sailing or steaming even 15 miles an hour, with her broadside to the breeze, will be carried the same distance at a right angle to her course as if she had been stopped during the same period—surface of hull, sails, &c., exposed being similar in each case. It is difficult to estimate the drift of a ship during a gale, but it is very seldom overrated. Courses and distances within 50 miles are usually obtained by laying the edge of the parallel ruler on the two positions and running it to the compass, which is drawn on the chart; then take the space between the places in the dividers and apply it to the scale of latitude opposite them: the number of miles there indicated will be the distance. Distant places on Mercator's chart, when so treated, will give the course and distance approximately.

To Work the Reckoning Arithmetically from the Ship's Log.—The true bearing of the Eddystone is reversed and treated as a course. To correct the compass courses, westerly variation and deviation are both applied to the left of the course steered, that is, against the sun, the reverse when they are easterly. In the example the variation is taken as 21° westerly throughout the day's run. The deviation is taken from a table of corrections for a compass to which a magnet had been applied (see COMPASS and MAGNETISM). The first course on the ship's log is W. by S. ½ S. or S. 73° 8′ W. Apply variation −21°; deviation (5° 30′) being easterly is +; leeway (5° 37′) as the wind is south is also +: result S. 63° 15′ W. In a similar manner deal with the other courses, marking well the change of sign east or west, and the direction of the wind with regard to the leeway. The direction of the current being true is entered as S. 79° W. After all the courses and distances for the day have been correctly entered in a traverse table, the corresponding differences of latitude and departure are taken from the traverse table of the epitome, and placed in the proper columns. If the angle be less than 45°, read difference of latitude and departure at the top of the page; if greater than 45° it is reversed. As the table is arranged in decimals, 2·5 can be treated as 25 or 250, or conversely, so that large distances may be embraced. This process is called working by inspection, and is sufficiently accurate for the purpose of finding the course and distance made good, or the course and distance, to places within 300 or 400 miles.

Traverse Table.

Magnetic Course.	True Course.	Distance.	N.	S.	E.	W.
...	N 34° W	1	·8	...	...	·5
...	S 79° W	5	...	1	...	4·9
WbS½S.	S 63° W	16	...	7·3	...	14·3
SW½S.	S 30° W	14	...	12·1	...	7
SbW¾W.	South.	29·6	...	29·6	...	...
South.	S 23° E.	12	...	11	4·7	...
SSE.	S 53° E.	11·3	...	6·8	9	...
WbN¾N.	West.	16·5 }	...	...	...	33
WNW.	West.	16·5 }				
NW.	N 67° W.	21·2	8·3	...	...	19·5
NW.	N 64° W.	19·5	8·5	...	...	17·5
SWbW.	S 43° W.	17·7	...	12·9	...	12·1
			17·6	80·7	13·7	108·8
			...	17·6	...	13·7
			...	63·1	...	95·1

As the difference of latitude is south, it must be subtracted from the latitude left.

Eddystone,	50° 11′·0 N.	4° 15′ W.
	−1 3·1	+2 27
	49 7·9 = 49° 7′ 54″	6 42

Log of H.M.S. "North Star."

H.	K.	$\frac{1}{10}$	Course.	Leeway.	Wind. Direction.	Wind. Force.	Weather.	Deviation.	Barometer.	Thermometer.	Temperature of Sea.	Remarks, &c. Tuesday, May 9th, 1882.
1	...	...		...	...	...	...	...	...	...	...	A.M.
2	...	...	Moored in Plymouth Sound.	...	...	...	...	...	...	...	...	
3	...	...		...	...	...	...	..	...	..	...	
4	...	...		...	Calm.	0	or	...	29·86	54	...	
5	...	...		...	...	...	...	...	...	...	...	
6	...	...		...	Vble.	2	og	...	...	...	...	6. Unmoored, and shortened in on SB. to 30 fathoms.
7	...	...	Single anchor.	...	...	...	...	...	...	...	...	
8	...	...		...	South.	4	bc	...	30·0	55	...	
9	...	...		..	...	...	..	...	...	...	...	9.30. Made all plain sail. Weighed and worked out of Plymouth Sound.
10	...	...		...	...	...	...	...	...	...	...	
11	...	...	Working out.	...	SW^{b}S.	...	...	...	...	...	...	
12	...	...		...	Vble.	6	bv	...	30·05	57	...	Noon. Tacked.

Course, made good.	Distance. Made Good.	Distance. Through the Water.	Latitude.	Longitude.	Variation Allowed.	True Bearings and Distance.
...			D.R.	D.R.		
Current. ...			Obs.	Obs.	20° 25′ Wly.	Eddystone Lighthouse, S 24° E., 1 mile.

H.	K.	$\frac{1}{10}$	Course.	Leeway.	Wind. Direction.	Wind. Force.	Weather.	Deviation.	Barometer.	Thermometer.	Temperature of Sea.	Remarks, &c.
1	7	4	W^{b}S½S.	½	Southerly.	6	bc	3½ E.	...	58	...	P.M.
2	8	6	...	...	...	...	...	...	...	...	...	Tide set W. by S. (true) 5 miles, during the afternoon.
3	7	6	SW½S.	0	SSE.	6.	og	8½ E.	...	...	...	
4	6	4	...	...	...	...	...	...	30·0	58	...	4. Lizard Lighthouses, N.W., 12 miles. (Ship's head S.W. by W.)
5	7	...	S^{b}W¾W.	½	Westerly.	5	oq	7 E.	...	...	...	" Taken aback, by shift of wind. Braced round on the starboard tack.
6	7	2	...	...	...	...	...	...	...	...	...	
7	7	6	...	...	...	...	...	...	...	...	...	
8	7	8	...	...	...	...	...	...	...	...	...	8.30. William Jones fell from the main-rigging and broke his arm.
9	8	...	South.	½	WSW.	7	bcp	0	29·90	56	...	
10	4 3	... 5	... SSE.	... ½	... SW.	...	...	... 4½ W.	...	...	...	
11	7	8	...	...	...	...	...	...	...	...	...	11. Tacked.
12	8	...	W^{b}N¾N.	½	...	7	bcq	2 W.	29·85	54	45	Midnight. Two sail in sight.

H.	K.	$\frac{1}{10}$	Course.	Leeway.	Wind. Direction.	Wind. Force.	Weather.	Deviation.	Barometer.	Thermometer.	Temperature of Sea.	Remarks, &c. Wednesday, May 10th, 1882.
1	8	5	W^{b}N¾N.	½	SW.	7	bc	2 W.	...	...	...	A.M.
2	8	...	WNW.	0	...	...	...	...	...	...	...	2.20. Exchanged numbers with the s.s. "Fox," bound to London.
3	8	5	...	...	...	...	...	...	...	...	...	
4	7	2	NW.	½	WSW.	6	om	4 W.	29·60	50	...	
5	7	...	...	...	...	...	...	...	...	...	...	
6	7	...	...	...	...	...	..	...	...	...	...	
7	6	5	...	½	...	5	od	...	...	...	...	7. Variation by azimuth (head N.W.) 24·25 westerly.
8	6	...	...	...	...	...	...	...	...	...	...	
9	5	...	...	...	Vble.	..	...	...	...	...	...	
10	2	...	...	...	...	3	or	...	...	...	...	10. Trimmed sails.
11	7	5	SW^{b}W.	0	SE.	6	bc	7½ E.	...	...	...	
12	10	2	...	..	...	7	bcv	...	29·9	54	46	Noon. Set port studding sails.

Course, made good.	Distance. Made Good.	Distance. Through the Water.	Latitude.	Longitude.	Variation Allowed.	True Bearings and Distance.	
S 56½° W.			D.R. 49° 7′ 54″	D.R. 5·42			
Current. ...	114·1	174·3	Obs. 49° 8′ 13″	Obs.	20° 25′ W.	Entrance to Strait of Belle Isle. N. 85° 9′ W.—1858 miles.	Do. By great circle sailing. N. 66° W.—1824·2 miles.

H.	K.	$\frac{1}{10}$	Course.	Leeway.	Wind. Direction.	Wind. Force.	Weather.	Deviation.	Barometer.	Thermometer.	Temperature of Sea.	Remarks, &c.
1												P.M.
2												
3												

With middle latitude 49° 40′ and departure 95·1, enter the traverse table.

Taking the complement of middle latitude as a course, and the departure in its column, the difference of longitude = 147 is found in the distance column; which being west is added to the Eddystone's westerly longitude.

To find the Course and Distance Made Good by Inspection.—Difference of latitude 63·1 and departure 95·1 will be found opposite 56½° and under 114; therefore it is S. 56½° W. 114 miles from the Eddystone.

To do the same more exactly by logarithms,—the multiplication and division of the quantities being performed by the addition and subtraction of their logarithms.

First, required the difference of longitude.

$$\frac{\text{dep. } 95{\cdot}1 \times \text{rad.}}{\text{cos mid. lat. } 49^\circ\, 40'} = \text{diff. long.}$$

95·1	log + 10 ...	11·978180
49° 40′	log cos.	9·811061
Diff. long. 146·9	log..........	2·167119

Or

$$\frac{\text{dep. } 95{\cdot}1 \times \sec 49^\circ\, 40'}{\text{rad.}} = \text{diff. long.}$$

95·1	log..........	1·978120
49° 40′	log sec − 10	0·188939
Diff. long. 146·9	log..........	2·167119

The proportions which sines, tangents, and secants bear to the course, distance, difference, latitude, and departure, and these to each other, form the principal points in plane trigonometry connected with navigation, which can be easily demonstrated by two figures. If the hypothenuse AB be made radius, as in fig. 12, the whole will be contained within the circle, and the sides are in proportion to the sines of their opposite angles; but if the base be made the radius, as in fig. 13, the other side BC is entirely without the circle, touching only at the point C; it is therefore a tangent subtending the angle A, and the hypothenuse AB becomes the secant of the angle A. In like manner BC may be made radius, then AC would become the tangent of angle B.

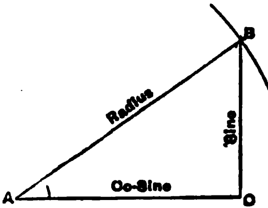

Fig. 12.

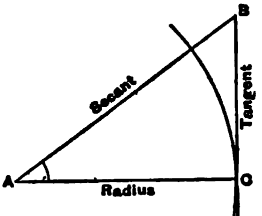

Fig. 13.

To find the course and distance made good by calculations. Making BC the radius,

$$\frac{\text{rad.}\times\text{dep. AC}}{\text{diff. lat. BC}}=\text{tan course.}$$

AC 95·1	log + 10...	11·978180
BC 63·1	log.........	1·800029
B 56° 26′ 7″	log tan.....	10·178151

$$\frac{\text{BC}\times\sec\text{B }56^\circ\ 26'\ 7''}{\text{rad.}}=\text{distance.}$$

BC 63·1	log.........	1·800029
B 56° 26′ 7″	log sec − 10	0·257872
AB dist. 114·1	log.........	2·057401

It is not necessary to work out a course to seconds; scarcely so to minutes. Distances are invariably expressed in miles and decimal parts.

To find the Course and Distance to the Place of Destination.—Suppose it be the Strait of Belle Isle. Choose a point of land, or assume a position, near the entrance, say 51° 45′ N. and 55° 10′ W. A line drawn on a chart of the Atlantic from the ship's position to the above will roughly indicate the course usually steered, which is a rhumb line cutting all the meridians at the same angle, and forming on the globe a spiral curve towards the pole. The exceptions are if it be east or west, north or south; in the former case it would be a small circle round the pole, and in the latter it would be on the meridian (which is a great circle) directly to one of the poles. The direction of the line on the chart is found by means of parallel rulers conveying it to the compass, or by a protractor placed on a meridional line; and the distance is measured on the scale of latitude at the side between the two places. Long distances are calculated by "middle latitude," or "Mercator's sailing." The former is most convenient in low latitudes and when the difference is small, but the latter is at all times more correct. Middle latitude may be made nearly as good a method by measuring from the chart half way between the two latitudes; or the same result may be obtained by taking the latitude corresponding to the mean of the meridian parts, as the table of these embodies the whole principle upon which Mercator's charts are made.

Continuing the day's work—

Lat. of ship	49° 8′	Merid. pts.	3394·29
Near Belle Isle	51 45		3640·90
	2 37 = 157′		2)7035·19
Mid. lat. 50° 27′ 30″.		Mean	3517·59

which differs only one mile from the mean taken directly.

To find the departure corresponding to the difference of longitude (55° 10′ − 6° 42′ = 48° 28′ = 2908′) in mean latitude 50° 27′ 30″:—

$$\frac{\text{diff. long. }2908\times\cos 50^\circ\ 27'\ 30''}{\text{rad.}}=\text{dep. }1851\cdot3\text{ miles.}$$

With difference of latitude and departure to find the course:—

$$\frac{\text{rad.}\times\text{dep. }1851\cdot3}{\text{diff. lat. }157}=\underset{85^\circ\ 9'\ 10'';}{\text{tan course}}\qquad\text{or}\qquad\frac{\text{rad.}\times\text{diff. lat.}}{\text{dep.}}=\text{cot course.}$$

The course is evidently 85 degrees to the west of north.

To find the distance:—

$$\frac{\text{dep. }1851\cdot3\times\text{rad.}}{\text{sin course }85^\circ\ 9'\ 10''}=1858\text{ miles.}$$

To find the course and distance by Mercator's sailing. The difference between the meridional parts as above is 246·6, difference of longitude 2908 miles, and difference of latitude 157; whence

$$\frac{\text{rad.}\times\text{diff. long.}}{\text{merid. diff. lat.}}=\underset{85^\circ\ 9'\ 10'';}{\text{tan course}}\qquad\frac{\text{diff. lat.}\times\text{rad.}}{\text{cos course}}=\text{dist. }1858\text{ miles.}$$

The result is the same by both methods when the difference of latitude is small. It is obvious that if we subtract the logarithm corresponding to the meridional difference latitude from that of the difference longitude increased by ten in the index, the remainder will be the logarithmic tangent of the course. In like manner, if the logarithmic secant of the course be added to the logarithm of the true difference latitude, and ten in the index rejected, the sum will be the logarithm of the distance.

Under some circumstances, in high latitudes, the ordinary mode of reducing the ship's run during the twenty-four hours, by taking the difference between the northing and southing as the difference of latitude, and the excess of easting or westing as the departure, would not be correct. For example, suppose that from a position off the west coast of Ireland, in 52° N. and 11° W., a ship were to sail in such a manner as to make during the first eight hours 96 miles on a true N.W. course, during the next eight hours a similar distance due north, and during the last eight hours N.E. 96 miles. Here we should have the two oblique courses producing 67·9 miles each, both of difference of latitude and departure, the departures apparently cancelling each other and leaving the ship on the same meridian. But in reality the ship would not be on the same meridian, as the latter departure was performed in a higher latitude than the former, and they are of opposite names. Therefore this peculiar "day's work" requires to be divided into two distinct parts; each may be taken by inspection from the traverse table. The first course N. 45° W. 96 miles will produce latitude 53° 7′ 54″, middle latitude 52° 34′, which with departure 67·9 will give difference longitude 111° 6′ W. The second course simply adds 96 miles to the latitude; the third, like the first, increases the latitude by 67·9 miles making it 55° 51′ 48″, and the middle latitude of the last section 55° 18′, which with departure 67·9 will give difference longitude 119·2; this being east, and preponderating over the former by 7·6 miles, the ship will be 7·6 miles east of the meridian she first sailed from, or in 10° 52′ 24″ W.

Great Circle Sailing.—The course between the ship on May 10th and the Strait of Belle Isle, as ascertained by middle latitude and Mercator's sailing, is a straight line on Mercator's chart, but is in reality a curve upon the globe, and the nearer the positions are to either pole the greater the curvature and consequent increase of distance. The shortest distance between any two points on the globe is an arc of a great circle, the centre of which is also the centre of the sphere. The equator, ecliptic, and all meridians are great circles, between which an infinite number of others may be drawn in every conceivable direction, each dividing the surface of the globe into two equal parts. It is only of late years that this subject has been revived, since ships have made long voyages entirely under steam, thereby having the ability to steer any course desired. The practice of this mode of sailing requires but a small general knowledge of spherical trigonometry, and to that extent only will spherical problems be here introduced; though a clear understanding of the doctrine of the sphere is very desirable for all navigators. The formulæ by which spherical problems are solved must here be postulated. They will be proved in TRIGONOMETRY. In all spherical triangles there are six parts, three sides and three angles, the sides as well as the angles being measured by degrees; any three being given the remainder may be found. The angles measured between heavenly bodies, or their altitudes, are treated as spherical sides. When two places are on the same parallel of latitude, the shortest course is not east or west (except on the equator), as the parallels are small circles having the pole as their common centre. In finding the true course and shortest distance, by calculating a segment of a great circle, the earth is treated as a sphere,—this being sufficiently accurate for the purpose. The advantage of sailing on a great circle instead of a rhumb is best demonstrated by stretching a thread across a globe, cutting the two places under consideration; while by calculation it can be found numerically. Returning to the day's work on May 10th, let us suppose it desired to find the great circle course and distance to Belle Isle. The co-latitude of each place gives the two sides, and the difference of longitude expresses the angle between them at the pole. Hence the two sides and included angle are given; required the third side and the angle at ship, which will be the distance and course (see fig. 14). P represents the pole, S the ship, and B Belle-Isle. It is necessary first to find the angles PSB and PBS. The formula is

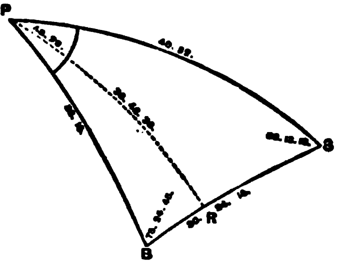

Fig. 14.

$$\frac{\sin\tfrac12\text{diff. sides}\times\cot\tfrac12\text{contained angle}}{\sin\tfrac12\text{sum of the two sides}}=\tan\tfrac12\text{diff. of other two angles;}$$

$$\frac{\cos\tfrac12\text{diff. sides}\times\cot\tfrac12\text{contained angle}}{\cos\tfrac12\text{sum of sides}}=\tan\tfrac12\text{sum of other angles.}$$

Instead of subtracting a sine or cosine, it is easier to add the cosecant or the secant and reject the index. The result is—

$$\frac{\sin\tfrac12(\text{PS}-\text{PB})[=1^\circ\ 18'\ 30'']\times\cot\tfrac12\text{P}[=24^\circ\ 14']}{\sin\tfrac12(\text{PB}+\text{BS})[=39^\circ\ 33'\ 30'']}=\tan 4^\circ\ 33'\ 15'';$$

$$\frac{\cos\tfrac12(\text{PS}-\text{PB})\times\cot\tfrac12\text{P}}{\cos\tfrac12(\text{PB}+\text{PS})}=\tan 70^\circ\ 51'\ 30''.$$

Hence 70° 51′ 30″ + 4° 33′ 15″ = 75° 24′ 45″ is the greater angle B, opposite the greater side; and 70° 51′ 30″ − 4° 33′ 15″ = 66° 18′ 15″ is angle S,—the ship's course at commencing,—say, N. 66° W. At the termination it will be S. 75° W. Having all the angles, we find the third side by the rule that the sines of the angles are proportional to the sines of the opposite sides.

$$\frac{\sin\text{PS }40^\circ\ 52'\times\sin\text{P }48^\circ\ 28'}{\sin\text{B }75^\circ\ 24'\ 45''}=\sin\text{BS }30^\circ\ 24'\ 15''=1824\cdot2\text{ distance;}$$

$$\text{or}\qquad\frac{\sin\text{PB }38\cdot15\times\sin\text{P }48^\circ\ 28'}{\sin\text{S }66^\circ\ 18'\ 15''}=\sin\text{BS }30^\circ\ 24'\ 15''.$$

The distance by Mercator's sailing was 1858, or 33·8 miles longer.

Should the sum of any two sides exceed 180°, the supplement of each must be used, and the supplement of the angles found. If a side be over 90° the logarithm found will be sine of its supplement or the cosine of its excess over 90°. It will be readily seen by the frequent alterations necessary in the course, to keep near the great circle, that the ship passes the pole, continually changing its bearing, as she would any other distant object on the globe. It is always desirable to ascertain the highest latitude a ship will pass when sailing on a great circle; this is done by imagining a perpendicular let fall upon the arc; the position, is then found by right-angled spherical trigonometry, the rules for which are very brief. Excluding the right angle, the triangle consists of five parts, three sides and two angles. Two of those parts at least must be given to find the rest. If the two parts given and the one required are joined, the central one is called the "middle part." If they are not joined (that is, an angle omitted between two sides, or a side between two angles, forming part of the equation) the part which is quite separate from the other two is called the "middle part." The solution is then by "Napier's rules," which have been embodied in the following rhymes:—

> "The product of radius and middle part's sine
> Equals that of the *tangents* of parts that *combine*,
> And also the *cosines* of those that *disjoin*."
>
> "Instead of the angles and hypothenuse
> Their difference from ninety or complements use."

We know that the perpendicular will fall upon the arc between B and S, because both the angles already found are acute; thus the triangle is divided into two parts, each having one side and one angle known. Take the hypothenuse PS and angle S, to find the length of the perpendicular PR. Here are opposite sides and angles, therefore

$$\frac{\text{sin PS } 40^\circ\,52' \times \text{sin S } 66^\circ\,18'\,15''}{\text{rad}} = \text{sin PR } 36^\circ\,48'\,30'',$$

which is the complement of 53° 11′ 30″, the highest latitude the ship will attain. To ascertain the longitude of that point it is necessary to find the angle RPS, which may be done according to the above rules in three ways, by varying the side or angle which is made the middle part. Thus,

$$\begin{aligned}
&\text{rad.} + \log\cos \text{PS} = \log\cot \text{PSR} + \log\cot \text{SPR};\\
&\text{rad.} + \log\cos \text{PSR} = \log\cos \text{PR} + \log\sin \text{SPR};\\
&\text{rad.} + \log\cos \text{SPR} = \log\tan \text{PR} + \log\cot \text{PS}.
\end{aligned}$$

As the part required is in each formula coupled with one which is known, the difference between that and the sum of the other two will give the angle SPR = 30° 7′ 45″; which, added to the longitude at ship, will give 36° 49′ 45″ as the longitude of the highest point. As the original oblique triangle BPS has been divided into two distinct right-angled triangles, having the perpendicular PR common to both, the parts which form BPR may be treated in a similar manner for the purpose of finding the angle BPR and perpendicular PR, either in preference to the first, or as a proof. Other points on the arc may be found by taking a part of the angle at the pole, with the side and angle previously known, and thus forming another oblique spherical triangle, in which two angles and an included side are given to find the rest; or by assuming a distance on the arc (in degrees and minutes) with the angle and side before known. In that case two sides and an included angle will be given to find the other side (co-latitude), and the part of the angle P to indicate the longitude of the assumed point.

Given two angles and an included side, to find the other two sides:—

$$\frac{\sin\tfrac{1}{2}\text{ diff. of angles} \times \tan\tfrac{1}{2}\text{ side}}{\sin\tfrac{1}{2}\text{ sum of angles}} = \tan\tfrac{1}{2}\text{ diff. of other sides};$$

$$\frac{\cos\tfrac{1}{2}\text{ diff. of angles} \times \tan\tfrac{1}{2}\text{ side}}{\cos\tfrac{1}{2}\text{ sum of angles}} = \tan\tfrac{1}{2}\text{ sum of other sides.}$$

The second case where two sides and an included angle are given has been done. When the polar angle (difference of longitude) does not much exceed 50°, especially in low latitudes, an approximate curve may be drawn on Mercator's chart by means of a pencil attached to a wire or batten making the curve to pass through three or four known points, after which it can be used from day to day as a guide to the ship's course; she may not keep on it, but she can keep near it. This curve becomes very incorrect when the angle is large.

One other example of finding the course and distance by each method will be given. The position has been chosen to show the great distance an arc of a great circle would carry a ship to the southward of her ordinary course, and also as touching upon the difficulty always experienced in finding a side or angle which is near 90°, in consequence of the very slight change in the value of large sines and small cosines.

A ship off the Cape of Good Hope in 34° 29′ S. and 18° 24′ E. is bound to Portland in Victoria. Assume a position outside the latter port to be in 38° 20′ S. and 141° 40′ E. The difference of latitude is 3° 51′ = 231 miles, the meridional difference of latitude 287·14, and difference of longitude 123° 16′ = 7396.

$$\frac{\text{rad.} \times \text{diff. long. } 7396}{\text{merid. diff. lat. } 287\cdot14} = \text{tan course } 87^\circ\,46'\,37'';$$

$$\frac{\text{diff. lat. } 231 \times \text{rad.}}{\text{cos course } 87^\circ\,46'\,37''} = \text{distance } 5955\cdot1;$$

or

$$\frac{\text{diff. lat. } 231 \times \text{sec course } 87^\circ\,46'\,37''}{\text{rad.}} = \text{distance } 5955\cdot1.$$

These two statements produce similar figures, because they are worked by the same course; an error of 10 seconds would produce over 7 miles in the distance, as the logarithm cosine and logarithm secant (arithmetical complements of each other) change very rapidly in large angles.

When the difference of latitude between two places is comparatively small, it is better to find the departure and use that in finding the distance. The table of meridional parts can be used for that purpose in two ways.

$$\frac{\text{true diff. lat. } 231 \times \text{diff. long. } 7396}{\text{merid. diff. lat. } 287\cdot14} = \text{dep. } 5950\cdot4.$$

For this the logarithms of numbers alone are used. The middle latitude is best found by seeking the latitude corresponding to the mean of the meridional parts, which in this instance will be 2350·13 and 36° 26′. The latter is the true central position on the chart, between the two parallels of latitude, the same as if measured on the side of the chart.

Radius bears the same proportion to the difference of longitude as the cosine of middle latitude does to the departure = 5950·4. Then

$$\frac{\text{rad.} \times \text{dep. } 5950\cdot4}{\text{diff. lat. } 231} = \text{tan course } 87^\circ\,46'\,36'';$$

or

$$\frac{\text{rad.} \times \text{diff. lat. } 231}{\text{dep. } 5950\cdot4} = \text{cot course},$$

and

$$\frac{\text{dep. } 5950\cdot4 \times \text{rad.}}{\text{sin course } 87^\circ\,46'\,36''} = \text{distance } 5954\cdot9.$$

Having found by Mercator and middle latitude that a ship from the position off the Cape would, by steering S. 87° 46′ E. for the whole distance, traverse 5954·9 miles before reaching the assumed point near Portland, it is now required to find an arc of a great circle passing through those points. The co-latitude of each place and the difference of longitude are given,—that is, two sides and an included angle; required the third side and angle C (fig. 15).

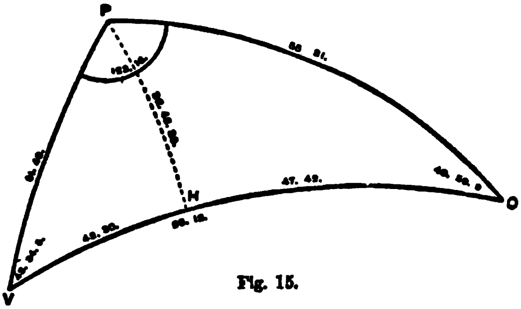

Fig. 15.

$$\begin{array}{llrl}
\text{1st position } 34^\circ\,29';\ \text{co-lat.} & = \text{PC } 55^\circ\,31' & & 18^\circ\,24'\ \text{E}\\
\text{2d} \quad ,, \quad 38^\circ\,20' \quad ,, & = \text{PV } 51^\circ\,40' & & 141^\circ\,40'\ \text{E}\\
& \overline{107^\circ\,11'} & & \overline{123^\circ\,16'} = \text{P}\\
\text{Half sum} & \overline{53^\circ\,35'\,30''} & & \underline{61^\circ\,38'} = \text{half P}\\
& \overline{3^\circ\,51'} & & \\
\text{Half difference} & \underline{\overline{1^\circ\,55'\,30''}} & &
\end{array}$$

$$\frac{\sin\tfrac{1}{2}\text{ diff. sides } 1^\circ\,55'\,30'' \times \cot\tfrac{1}{2}\text{P } 61^\circ\,38'}{\sin\tfrac{1}{2}\text{ sum of sides } 53^\circ\,35'\,30''} = \tan\tfrac{1}{2}\text{ diff. of angles } 1^\circ\,17'\,28''$$

$$\frac{\cos\tfrac{1}{2}\text{ diff. of sides} \times \cot\tfrac{1}{2}\text{P}}{\cos\tfrac{1}{2}\text{ sum of sides}} = \tan\tfrac{1}{2}\text{ sum of other two angles } 42^\circ\,16'\,37''.$$

Consequently angle V is 43° 34′ 5″ and angle C is 40° 59′ 9″, the larger angle being opposite the larger side. Having all the angles, the remaining side is found by the proportion which the sines of angles bear to their opposite sides; thus

$$\frac{\sin \text{PC} \times \sin \text{P}}{\sin \text{V}} \left[\text{or } \frac{\sin \text{VP} \times \sin \text{P}}{\sin \text{C}}\right] = \sin \text{VC } 90^\circ\,12'.$$

This example has been chosen because the side VC is so near to 90° that it can only be treated with certainty by letting fall a perpendicular from P to the arc, as represented by the dotted line PH; which also gives the latitude of the highest point the ship would reach if she sailed on that arc. Thus the oblique-angled triangle, in which all the angles were known, is divided into two right-angled spherical triangles, each possessing one side and one angle previously known, and the side PH common to both is to be found. First, to find the side (or segment) HC. The angle at C is obviously the "middle part," as it is between the known side and the one sought; they are joined or combined. Therefore

$$\text{rad.} + \log(\text{co})\sin C = \log(\text{co})\tan PC + \log\tan HC;$$

or

$$\frac{\text{rad.} \times \cos C}{\cot PC} = \tan HC\ 47° 42'.$$

Similarly

$$\frac{\text{rad.} \times \cos V}{\cot PV} = \tan VH\ 42° 30'$$

The sum of the two segments will be 90° 12′, equal to the side VC, representing the distance of 5412 miles, which is 543 miles less than the rhumb line. Similar calculations must be made every day at sea to find the new course and remaining distance. It is necessary, before deciding upon a voyage following the arc of a great circle, to ascertain the shape of the curve and the highest latitude it will attain; for which purpose the side PH must be found (fig. 15) by either of the segments as before explained; it will be 32° 43′ 30″, which is the complement of the latitude 57° 16′ 30″. To find the longitude of that point: by opposite sides and angles—

$$\frac{\text{rad.} \times \sin CH}{\sin PC} = \sin CPH\ 63° 48' 30'',$$

which added to the longitude of position off the Cape, 18° 24′, gives 82° 12′ 30″ E. A glance at the chart will show that such a course would run the ship among the icebergs; therefore a position three or four hundred miles farther from the pole should be chosen, according to the time of year, and the course divided in two parts. It is easy to make a pencil curve on the chart in a lower latitude: the saving of distance would still be great.

The arc of a great circle from a position off Rio de Janeiro, 23° 5′ S. and 43° 4′ W., to the vicinity of Perth in Western Australia, 32° 2′ S. and 115° 25′ E., would measure 7270 miles. The rhumb line by Mercator (if it were possible) would be 8437 miles, or 1167 more. The highest latitude would be 76° 28′, therefore impracticable. Such a curve as this could not be laid down on Mercator's chart.

Soundings.—When approaching land in thick weather the precaution of taking frequent soundings should not be neglected, especially when the depth and nature of the bottom is clearly defined on the chart, as it is at the entrance of the English Channel. Loss of time should not be made an excuse for incurring a serious additional risk. Several ingenious devices have been provided by which the depth of 80 fathoms can be tested without stopping the ship, but the result is not so certain as the old plan of getting the line "up and down" and feeling the lead touch the bottom. If soundings are taken at ten or more miles apart, and do not coincide with those on the chart, it is a good plan to write them up the edge of a strip of paper, preserving the distances the ship has run, according to the scale of the chart; when two or three are thus marked the slip should be moved about the chart, with the edge of the paper parallel to the course steered, till it coincides.

Observations.—The quadrant and sextant are practically the same instrument: the first is the eighth part of a circle, and by reflexion measures an angle of 90°; the second is the sixth part of a circle, and measures an angle of 120°. Both are fitted with verniers graduated in such a manner that the angle on the arc of the quadrant can be read to half a minute, and that on the sextant to ten or even six seconds. The handling of the instruments for five minutes will be better than a long description. The errors and adjustments are similar. The large movable mirror must stand perpendicular to the plane of the instrument. This is tested by placing the radius bar near the centre of the arc, and looking into the mirror at the reflexion of the uncovered part, which if all be right will continue in a straight line from the arc itself. If it appear broken, the screws must be moved. The error is difficult to remedy; therefore when practicable it is better to send the instrument to a maker. The fixed reflector, or horizon glass, has two adjustments. To make it perpendicular to the plane of the instrument, let the radius bar be placed near zero, and while the instrument is held quite vertical make the direct and reflected view of the horizon coincide, by moving the tangent screw. Then, if by sloping the instrument on one side or the other that line becomes broken, the glass is not vertical, and the screw for that purpose must be slightly moved till the lines coincide even when the instrument is held sixty degrees on one side or the other of the perpendicular. Also the reflected image of the sun or a star will cover the direct rays from them if the glass be vertical. If an horizon be not available, a distant hill or any sharp outline will do as well. The second adjustment is to make it parallel with the movable reflector. If at the end of the adjustment or test just described the radius stands at zero, or within two minutes, no adjustment is necessary. If it be much beyond that amount the radius should be set exactly at zero; and while looking at the horizon, which will appear broken, let the screw under the horizon glass be turned gently till the two parts coincide. To find the amount of index error accurately, the best method is that of measuring the diameter of the sun many times, which will give a number of small angles on and off the arc, as it is commonly called: that is, on the positive and negative side of zero, the mean of which will be the correction,—+ if it be off the arc, and − if on. Thus 32′ 20″ on and 30′ 40″ off would give a mean of −50″. The observer can at the same time test his own accuracy: thus, in the above example, the sun's diameter appears to be 31′ 30″; the *Nautical Almanac* will show if it were so on that day.

There is one error to which all sextants are liable that is seldom mentioned or attended to. It arises from the great difficulty of placing the centre of motion given to the radius bar and movable reflector exactly in the centre of the arc, or from the contraction or expansion of the metal. It has no connexion with the index error, and admits of no adjustment. Its existence and amount are not easily ascertained, but demand both time and patience. As it has no appreciable effect on small angles, it is advisable to use the artificial horizon, and take a set of altitudes, say ten, which will form a mean of about 100° on the arc, noting the time of each accurately by a trustworthy chronometer. Take similar altitudes in the afternoon, and work each set independently, as though to find the error of the chronometer (see below). Should the time so found coincide with the known rate of the chronometer, there is no error. Should the results differ several seconds of time, it may be assumed that the error of the instrument combined with personal error has caused it. By the rate at which the sun was rising or going down during the observations the amount of angle due to those seconds is easily found. Half that amount will be the error of the sextant upon that angle. As an example, suppose the true reflected altitude to be 100° while the instrument made it 100° 1′, the calculation would make it about three seconds later than the truth; in the afternoon a similar error would make it three seconds earlier. Thus a disagreement of six seconds arises for about one minute of altitude. By four or five such sets of altitudes at different parts of the arc sufficient data will be procured from which to form a table of corrections for all altitudes. This can be done by calculation, but a simple graphic method will be found sufficiently correct. Describe an arc of a circle with a radius of 6 or 8 inches. Let a line from the centre of projection indicate zero, from which lay off half the altitudes which have been observed, but give them the full numbers, *e.g.*, mark 45° as 90°, to correspond with the motion of the radius bar and numbers on the sextant. From the points representing the altitudes lay off the errors towards the centre, from any convenient scale of equal parts, perhaps one hundred seconds to half an inch. Between zero and the centre of the arc will be found the centre of a second and smaller arc which will pass through all the points representing the corrections, or nearly so. The space between the two arcs may be remeasured at every 5° or 10° for the table of corrections (plus or minus, as the case may be).

Meridian Altitudes.—The first astronomical observation at sea is usually a meridian altitude of the sun for the purpose of obtaining the latitude. The reflexion of the sun's lower limb having been brought by a sextant or quadrant to the edge of the visible horizontal on May 10, 1882, commencing a few minutes before noon, the greatest altitude that could be obtained was 58° 20′ 15″. The index correction was + 1′ 30″, and the eccentric error due to 58 degrees was −40″. The *Nautical Almanac* shows the sun's semidiameter on that day to be 15′ 52″; as the lower limb was observed it is plus. The height of the observer's eye above the sea was 20 feet, which on account of the spherical figure of the earth makes the altitude appear too great. The correction is taken from a small table for the "dip of the sea horizon," which opposite 20 feet gives 4′ 24″—always minus. The result will be the apparent altitude of the sun's centre, which must still be corrected for refraction and parallax, the former on account of the rays of light from any object beyond the earth's atmosphere being deflected upwards, and the latter because the sun does not appear to a person on the earth's surface so high as it is in reference to the centre of the earth; the horizontal parallax is only nine seconds in the winter of the northern hemisphere, when the earth is nearest the sun. A table is usually arranged for refraction, minus the sun's parallax; in one such table the altitude 58° 32′ 33″ requires a correction of 31 seconds—always minus. The result will be the sun's true altitude, which taken from 90° gives the sun's zenith distance 31° 27′ 58″, the sun being thus much south of the observer when on the meridian. By the *Nautical Almanac* it will be seen that the sun's declination at apparent noon at Greenwich on May 10th was 17° 39′ 57″ N., increasing 39″ hourly. As the ship is in 7° W. long. nearly, the meridian passage was 28^{m} later, and about 18″ must be added. This is of importance when the difference of longitude is great, as Greenwich time must always be found within a few minutes. The observer having found the distance he is north of the sun, and also that the sun is 17° 40′ 15″ north of the equator, the sum, or 49° 8′ 13″, will obviously be his distance from the equator, which is the latitude.

Finding the latitude by a meridian altitude of a star differs from a similar operation for the sun only in so far as there is no semi-diameter or parallax to be applied. Star observations are of great value after the sun has been obscured for one or more days, for which reason a navigator should know all the principal stars, so as to recognize them during a very partial clearance of the sky. The *Nautical Almanac* gives the positions of all the principal fixed stars. The apparent right ascension of a heavenly body is its angular distance from the true equinox,—expressed by the abbreviation R.A. Sidereal time, given in page ii. of each month in the *Nautical Almanac* for mean noon each day, is the angular distance between the mean or imaginary position of the sun and the true equinox. Declination is the distance from the equinoctial or celestial equator. Mean time is that shown by a good clock, regulated upon the supposition that every day is of equal duration. Apparent time has reference to the time actually occupied by the sun between successive transits over any meridian. Equation of time is the difference between mean and apparent time. Sidereal time is measured by the transits of a star over any meridian. See ASTRONOMY.

To find the time that any star will pass the meridian, subtract the sun's R.A. from that of the star; or, in other words, find their distance apart as expressed in time by R.A. As an instance, on May 10, 1882, between 7 and 8 P.M. the sun's R.A. was $3^{h}\ 10^{m}$ and that of α Ursæ Majoris $10^{h}\ 56^{m}$; consequently the star will pass the meridian of the ship in 7° W. at $7^{h}\ 46^{m}$. The knowledge of the longitude is only necessary for finding the Greenwich time (G.T.) and the sun's R.A. The same night, the R.A. of Vega (α Lyræ) being $18^{h}\ 33^{m}$ and that of the sun $3^{h}\ 11^{m}$, the star was $15^{h}\ 22^{m}$ after the sun, and would pass the meridian about $3^{h}\ 22^{m}$ A.M. of next day. To know which suitable star will pass the meridian after a certain hour, add that hour to the sun's R.A., the sum will be the R.A. of the meridian (decreased by twenty-four hours if necessary); the star table will then show the stars of that or greater R.A. Thus, on October 2, 1882, in 160° E. long., which bright star will pass the meridian after 10 P.M.? The difference of longitude in time being $10^{h}\ 40^{m}$ E., when the sun has passed the meridian ten hours it will evidently be forty minutes before noon at Greenwich, therefore the sun's R.A. will be $12^{h}\ 33\frac{1}{2}^{m}$ at the time named. As it will be 10 P.M. at ship, the R.A. of any star then on the meridian must be ($12^{h}\ 33\frac{1}{2}^{m} + 10^{h}$) $22^{h}\ 33\frac{1}{2}^{m}$. The first bright star found in the table having greater R.A. is Fomalhaut (α Pis. Aus.), the R.A. of which is $22^{h}\ 51^{m}$, which is seventeen minutes more than the time sought; consequently that star will pass the meridian of the ship at 10.17 P.M., and Markab (α Pegasi) eight minutes later. Another ship on the same day being in 90°—6 hours west, the sun's R.A. at her 10 P.M. would be $12^{h}\ 36^{m}$, and Fomalhaut would pass her meridian at 10.15 P.M., two minutes earlier by apparent time; the difference is due entirely to the change in the sun's position. All doubt will be removed, when finding the approximate time of a star's transit, if it be remembered that the sun (from which we reckon apparent time) indicates a position the R.A. of which is known; therefore by adding any time which it may have passed the meridian the R.A. of another meridian in the sky is obtained, called the R.A. of the meridian at that moment.

Having the true altitude of a star, and thus the Z.D. (zenith distance), we can determine the latitude without risk of mistake by remembering that the declination in the heavens corresponds with the latitude on the earth; therefore a star will pass the zenith of every place whose latitude corresponds with its declination. If a star having north declination passes south of the observer, the zenith distance must be added to the declination, as the latitude is then the greater. If such a star pass north of the observer, his north latitude will be less than the star's declination, and the difference will be the latitude. The reverse holds good if the star has south declination and the observer is north of the equator. An old rule is also useful and simple:—If the zenith distances be invariably marked north or south according as the observer is north or south of the object observed, and the declination placed under it marked north or south, add like signs and take the difference of the unlike; the latitude will take the name of that which preponderates.

The oldest of all nautical observations is that of taking the height of the pole-star,—a star which everybody should know whether at sea or on shore. If it were exactly at the pole the corrected altitude would be the latitude, but it is not so. During 1882 its mean declination has been 88° 41′, therefore it describes a diurnal circle round the pole with a radius of seventy-nine minutes. It was once far from the pole, and now advances nearly nineteen seconds annually. The mean R.A. has been during 1882 about $1^{h}\ 16^{m}$, increasing about 28^{s} annually. The time it passes the meridian above and below the pole can be found as has been before described; and 1° 19′ being subtracted from the upper transit or added to the lower one will give the latitude. The great consideration attached to the pole star is in consequence of the facility it affords, with very little calculation, for finding the latitude at all times when the star and horizon are visible. It is necessary to know the time at ship to the nearest minute. Apparent time is invariably kept on board ships at sea, corrected at noon each day. The change of longitude since noon must be roughly worked up in order to find the correct apparent time at ship, also the Greenwich time within half an hour, for the purpose of finding from the *Nautical Almanac* the sun's R.A. at that time, which added to the time at ship will give the R.A. of the meridian, rejecting twenty-four hours if necessary. With all nautical tables there is one for finding the latitude by the pole star, in which the correction is given for every ten minutes.

Enter the table with the year and R.A. of meridian. Opposite the latter, or by proportion, will be found a correction + or − to be applied to the true altitude; the result will be the latitude.

The principle of this table is that when the R.A. of the meridian coincides with that of the star the whole mean distance of the star from the pole for that year must be subtracted, while if the two R.A.'s differ by exactly twelve hours the same distance must be added, as the star is then on the meridian below the pole. If the star is six hours from the meridian on either side no correction is necessary. At other points the correction varies as the cosine of the time angle between the pole star and the meridian. Thus the R.A. of the pole star being $1^{h}\ 16^{m}$ for 1882, and distance 79 minutes, the correction corresponding to five hours is thus found:

$$5^{h} - 1^{h}\ 16^{m} = 3^{h}\ 44^{m}. \qquad \frac{79 \times \cos 3^{h}\ 44^{m}}{\text{rad.}} = 44'\ 10''.$$

(Multiply the decimals taken from the logarithms of numbers by six, to bring them into seconds.) As the star was less than six hours past the meridian the correction is −. A similar calculation having been made for every ten minutes of one quadrant, the result may be applied inversely to the one below it, and the remaining twelve hours written on the opposite side of the page with the sign + or − the reverse of the first column.

It is evident from the above that the table may be easily dispensed with; also, as annual tables must be founded on the mean position of the star during that period, greater accuracy would be obtained by taking the R.A. and declination for the day required from the *Nautical Almanac*, and finding the corrections as above.

A table for finding the latitude by the pole star when off the meridian is also given in the *Nautical Almanac* with instructions. It is used with sidereal and mean time; also an allowance is made for the spheroidal figure of the earth. When the latitude found by any star observation at sea is within one mile of the truth it may be considered satisfactory.

Latitude by the meridian altitude of the moon is obtained in a manner similar to that applied to the sun, but not so simple. First it is necessary to ascertain the approximate time of transit, by reference to p. iv. of each month in the *Nautical Almanac*. It is there given in mean time both for Greenwich and the antipodes; to one of those periods apply the proportion due to the ship's longitude in time. It is necessary to guard against a false horizon often produced by clouds under the moon. Having obtained the meridian altitude, correct for errors of instrument and dip. From *Nautical Almanac*, p. iii., take the moon's semi-diameter (calculated from the centre of the earth) for the nearest noon or midnight, augmenting it by a table for the purpose, as it increases with the altitude (only a few seconds); add it if the lower limb were observed, and subtract the refraction due to that altitude. Take from the *Almanac* the horizontal parallax for the time of observation, correcting it for decrease in proportion to altitude by a table for the purpose, and add it to the apparent altitude. Tables generally give the parallax due to altitude, minus refraction, in one correction. Having the true altitude, take it from 90°, and mark the zenith distance N. or S. as it is north or south of the moon. Take the declination for the nearest minute of Greenwich time. It is now given for every hour (mean time), and the change in ten minutes. Place the reduced declination marked N. or S. under the zenith distance; add if the signs are like, or take the difference if unlike, and the result will be the latitude.

Ex-meridian Altitudes.—It is important to be able to get the latitude when the sun may have been obscured from a few minutes before noon till some minutes after. Such observations near the meridian are called ex-meridian altitudes. When the sky is cloudy the observer should keep the watch in hand in order to secure the apparent time with the altitude nearest the meridian. If the sun be rising fast or declining fast, it will be better to work the sight with two latitudes, and with the assistance of the chronometer, as described below. In a low latitude and less than half an hour from noon, the pamphlet by J. T. Towson, containing tables for the reduction of ex-meridian altitudes, will be found very useful, as the correction or allowance for what the sun would further rise (or had risen) can be taken out entirely by inspection, which saves the labour of working four propositions. The principle is illustrated by fig. 16, which is projected with double the angle at P in order to make it more

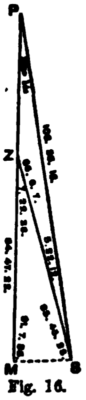

Fig. 16.

intelligible. PS represents the sun's polar distance when observed, and M his position when he reaches the meridian. Consequently PS and PM are sides of an isosceles triangle, having the distance between the two positions as a base, and equal angles since the sides are equal. The thing sought is the length of ZM, or where PM is to be divided at noon; the lower part being the true zenith distance and the remainder co-latitude. The data are the same as those in Towson's first example, which he there solves by his table only. Time from noon $28^m\ 14^s$; sun's true altitude 24° 53′ 53″, and declination 18° 35′ 16″ S: to find the angles at the base we use the supplements of the legs, and get sec 71° 24′ 44″ (180° − 108° 35′ 16″) × cot ½P[$=14^m\ 7^s$] = tan 88° 52′ 25″, the supplement of each angle at the base; and

$$\frac{\sin ZS\ 65^\circ\ 6'\ 7'' \times \sin PS\ 108^\circ\ 35'\ 16''}{\sin P\ 28^m\ 14^s} = \sin PZS.$$

As PZS is very obtuse, and the supplement is really required, it is taken out at once as the sine of 7° 22′ 38″, which is the angle MZS. The angle PSZ is next found; it is between two known sides, and the other angles are known, but not the opposite side:—

$$\frac{\cos \tfrac{1}{2} \text{ sum of sides} \times \tan \tfrac{1}{2} \text{ sum of angles}}{\cos \tfrac{1}{2} \text{ diff. sides}} = \cot \tfrac{1}{2} PSZ,$$

which is 5° 22′ 12″; taking this from PSM 91° 7′ 35″, we have the angle ZSM 85° 45′ 23″. Finally,

$$\frac{\sin ZS \times \sin ZSM}{\sin ZMS} = \sin ZM\ 64^\circ\ 47'\ 22'',$$

the true meridional zenith distance, which taken from the polar distance gives co-latitude 43° 47′ 54″, showing that the sun was 18′ 45″ higher when on the meridian. When the sun is on the equator, both the angles at the base are 90°, and the base MS will be the measure of the angle MPS. Norie's method is short, but the latitude by dead-reckoning is used, which may cause the whole operation to be repeated. Also the use of a "log-rising" and natural versed-sines is objectionable. No one possessing a copy of Towson's table need take the trouble to work the problem when in actual want of the latitude.

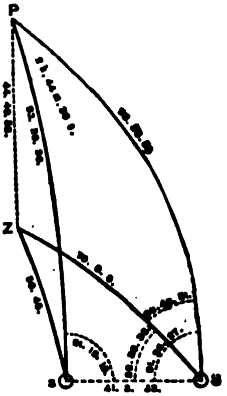

Fig. 17.

Double Altitudes.—Another mode of obtaining the latitude is by two altitudes of the sun or a star, with the interval between the observations carefully noted, or by simultaneous altitudes of two stars having a suitable difference in bearing. These are called "double altitudes." The principle is the same in each case. The elapsed time in the one and the difference between the right ascensions in the other indicate the angular distance at the pole. Fig. 17 represents two observations of the sun on the same side of the meridian,—the dark lines showing the parts which are given and the dotted lines those which are to be found.

On October 2, 1882, the estimated latitude was 45° 10′ N. and longitude 35° 30′ W. The first altitude was taken about 8.18 A.M. apparent time, and when corrected for errors of instrument, dip, refraction, and parallax was 20°. The second altitude, corrected, was 39° 15′, taken about 10.58 A.M. The elapsed time by a good watch was $2^h\ 44^m\ 33^s$, which being mean time is reduced to apparent time by adding the proportionate increase in the equation taken from the *Nautical Almanac*, which for 2¾ hours will be two seconds additive. Therefore the change in apparent time was $2^h\ 44^m\ 35^s = SPs$.

Each altitude taken from 90° will give a zenith distance, 70° and 50° 45′ respectively = ZS and *Zs*. Having the apparent time at ship and the longitude, which converted into time will be $2^h\ 22^m$, we take the declination of the sun from the *Nautical Almanac* for apparent noon and correct it for the Greenwich time of each observation, obtaining 3° 36′ 56″ S. and 3° 39′ 36″ S. Those amounts added to 90° will give the sun's polar distance at each period = PS and P*s*. Thus four sides and one angle are known, which is all that is required to find the complement of the latitude PZ.

We shall work out this by the most simple method, in order to show the principle upon which it is done. First, in the triangle *s*PS two sides and the included angle are given, required the other two angles. Add together the sides P*s* (93° 39′ 36″) and PS (93° 36′ 56″), and find their half sum and half difference:—

$$\frac{\sin \tfrac{1}{2} \text{ diff.} \times \cot \tfrac{1}{2} P}{\sin \tfrac{1}{2} \text{ sum}} = \tan \tfrac{1}{2} \text{ diff. of other angles} = 0^\circ\ 3'\ 36'';$$

$$\frac{\cos \tfrac{1}{2} \text{ diff.} \times \cot \tfrac{1}{2} P}{\cos \tfrac{1}{2} \text{ sum}} = \tan \tfrac{1}{2} \text{ sum of other angles} = 88^\circ\ 38'\ 9''.$$

The half difference taken from the half sum gives the smaller of the two angles = 88° 34′ 33″, and the two added give the greater. Had there been no change in declination, the two sides including the elapsed time would with the side S*s* form an isosceles triangle, and the first equation would be unnecessary.

As the two sides were each more than 90° the angles found are the supplements of those required. One is sufficient for the present purpose; 180° − 88° 34′ 33″ = 91° 25′ 27″, which is PS*s* opposite the larger side. That angle includes the two angles PSZ and ZS*s*, which must be separated in order to obtain PSZ. The side S*s*, which is the spherical distance between the two positions of the sun, is given by the equation

$$\frac{\sin Ps \times \sin sPS}{\sin PSs} = \sin Ss\ 41^\circ\ 3'\ 33''.$$

In the second part of the problem three sides are given to find an angle, namely ZS*s*. Write under each other the values of the two sides (SZ and S*s*) enclosing the required angle and also the opposite side Z*s*. Find the half sum of the three sides and the difference between it and the opposite side (Z*s*). Add together the logarithm cosecant of the first two and logarithm sine of the last two; half the sum of those four logarithms (rejecting twenty from the index) will be the log. cosine of half the required angle. Thus ZS*s* = 52° 36′ 36″, which taken from PS*s* will leave 38° 48′ 51″ as the angle PSZ. The third part is similar to the first,—two sides and an included angle given, to find the rest, principally the side PZ:—

$$\frac{\sin \tfrac{1}{2}(PS - ZS) \times \cot \tfrac{1}{2} PSZ}{\sin \tfrac{1}{2}(PS + ZS)} = \tan \tfrac{1}{2}(SZP - ZPS)\ 30^\circ\ 24'\ 21''.$$

A similar statement using two cosines instead of sines will give the half sum of the angles = 87° 3′ 51″. By subtracting the half difference the smaller angle is obtained, ZPS = 56° 39′ 30″, which by the figure should evidently be placed opposite ZS. Finally,

$$\frac{\sin ZS \times \sin PSZ}{\sin ZPS} = \sin PZ\ 44^\circ\ 49'\ 58'',$$

which is the complement of the latitude 45° 10′ 2″. If the first observation of the sun had been used to find the longitude by chronometer (the ship being stationary between the observations) the hour angle would coincide with the angle ZPS, and afford a test of its correctness. Simultaneous observations of two stars would be worked in a similar manner, with the advantage of having the difference of R.A., SP*s*, the spherical distance S*s*, and the angles at S and *s* nearly permanent (requiring only a slight annual correction), consequently that part of the calculation might be used many times. Kerigan's tables have been mentioned as giving the distances between the principal stars for this purpose. When two altitudes are taken of the same star, the interval by a watch keeping mean solar time must be reduced to sidereal time, as the stars pass the meridian quicker than the sun by $9^s \cdot 8$ per hour.

The above illustration has been treated as if the ship were stationary, which at sea would seldom be the case. The bearing of the sun or star should be taken at the time of the first observation, and the run of the ship should be worked with reference to that bearing and also with regard to the change in longitude. Every mile which has been made good in a direct line towards the sun must be added to the first corrected altitude; if from the sun, it is subtracted. For every mile of longitude four seconds must be subtracted from the elapsed time if the ship ran west or added if she ran east. The result will then be the same as though the ship had been stationary at the place of the second observation.

Had the observations been taken on opposite sides of the meridian the calculations would be similar to the above, and the figure would differ only in having the triangle P*s*Z folded over, as it were, to the opposite side of the central line.

Other Double Observations.—The double altitude, though a very interesting problem in connexion with navigation, is at the present day of very little practical utility. When ships are provided with chronometers both latitude and longitude can be found more readily by two distinct observations of any of the heavenly bodies on different bearings. To find the longitude by means of a chronometer and also the variation of the compass should be one combined operation under ordinary circumstances, therefore they will be described together. It is desirable that every navigator should accustom himself to act independently of an assistant. A pocket-watch with a distinct second hand being taken to the chronometer, the hours and minutes about to be shown by each may be noted in the "deck-sight book," and if the observer then counts the half-second beats of the chronometer for five seconds previous to the even minute, the tenth beat will answer the purpose of the word "top" of the assistant, and more correctly. Let a similar comparison be made after the sights have been taken, and if there be any difference adopt the mean, or proportion. Take one or three bearings of the sun's centre with the azimuth or standard compass in its usual place, noting the time, and then take three or five altitudes of the sun's lower limb. The watch being held in the palm of the left hand, the fingers are free to move the tangent screw till the moment the contact is formed between the sun's reflected image and the edge of the horizon, when the eye is dropped from the telescope of the sextant to the face of the watch, and the second or even the half second noted; the minutes should be written before commencing, and seen to be correct on finishing the set. Take bearings again of the sun as before, noting the time. Make the mean of the sun's bearings correspond with the mean of the time of sights (*i.e.*, the sun's altitudes).

On October 17, 1882, about 8.24 A.M. apparent time, in 38° 15′ N. and 6° 50′ E., observations were taken to ascertain the longitude and variation of the compass. The mean of the times by watch when the altitudes were taken was $8^h\ 25^m\ 35^s{\cdot}5$. The result of comparison between the watch and chronometer was $-\ 7^m\ 14^s$, the negative sign meaning that the watch was faster than the chronometer. The latter was known to have been fast on that day $36^m\ 3^s$. Therefore, both those amounts being subtracted, the mean time at Greenwich was $7^h\ 42^m\ 18^s{\cdot}5$. The mean of five observations of the sun's lower limb was 20° 42′ 30″. The corrections were index error + 2′; eccentric error (in proportion to altitude) − 15″; dip of the horizon corresponding to the height of eye, 24 feet, − 4′ 50″; sun's semidiameter + 16′ 5″; refraction, minus parallax, − 2′ 22″; hence the true altitude of sun's centre was 20° 53′ 8″ and zenith distance 69° 6′ 52″. The sun's declination is more conveniently taken from the *Nautical Almanac* for mean noon, as the mean Greenwich time is always known by the chronometer, but the hourly variation is given on the opposite page. Thus, on the day in question, 9° 19′ 29″ S., having been corrected for $4^h\ 18^m$ before mean noon, gave 9° 15′ 33″ as the sun's declination at the time of observation. We have now to find the hour angle and azimuth from three sides:—viz., co-latitude 51° 45′, co-declination or sun's polar distance 99° 15′ 33″, and the zenith distance 69° 6′ 52″ (fig. 18). For convenience let these be placed under each other as mentioned, take their sum and half sum (110° 8′ 42″); also the difference between the half sum and the side opposite the required angle, the zenith distance, = 40° 56′ 50″. Add together the logarithm cosecant of the first two and logarithm sine of the last two, remembering that when the degrees exceed ninety the supplement must be used, or the amount over 90° with reverse term. Half the sum of those four logarithms, rejecting twenty from the index, will be the cosine of half the angle required ($3^h\ 35^m\ 48^s{\cdot}4$), the time from noon. This is the principle upon which the angle is found, but it is rather quicker to use the latitude and declination direct. Write the latitude, declination, and zenith distance under each other, marking the declination + if on the contrary side of the equator to the latitude, and − if they are on the same side. In the present instance the latitude being N. and declination S. the latter is additive. Take the difference between the half sum and the zenith distance, that still being the side opposite the required angle. Add together the secant of latitude, secant of declination, sine of half sum, and sine of difference; the sum of those four logarithms, rejecting twenty from the index, will be the sine of half the hour angle, $1^h\ 47^m\ 54^s{\cdot}2$. That being doubled and taken from twelve hours shows that the apparent time at ship was $8^h\ 24^m\ 11^s{\cdot}6$. The equation at mean noon was $14^m\ 35^s{\cdot}1$, the correction for four hours and eighteen minutes before noon was $-\ 2^s$; leaving $14^m\ 33^s{\cdot}1$ to be subtracted from apparent time (as the sun was then in advance of a mean clock). The result for ship mean time is $8^h\ 9^m\ 38^s{\cdot}5$, the difference between which and the Greenwich mean time as found by the chronometer, $27^m\ 20^s$, is the longitude in time = 6° 50′, and it is east, because ship time is the greater. The azimuth would in practice be partly sought at the same time as the hour angle; as the sine of the polar distance or cosine of the declination can be taken at the same opening of the tables where the cosecant or secant was found. We have then

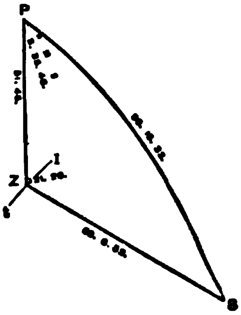

Fig. 18.

$$\frac{\sin P \times \sin PS}{\sin ZS} = \sin Z,$$

the sun's azimuth or angle from north, observing that when the angle is more than 90° the supplement is found opposite the log. sine, and the amount over 90° opposite the cosine. Thus

$$\frac{\sin P\ 3^h\ 35^m\ 48^s \times \sin 80^\circ\ 45' \text{ (or } \cos 9^\circ\ 15')}{\sin ZS\ 69^\circ\ 7'} = \sin 58^\circ\ 40',$$

which is the supplement of PZS, and therefore reckoned from the south, which in this instance is most convenient, as the mean of bearings taken of the sun, by the standard compass, immediately before and after the altitudes for time, was S. 43° 30′ E., which taken from the sun's true bearing S. 58° 40′ E. showed an error of 15° 10′ westerly,—that is, that the north point of the compass was so much to the westward of the true north. It is unnecessary to reckon seconds of angle in an azimuth. It is always necessary to note the direction of the ship's head at the time of observation, as there is in general an amount of local deviation caused by the iron in the ship. In the instance given the ship's head was W.N.W., on which point, as previously ascertained, the local deviation was 2° westerly; consequently the variation of the compass when freed from the ship's influence was 13° 10′ westerly.

When it is desirable to take an azimuth without finding the hour angle as above, there appears no clearer or better mode than that of treating it as a spherical triangle in which the three sides are given to find the angle opposite the sun's polar distance.

From the above example take the zenith distance, co-latitude, and polar distance; place the degrees and minutes only under each other in the above order; take the difference between their half sum and the polar distance, which will be 10° 48′. Add together the logarithm cosecant of the first two terms and the logarithm sine of the last two; half the sum of those four logarithms will be the cosine of ½PZS. Thus PZS = 60° 40′ × 2 = 121° 20′. This is evidently from north, consequently the supplement is S. 58° 40′ E. as before. It is sometimes necessary to have recourse to this mode of finding the sun's bearing even when the hour angle is known, as it may be difficult to decide which side of the east or west line the sun may be upon when the angle is near 90°. As the last method brings out the angle in two halves there can be no mistake.

Position by Cross-Bearings of the Sun.—The most practical method of obtaining the greatest amount of information and immediate benefit from observations similar to those just described is by laying off the position on the chart (especially if it be on a large scale), using the estimated latitude by which the sights were worked, and the longitude found by the chronometer, the accuracy of which depends on that of the latitude. Through that position draw a line at right angles with the sun's bearing; in the above instance it would run N. 31° 20′ E. and S. 31° 20′ W. Though the latitude were wrong by many miles, the ship would, if all else were correct, be somewhere on that line. For the line thus drawn corresponds to a small arc *tI* in fig. 18, drawn at right angles to ZS, and all positions for which the sun's zenith distance = ZS lie on that arc.

As an illustration, suppose that the above sights were worked by a dead-reckoning latitude, which the next observations about $10^h\ 14^m$ will prove to be 17 miles too far south. The ship sailed during the interval W.N.W. 15 miles, wind south, leeway half a point, variation + 13° W., and local deviation − 2° W. Hence the true course was N. 77° W., which by inspection, under distance 15, gives diff. lat. 3·4 +, and dep. 14·6. The latter opposite the complement of the latitude (38°) gives 18′·5 in the distance column, which is the difference of longitude, subtractive as it was westing and the longitude was east. The latitude was then assumed to be 38° 18′ 24″ and longitude 6° 31′ 30″. Draw the bearing taken at $8^h\ 24^m$ through the newly found point, which will represent the line the ship was on at $10^h\ 14^m$. Five observations of the sun were then taken, and the mean of the times by watch was $10^h\ 17^m\ 39^s$; the comparison showed $-\ 7^m\ 16^s$, and the error of chronometer (fast) $-\ 36^m\ 3^s$. Greenwich mean time was $9^h\ 34^m\ 20^s$. The equation was at that time $14^m\ 34^s$ + to mean time, and the corrected declination was 9° 17′ 15″ S. The mean of the altitudes when corrected gave a true zenith distance of the sun's centre 53° 39′ 52″. All the data are thus given to find the hour angle as before described = $1^h\ 46^m\ 20^s$, and apparent time at ship, $10^h\ 13^m\ 40^s$; subtract the apparent time at Greenwich, $9^h\ 48^m\ 54^s$; the difference, $24^m\ 46^s$, is the longitude in time, = 6° 11′ 30″ E.

As the longitude carefully worked up from the former sights appeared to be 6° 31′ 30″, it is evident they have both been worked by an erroneous latitude, which is easily discovered.

The sun's bearing was not taken at the time of the second set of observations, as it was too high for accuracy, but the true bearing was calculated as before described and found to be S. 33° 15′ E., a right angle to which was E. 33° 15′ N. If a chart on a sufficiently large scale be in use (or if one of similar latitude can be substituted) the most simple mode is to lay down the two positions (as A and B, fig. 19) on the same parallel and draw the two lines through them, as Ax and Bx. The point of intersection will be the ship's true position, which can be proved by working the second set of observations again with the corrected latitude. If the chart be too small,

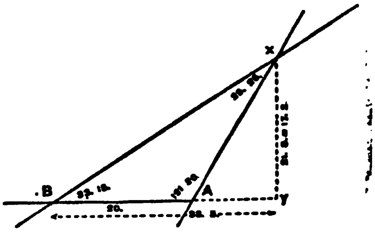

FIG. 19.—Cross bearings of the sun.

the diagram can be made on a piece of paper, the difference between the two longitudes being laid off from any scale of equal parts; *e.g.*, BA is made to measure 20 and becomes the scale for the remainder of the figure. The lines at right angles from the sun's bearing intersect at *x*, whence a perpendicular drawn with the protractor will give *y* on the base line. Then B*y* is the total error in longitude to be applied to that found by the second observation, in this case 33′·3, which added to 6° 11′ 30″ gives 6° 44′ 48″. The perpendicular *xy* represents the error in latitude, and would be correctly measured on the side of the chart as 17·2. But from the plain paper the numerical measurement would be too great in the ratio of the difference of longitude to the departure.

The measurement of *xy*, on the scale BA = 20, would be 21·8. By inspection (in traverse table) distance 21·8 opposite co-latitude 38° is found to give departure 17·2, which in this instance will represent the miles of latitude increased in size to suit the miles of longitude upon which the diagram is formed. That is the required correction to be added to the latitude assumed at the time of the second observation, and will give 38° 35′ 36″ as the true latitude at that time. The same corrections may be found arithmetically by plane trigonometry, in which case it will be desirable to draw a rough figure showing how the lines cross. This mode of correcting the latitude admits of easy proof; by working the second set of sights with the latitude increased by 17′ 12″, the longitude will come out 6° 45′. Another good practical method is to work each set of sights by two latitudes, 10 or 20 miles apart. The logarithms can be taken out for the two with little more trouble than one, and they form a check on each other. When the two sets of sights are not worked by the same latitudes, but by latitudes in accord with each other by allowing for the run of the ship during the interval, and when the change of longitude due to 10 miles of latitude is known, the true position can be found by placing equivalent proportions under the first longitude brought forward and the second as found, till they agree.

By such double observations H.M.S. "Devastation," in January 1847, was enabled, after having been set by current 28 miles past Goree, to which she was bound, to alter course at 11 A.M. instead of increasing her distance by another hour's steaming.

By this method the greatest accuracy of position may be maintained throughout the day and night, if the horizon be clear. The one line is very useful though the other may never be obtained, which is not so with the double altitude, where nothing is known till the whole calculation is completed.

In high latitudes during the winter the sun is of little use in finding the longitude; bright stars and planets must be used, taken near twilight when the horizon is clear, and also when they are near east or west if longitude only is required, and with sixty to ninety degrees difference in bearing at other times.

The only difference in the treatment of stars and planets from the treatment of the sun when finding the longitude consists in applying the difference of their right ascensions and that of the sun, reduced to the time of observation in order to obtain apparent time at ship, and from it mean time, to compare with that shown by the chronometer as Greenwich mean time. A mistake in the manner of applying the difference in right ascension to the hour angle found by a star is less likely to occur in actual practice than in a problem taken for exercise. The stars may be considered as marks in the heavens which pass the meridian so many hours and minutes after the sun, until it becomes more convenient to reckon how much they are before the sun,—remembering that, as the sun moves from west to east among the stars at a mean rate of nearly one degree or nearly four minutes of time daily, its right ascension must be carefully noted. It has been attempted to find the longitude by marking the time of sunset, without the aid of any instrument except the chronometer, but this process is very rough on account of the uncertain amount of refraction; and if the lower limb is allowed to touch the bright reflexion which appears to rise to meet it, the correct angle will be lost, as the centre of the sun will then be about 18 minutes below the horizon, in addition to the "dip of the horizon."

Lunar Observation.—The moon is the least serviceable of all the heavenly bodies for the purpose of finding apparent time at ship and longitude by chronometer, in consequence of its rapid motion entailing more care in the corrections, though the *Nautical Almanac* gives its place with great accuracy for every hour, and the variation in ten minutes. That rapid and uniform motion rendered it the most valuable and at sea the only means of ascertaining the longitude after the construction of almanacs, and before the present perfection of chronometers. In presence of the latter lunar observations have fallen into the shade, and like double altitudes are found principally in examination papers. As the moon passes the stars at the mean rate of 33″ of angle in one minute of time, it is obvious that an error to that amount in measuring the distance from a star would produce an error of 15 miles in longitude. As the moon's motion with regard to the sun is nearly one degree a day less, a similar error in the distance would produce still more effect.

The *Nautical Almanac* gives the true distance between the centre of the moon and the sun while within range by the sextant, as it would be seen from the centre of the earth; and in like manner the distance from some of the principal fixed stars and planets, for every three hours of Greenwich mean time, with the proportional logarithm of the change in that time. It is essential that the star from which the lunar distance is measured should be near the ecliptic, in order to obtain the greatest amount of change. If the star is quite in the path of the moon the distance may be small, when the measurement will require less steadiness.

We take a star lunar as an example, which will introduce the problem of finding the time at ship by a star (fig. 20). On November 18, 1882, about 9 P.M. apparent time, the ship was in 38° 10′ N. and 45° 15′ W. by dead-reckoning; height of the eye 20 feet. There was not a chronometer on board. An assistant was employed to show a light on the arc of the sextant, to take time, and to write down; consequently the same sextant was used. An altitude of the moon's lower limb was taken before and another after the other observations, and the mean was reduced by proportion to what it would have been if observed at the same instant as the mean of the distances, namely 35° 15′. Two or more altitudes of Aldebaran were taken before the distances and as many after, the mean of which when reduced to the same instant was 35° 6′. The mean of several measurements of distance from the moon's farthest limb was 94° 40′ 18″. The index correction was + 1′ 20″, eccentric error − 2′ 9″, semidiameter at midnight was 16′ 9″, which was augmented by 9″ (taken from a table) in consequence of the moon being nearer the observer as it approaches the zenith. As the farthest side of the moon was used, the augmented semidiameter was subtracted. The corrected observed distance was then 94° 23′ 11″.

The observed altitude of Aldebaran was 35° 6′, index correction + 1′ 20″, eccentric − 25″, dip of the horizon − 4′ 24″; giving apparent altitude 35° 2′ 31″ and Z.D. 54° 57′ 29″. Apply refraction − 1′ 23″; then the true altitude is 35° 1′ 8″ and true Z.D. 54° 58′ 52″. Add the difference between latitude 38° 10′ N. and declination (from *Nautical Almanac*, p. 327) 16° 16′ 21″ N. to true Z.D. 54° 58′ 52″, and note the difference betweeen the half sum and the true Z.D. Add together the logarithm secants of latitude and declination and logarithm sines of half sum and difference; half the sum of the four logarithms will be the logarithm sine of half angle SPZ = $3^{h}\ 51^{m}\ 43^{s}{\cdot}8$, which is the time the star was east of the meridian. By adding the longitude in time to the time at ship it will appear that Greenwich apparent time was about midnight, when the sun's right ascension was $15^{h}\ 37^{m}\ 6^{s}$. That of the star being $4^{h}\ 29^{m}\ 14^{s}$, it is evident that the star would pass the meridian $11^{h}\ 7^{m}\ 52^{s}$ before the sun, and $12^{h}\ 52^{m}\ 8^{s}$ after it. The latter is more suitable at present. Taking the time the star is from the meridian from the time it is after the sun, it is seen that the sun had passed the meridian $9^{h}\ 0^{m}\ 24^{s}{\cdot}2$, therefore that is the true apparent time at ship, provided the latitude was correct by which it was found. Hence the necessity of choosing a star when nearly east or west. The equation of time taken from the *Almanac* and reduced to apparent midnight was $14^{m}\ 32^{s}{\cdot}5$, and the result was ship mean time = $8^{h}\ 45^{m}\ 51^{s}{\cdot}7$.

The altitude of the moon's lower limb was 35° 15′, index correction + 1′ 20″, eccentric error − 25″, dip − 4′ 24″, semidiameter + 16′ 9″, augmentation 9″; giving apparent altitude 35° 27′ 49″ and apparent Z.D. 54° 32′ 11″. To the latter add the refraction 1′ 22″, and subtract the parallax due to altitude, 48′ 12″. The result is true Z.D. = 53° 45′ 21″. The horizontal parallax is the angle at the centre of the moon subtended by the semidiameter of the earth, and the parallax due to any altitude of the moon (that is, the amount by which the apparent altitude would increase if the observer were sunk to the centre of the earth) is given by the equation—

$$\frac{\text{hor. parallax in seconds} \times \text{cos of ap. alt.}}{\text{rad.}} = \text{parallax in alt.}$$

It must always be added to the apparent altitude. With all navigation tables there is one for reducing the parallax, sometimes to every two minutes in altitude. The refraction is then included in the correction.

The most important part of this problem is finding the true distance between the star and centre of the moon at the moment of observation, from the data already obtained; it is confined to the triangle ZSM (fig. 20). The two apparent zenith distances 54° 57′ 29″ and 54° 32′ 11″ with the apparent distance (that is, as measured) are drawn to scale, and from the three sides we find the angle MZS = 127° 53′ 54″.

As the correction applied to the altitudes of moon and star on account of parallax and refraction were in a direction to or from the zenith, the angle between the two zenith distances will be unaffected by any change in the length of those legs. We have therefore the true zenith distances Z*m* 53° 45′ 21″ and Z*s* 54° 58′ 52″ with the included angle just found, to find the third side—a problem which has been already exemplified (see fig. 15 and the accompanying calculations).[1] The true distance being over 90° will come out as a small cosine, the change in which (at that angle) is only one unit in the sixth place of figures for seven seconds. It is desirable to avoid angles of this description, which can be done by dropping a perpendicular from Z to the required side *ms*, which would then be found in segments, by two right-angled spherical triangles, as exemplified with fig. 15. The sum of the two segments, 93° 48′ 36″, is ten seconds more than the result obtained directly from the oblique-angled triangle, and is more likely to be correct.

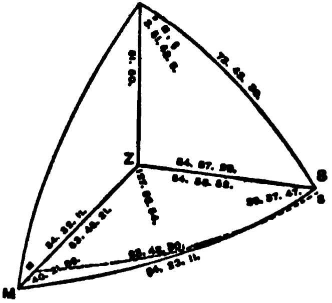

Fig. 20.

Take the true distance as 93° 48′ 30″, and find in the *Nautical Almanac* an approximate distance, which was 93° 40′ 45″ at midnight of the 18th; the difference is 7′ 45″. As the moon was approaching the star the greater distance was before midnight. There are tables of proportional logarithms arranged for finding readily the proportion which three hours or three degrees bear to any part of either, or one part to another. The *Nautical Almanac* gives after each distance the logarithm due to the amount of change during the next three hours, to four places of figures. As the distance in the present instance is so close to one of the periods, namely midnight, it is necessary to take the mean of the two logarithms before and after, which is ·2314. The difference between it and the logarithm for 7′ 45″ = 1·3659 is 1·1345, = 13^{m} 12^{s}·5; or it may be found by simple proportion. Greenwich mean time was therefore 11^{h} 46^{m} 47^{s}·5, and ship mean time as found by the star 8^{h} 45^{m} 51^{s}·5; difference 3^{h} 0^{m} 56^{s} = 45° 14′ W. long.

There are various graphic methods for finding the correction to the distance due to parallax and refraction, for which space cannot here be spared, as they are at best but approximations, and belong rather to the progress of the art. See Kelly's *Spherics*.

The moon is occasionally used for finding the longitude with the aid of a chronometer, and the method is then similar to that with a planet or star, except that the parallax is so great and the change in right ascension and declination so rapid that the greatest care is necessary in taking out the corrections to the nearest minute of Greenwich time. A star appears to be far preferable for the purpose. The horizon under the moon sometimes assumes a bright sharp appearance which appears tempting; but caution is necessary, as a bank of cloud below the moon sometimes cuts off the more distant part of the water and presents a false horizon.

It should be mentioned that extraordinary refractions sometimes occur in the daytime which make the horizon appear many minutes of angle higher than it really is. That has been observed in a very remarkable manner in the Baltic. The results of apparently good observations of the sun for the chronometer were found to be very erroneous, and, a short time after, the island Gottsko Sandö was seen presenting a second waterline above what had previously appeared to have been the horizon. On another occasion, April 21, 1854, the low islands and land east of Stockholm were seen from a distance of 12 miles as if inverted on the sky, presenting the appearance of level tableland, with dark cliffs, about half a degree above the horizon. On approaching, the upper line gradually disappeared, leaving the low islands covered with fir trees, in their natural state. It was calm at the time, and there was much ice in the Gulf of Bothnia. Fortunately such a state of the atmosphere is not frequent. In the *Standard* of August 12, 1882, mention is made of an extraordinary mirage at Alexandria on the previous evening, which caused the forts about Aboukir Bay, distant 15 miles, to be plainly visible.

Artificial Horizon.—The artificial horizon is a most useful contrivance whereby the effects of mirage or fog are avoided, but unfortunately it can only be used on solid ground, though many attempts have been made to overcome the effect of the ship's motion. The artificial horizon in common use is composed of a wooden or copper trough 5 or 6 inches long by 3 to 3½ inches broad and ½ inch deep. This being placed on a solid stone or hard ground, 100 yards from vehicular traffic, and at least 20 yards from foot passengers, mercury is poured into it from a small-necked bottle, till the bottom of the trough is covered. In pouring, the neck of the bottle should be kept well down in order to keep back the scum. A metal frame carrying two pieces of plate glass, which are fixed at 45° from the horizon, and at right angles to each other, is placed as a screen over the trough and mercury, to keep off the wind.[2] By this arrangement of the glasses forming the screen, the refractions which a ray of light suffers when passing obliquely through the glasses destroy each other. The observer may be seated close to the horizon if the sun or star be high, and the whole disk of the sun will be seen; but with a low altitude the image passes into the box so obliquely that the observer must place himself at a distance and be content with seeing the upper half of the sun's reflected image, to which is brought by the sextant the reflexion of the sun's lower limb. An object with less altitude than 6° or 7° cannot be taken, nor a greater angle than 60°. By using suitable shades the two reflected disks will appear so sharp that a very accurate contact may be made, and repeated as desired.

Rating Chronometers.—Observations in port with the artificial horizon are used to rate chronometers. For this purpose a good watch should be compared with each before leaving the ship, and immediately on returning. The angle measured by the artificial horizon must be halved, after instrumental corrections have been made, and from the altitude thus obtained the mean time at the place can be found just as at sea. But in the present case the longitude is known, and Greenwich mean time will be found from the local mean time by adding or subtracting the longitude in time, according as the latter is W. or E. The difference between it and the time shown by each of the chronometers at the same instant will be their errors, which taken from the last error found and divided by the number of days and fractions of days will give the rate. The errors of chronometers should be ascertained at every port, and every ten days if a ship remains long at one port. The results being tabulated, the character of a watch during a year can be seen at a glance.

Chronometers should be kept in a dry place and equal temperature, free from vibration, not too softly padded (for fear that the motion of the balance-wheel should be imparted to the body of the watch); and they should not be carried about for any purpose.

"Equal altitudes" is a term which signifies a mode of obtaining the time by means of altitudes of the sun or a star taken at each side of the meridian; it is more accurate in result than any other method, as all errors, personal or instrumental, are neutralised by the repetition, as are also errors in latitude. If the object observed were perfectly stationary with regard to the celestial concave, as a star may be considered to be, one-half the elapsed time added to the time of the first observation would be the time of transit; and, the difference between the star and sun in right ascension being applied to this, the apparent time at place would be obtained. The motions of the planets vary in amount, and must be treated accordingly. Jupiter's orbitual motion is so slow that the change during an interval of three or four hours may be disregarded, excepting where great accuracy is required.

When equal altitudes of the sun are observed, a considerable correction has usually to be made in consequence of the change of declination during the interval. Thus in the example illustrated by fig. 21, though the zenith distance was precisely the same before and after noon, the sun increased its distance from the pole, and instead of passing by the upper dotted line from S to *s* it is found to join the curve representing the zenith distance farther south, say at *d*. During three or four days at each solstice the change in declination is very slight, and may therefore be disregarded; also when the sun bears nearly east or west the change of a few minutes in declination will not affect the hour angle. If when on the meridian the sun be nearly vertical, and a sea horizon available, an altitude correctly timed ten minutes before noon and ten after will give the time of transit without any calculation.

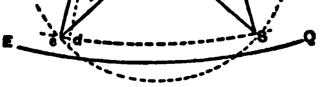

Fig. 21.

In order to secure a set of observations which shall have their mean exactly on either side the meridian, it is customary to fix the arc of the sextant in positions five or ten minutes apart (according to the motion of the sun, and whether the artificial horizon is used or not) in anticipation of the contact, calling "'top" when it takes place, and to repeat a similar operation in the afternoon with the same altitudes, but in the inverse order. It is more convenient to take the first set of sights, five or more, in the ordinary manner, that is, leaving the observer free to use the tangent screw and cry stop when he secures the contact. In the afternoon it will be desirable to begin a minute or two before the time for the greatest altitude, and to continue observations till past the lowest altitude of the forenoon. In other words, take one more at each end, the mean of which is likely to correspond nearly with the mean of the forenoon set. If desirable cut off one of the extremes and rectify any small disagreement by simple proportion till the exact altitude is obtained, with the equivalent time.

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[1] The corrected positions of the moon and star in fig. 20, and the dotted line representing the true distance, are not according to scale, as it would be impossible to draw lines fine enough.

[2] The older form of the artificial horizon, as described in Robertson's *Navigation* (1755), was a box placed on gimbals, containing 1 ℔ of quicksilver, with a parallel glass floating on it. It has been attempted to use a top with a polished plane surface rotating horizontally—which would remain steady on the principle of the gyroscope—as an artificial horizon on shipboard. An instrument of this kind, the invention of a Mr Serson, was described in 1752; and Brunel proposed a similar device to be used on the "Great Eastern."

Example (fig. 21).—September 9, 1882. On the Mole of Palermo, 38° 8′ 15″ N., 13° 22′ 50″ E. ($-53^{m}\,31^{s}{\cdot}3$), at 10 A.M. apparent time, the chronometer showed $9^{h}\,43^{m}\,15^{s}{\cdot}5$ as a mean when the five altitudes of the sun were taken by the artificial horizon, which gave a mean (after all corrections) of 47° 20′ 22″. Precisely the same mean of altitudes was procured in the afternoon when the chronometer showed $1^{h}\,42^{m}\,51^{s}{\cdot}2$. The chronometer was supposed to have been $39^{m}\,30^{s}$ fast on Greenwich mean time, gaining $1^{s}{\cdot}8$ daily.

This last information is only useful for reducing the equation of time and declination; it gives $9^{h}\,4^{m}$ (nearest minute) Greenwich mean time for the first and $1^{h}\,8^{m}$ P.M. for the second sight, or in Greenwich apparent time $10^{h} - \text{long. } 53^{m} - 9^{h}\,7^{m}$, and $2^{h} - 53^{m} - 1^{h}\,7^{m}$. The declination at apparent noon was 5° 15′ 52″ N., decreasing 56″·7 hourly, which for three hours less seven minutes before noon, gives a correction +2′ 48″; for one hour and seven minutes after noon it is −1′ 3″. The equation at apparent noon was $2^{m}\,46^{s}{\cdot}4$ (to be subtracted from apparent time), increasing $0^{s}{\cdot}85$ hourly, which for the above periods gives $-2^{s}{\cdot}4$ and $+1^{s}$.

The latitude, the reduced declination (marked − because it is on the same side of the equator as the latitude), and the zenith distance can now be used as in the calculation with fig. 18 to find the hour angle, or time from apparent noon. For the forenoon it is exactly two hours (10 A.M.); for the afternoon, the declination being 3′ 46″ less, the latitude and zenith distance the same as before, the hour angle will be $1^{h}\,59^{m}\,38^{s}{\cdot}8$.

In order to make the mode of arriving at the error of the chronometer perfectly clear, the figures will be given in full:—

	Morning.			Afternoon.		
Hour angle..................	2^{h}	0^{m}	0^{s}	1^{h}	59^{m}	$38^{s}{\cdot}8$
Apparent time................	10	0	0			
Equation......................	−0	2	44	−0	2	47·4
Mean time......................	10	57	16	1	56	51·4
Longitude......................	−0	53	31·3	0	53	31·3
Greenwich mean time.......	9	3	44·7	1	3	20·1
Chronometer No. 1 showed	9	43	15·5	1	42	51·2
Chronometer fast............	0	39	30·8	0	39	31·1

Here there is a perfect agreement in the result; as the chronometer was supposed to be gaining $1^{s}{\cdot}8$ daily, four hours would show an increase of three-tenths. As the altitude and latitude were assumed, they are necessarily faultless; but in actual practice such a result would rarely occur. The latitude of such a place as Palermo Mole, which was once used as a base from which to take chronometrical lines, is undoubted, but the error of one minute in the altitude would in this example produce a difference of fourteen seconds between the two results; the mean, however, would be quite correct.

There is no ambiguity in this mode of finding the errors of a dozen chronometers and of the sextant (if it has any) at the same time. The two separate sets of logarithms also afford a desirable check upon the work. The principal reason why ship's chronometers are not always rated in this manner is that double the boat-work is required, perhaps from a distance. Various shorter methods have been devised: Norie's is very short, but he uses a special table, with logarithms A and B, with rules respecting the correction being + or −; Inman's rule is very confusing.

Chronometers can be rated with greater ease by means of a transit instrument, but that does not come within the reach of an ordinary navigator; nor can telescopes be used on board ship to find the longitude by Jupiter's satellites, by occultations, or eclipses of sun or moon in a practical and satisfactory manner.

Variation.—The variation of the compass has been slightly touched upon when speaking of the most desirable mode of acquiring the longitude, altitude, and variation by the same daily observations. In addition to azimuths taken casually with reference to the direction of the ship's head, it is occasionally necessary to take a round of observations of some kind in order to test the change which altered circumstances have produced in the attraction of iron in the ship (compare METEOROLOGY, section on *Terrestrial Magnetism*).

The standard compass by which the ship's course is governed should always be placed in a position which is least affected by the ship's iron, and whence azimuths and all other bearings can be conveniently taken. Whenever an azimuth or amplitude is taken the direction of the ship's head should be noted and logged with the variation. The most simple mode of obtaining the variation is by amplitude—observing the bearing of the sun's centre when it is more than the whole diameter above the horizon, as the refraction will be thirty-four minutes and the dip four or five more.

To find the true bearing at sunset or sunrise, add together the log. secant of lat. and log. sine of declination; the sum will be the log. sine of the amplitude, that is, the number of degrees to the right or left of the east or west point according to the declination. To an observer on the equator the declination is also the bearing. Under the true bearing, however found, place the compass bearing; the difference will be the variation, which is called east or west according to the position of the north point, with regard to the meridian, or true north. By keeping that point in view mistakes will be avoided; the same applies to local deviation. The true bearing may also be taken from the amplitude tables.

The best mode of ascertaining the amount of local attraction or deviation is by means of a second prismatic compass, placed on shore near the ship, free from guns or other metal. While the ship is slowly hove round by hawsers and stopped at each point, simultaneous bearings are taken, noted, and timed. The difference between the two compasses is attributed to error caused by the ship's influence while her head was on each successive point. If landing cannot be effected, the thing may be done by observing a distant object, or by a succession of azimuths. If the latter case it may be found more convenient to use apparent time only for finding the true bearing about every twenty minutes, and the intermediate bearings by simple proportion.

In a time azimuth the apparent time from noon, the co-latitude and co-declination are given to find the angle opposite the latter. As the change in hour angle is the chief thing affecting the azimuth, two or three minutes in declination may be disregarded, and the declination may be treated as constant for two or three hours. Accurate bearings cannot be taken when the sun is more than 25° or 30° above the horizon. Burdwood's azimuth tables are very useful; from them the true bearing can be taken out by inspection. When a round of azimuths have been taken for the purpose of ascertaining the deviation of the compass, the variation should also be obtained on shore, or taken from a recent authority, in order to separate the amount due to the ship. It has been found very convenient to gum a diamond of paper about $\frac{4}{10}$ths of an inch broad on each point, bearing the number of degrees deviation to be allowed when the ship's head is in that direction, westerly deviation being marked in blue or black and easterly in red. There is a very simple graphic method, when the deviation has been found upon six or eight scattered points only, of deducing therefrom the amount due to the intermediate points. Draw a central line through the length of a sheet of foolscap as a datum line, and about forty lines at right angles to it, three-tenths of an inch apart, to represent the thirty-two points of a compass, and a few repeated at each end. At the left side of the paper write on those lines the names of the points, commencing at north-west and so through north, east, south, and west to north and north-east. Lay off the amount of deviation found on any point upon the corresponding line, taking any convenient scale of equal parts, perhaps one or two tenths of an inch to a degree, according to the amount of deviation; there is no connexion between this scale and that by which the points are represented. Place the easterly deviation on the right of the datum line and the westerly on the left, till all the points secured have been marked. With a pencil form curves which will pass through those marks, or between them if they are close together and disagree, attributing the difference to errors in observation. Ultimately ink an approved curve and remeasure it, as the corrected scale of deviations. The result of this rough method will be found the same as that by a highly scientific calculation, which would be out of place here. See *Admiralty Manual*.

To insure the true bearing of a distant object it is necessary to take an angle from the sun (or a star) to the object, and find the bearing of the sun as above by amplitude or azimuth. If the former and the distant object be on the horizon, there is nothing to be done but apply the distance from the sun's centre. Also if the sun has considerable altitude and the distance be measured by a theodolite or standard compass are acting as such, or if the distance measured be 90° no correction is necessary. Otherwise the distance measured by the sextant is one side of a spherical triangle, the sun's zenith distance another, and the distant object to the zenith the third; and from these the angle at the zenith must be found.

The position of a ship when in the vicinity of land is usually determined by cross-bearings; but if greater accuracy is required, and three objects are visible which are not in the circumference of a circle passing through the ship's position, sextant angles should be taken between them, and laid off on a piece of tracing paper as a substitute for a station-pointer. When the three lines are brought to coincide with the three positions prick the point of junction, which will be the ship's true position; or, without tracing paper or station-pointer, lay off the angle from 90° opposite each station towards the other which was observed with it; those lines will cross in the centre of the circle upon which the ship was situated. Repeat the operation from the centre to the third object, and where the two circles cross will be the ship's position. The distance off shore can be ascertained by one such angle subtended by two known objects nearly abeam, which might be useful in keeping a ship outside or within a shoal. About 60° is a desirable spread. The distance from an island, the extremities of which do not spread sufficiently to give cross-bearings by the compass alone, or the height of a lighthouse, tower, or cliff, may be made useful in like manner.

Tides.—The ability to find the time of high water at any place during the interval between "full and change" was once highly estimated, but in the present day, when almanacs are so plentiful, the information can be had without trouble. As a fact a modern navigator never does calculate the time of high water, because the rule only gives a uniform rate of change for all places on the globe, which is more or less incorrect; and, knowing the change which has taken place at London Bridge since the new moon by the *Almanac*, he has but to apply it to the standard of any other place.

The *Nautical Almanac* gives the mean time of two tides daily at London Bridge throughout the year, and the apparent time of high water on full and change days at about two hundred places in the United Kingdom and on neighbouring coasts. A more full account of the tides is published annually by the Admiralty. The times predicted in the *Almanac* are but approximations, and are frequently half an hour too soon or too late. A ship under sail only, working up or down the British Channel, will derive great assistance from the tides by making short tacks close to the headlands and a line joining them in the greatest strength of the tide, during the time it is favourable, and standing out towards the centre of the channel during the adverse tide.

Winds and Currents.—To make good passages a navigator should possess a general knowledge of the prevailing winds and principal currents which he is likely to encounter whether he be under sail or steam. When in the vicinity of land he should always be on his guard against unexpected effects from currents, for none are accurately known or free from change at certain or rather uncertain periods. The strength and direction of ocean currents can only be ascertained by comparing carefully kept dead-reckoning with the result of frequent observations, both of which are apt to be neglected when the navigator is free from land. A great impediment to a better knowledge of the currents is the assumption that they are well known and that the same water circulates across and round the seas, as it would in an enamelled basin. There is decidedly an indraught on the north-west coast of Africa, in the Bight of Biafra, and in many other places. A navigator should therefore be on the watch when steering parallel to a coast at night.

The advice here offered with regard to the choice of a track is intended for sailing ships only, steamships are more independent.

On leaving England for Gibraltar or Madeira the prevailing winds and currents will be found to set along the coast of Spain and Portugal; generally a passage to the south is easily effected. Westerly gales are frequently very strong; therefore ships should, while able, shape a course well outside of Cape Finisterre, towards which there is frequently an indraught. Should bad weather threaten from the south the ship (unless convenient to a port) should stand to the westward to gain an offing, before the force of the wind is felt or it turns to the westward. She should then wear and heave to on the starboard tack, which will enable her to bow the sea as the wind changes to west and north-west. This is an invariable rule when north of the equator; the reverse is the rule in the southern hemisphere.

Ordinary heavy gales frequently give warning of their approach by causing a set of the sea in the direction of their course, accompanied by a long swell, the day previous to the force of the wind being actually felt at the ship. The height of the waves from hollow to crest is sometimes over 40 feet.

Ships bound to the West Indies usually call at or pass near Madeira, thence continue south past the Canary Islands till they fairly catch the north-east trade wind, which may be expected in 30° N. lat., or sooner about the month of July. A fair wind and current will then be secured to the vicinity of the West India Islands, where it either falls calm, or a light wind from the shore is experienced every night. When bound to ports in the United States it is necessary to keep to the southward in a similar manner, skirting the northern edge of the trade wind. From either of those places or the Gulf of Mexico the homeward track is the same, that is, close to the banks of Newfoundland, in order to get the prevailing westerly winds.

Ships bound up the English Channel should enter near the centre, avoiding Ushant and Scilly, especially in thick weather. Steamships are more under command, and should be more accurately navigated, but the advantage thus gained in point of safety is more than counterbalanced by the unreasonable things required of them, such as communicating with the lighthouse on Bishop Rock, which caused the loss of the "Schiller" and many lives a few years back. The prevailing wind in the English Channel is south-west, and it will be found in the western half of the circle two days for every one in which it is in the eastern half.

Ships bound to Sierra Leone and the coast of Guinea should pass Madeira on either side, then outside or through the Canary Islands, and if it be about the month of March inside the Cape Verd Islands, where a strong north-east trade will be blowing. At other seasons pass outside these islands to avoid calms, thence close along shore with westerly and south-westerly winds. The current in this track will be found favourable from the Bay of Biscay to the Bight of Biafra, but not farther south. From Sierra Leone to Loando steer along the coast to Cape Palmas, then stretch across the south-east trade till able to return towards Africa on the opposite tack, which may be at 200 or 300 miles south of Ascension. It is especially necessary to keep well to the southward during July and August, when calms prevail near the shore. From Biafra to near the Cape of Good Hope the usual wind near the coast is from the south-west during the day, and either very light off shore or calm at night.

From England to South America the track will be similar to that to Sierra Leone as far as the Cape Verd Islands, when ships for the north-east coast may bear away to the westward, but always allowing for the strong current which may set them to leeward of their port during the calms to which they will be liable. Those bound to the southward of Cape St Roque must be careful not to make much westing till they have crossed the equator; the exact place most desirable for crossing has long been disputed, though the positions generally advocated lie between the meridians 18° and 26°. The argument in favour of the former is the certainty of weathering Cape St Roque, and for the latter less delay by calms between the two trade winds, *i.e.*, in the space from about 10° north to the equator, or from 10° to 4° north while the sun is north of the equator; in this half of the year the S. E. trade comes farther north, and on the coast of Brazil it then blows from south-east and south, so that it is advisable to cross the equator at about 20° W. During December and January the wind frequently draws along the south-east coast of Brazil, past Bahia, from the E.N.E. At that season the line may be crossed in 25° or 26°. All these rules have their exceptions: when the wind deviates from the usual direction, and the deviation is unfavourable, it is unquestionably better to put the ship on the opposite tack till it returns to the usual direction.

From the United States to the South Atlantic the course should be east, keeping to the north of Bermuda (32½°) till past 40° W., then south-easterly across the north-east trade, and joining the track of ships from Europe.

After passing the latitude of Cape St Roque, ships for Rio, Monte Video, or Cape Horn may steer direct courses, but for St Helena or Benguela they should keep to the port tack, standing to the southward till past the twentieth parallel, or a day longer if the wind should then be to the eastward of south-east. If bound to the Cape of Good Hope we must be content with making southing only till past the latitude of Rio; westerly winds may then be expected. The track indicated by an arc of a great circle from Rio to the Cape is not only the shortest, but about the best with regard to the wind.

When homeward bound from the Cape, ships should pass close to St Helena with a fair wind and current, and steer for about the western limit for crossing the line on the outward voyage, where they would meet the ships from the south-east coast of America, and running together across the centre of the Atlantic join the homeward bound West Indiamen between the Azores and Newfoundland, according to the winds experienced. From the Bight of Benin or any part of the Guinea coast it is necessary to stand south on the starboard tack to within a degree of the equator, then due west till past the meridian of Cape Palmas, and north-west into the middle of the Atlantic.

In the Mediterranean the prevailing wind is west, therefore there is no difficulty in running up that sea. A slight current sets from all directions towards Cephalonia. Off the coast of Algeria, during westerly gales, heavy hollow waves are experienced, running at the rate of 10 or 12 miles an hour. When making a passage out of the Mediterranean it is better to keep near the African coast while the wind is to the southward of west, to which it is sure to turn, and then stand over to the Spanish coast, where shelter can be found if required.

The destructive circular storms or cyclones in the West Indies, called hurricanes are generally preceded by calm gloomy weather and a high barometer. It is very desirable that the electric state of the atmosphere and the earth should be known, which is not the case at present. Their immediate approach is indicated by the barometer falling rapidly; which is the more remarkable, because the changes in the barometric readings are usually very slight within the tropics. If the ship be in a safe anchorage or harbour, the lower yards and topmasts should be struck and anchors laid out in the direction of the most probable danger. If the anchorage be not satisfactorily protected the sooner she is out of it the better. At sea it is necessary to get down the upper spars, and to run, if there be sea room, across the direction of the wind, from the centre of the storm,—that is, with the wind on the starboard side in north latitude, and on the port side in the southern hemisphere. If it be necessary to scud, it should be done with the wind as much on the starboard or port quarter as the ship will bear, in order to avoid running round or into the centre. The wind does not run in parallel circles round the centre, but rushes spirally towards it, especially when close (see fig. 22).

There is one dangerous position in which a ship may be placed with respect to an advancing cyclone for which no certain rules have been given, such as at A or D, or between those two positions, near the track upon which it is advancing. It is evident from the diagram that to run from A either before the wind, or with it on the starboard quarter, in the direction of the small arrow, would cause the ship to intercept the storm's centre. It would be advisable to carry sail with the wind abeam as long as possible, and ultimately to heave to on the starboard tack (in north latitude) till the barometer begins to rise and the wind turns more to the south and west.

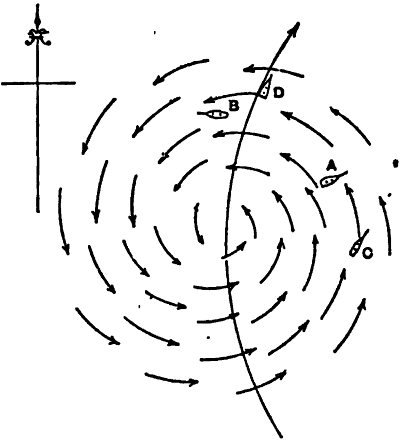

FIG. 22.—Cyclone in 30° N. lat.

As the centre of the storm is supposed to move at a rate varying from 12 to 30 miles an hour, a ship sailing 10 or 12 miles an hour in a direct line from the centre, but on the track, would be overtaken by it. The great hurricane of 1830 extended from the West India Islands to Newfoundland at a mean rate of 18 knots an hour, and by the average time occupied in passing intermediate places (eighteen hours) it must have been about 330 nautical miles in diameter. The centre of the hurricane which devastated Barbados August 10, 1831, moved at a mean rate of about 14 knots an hour. It is evident from those quotations that a ship cannot depend upon running faster than the storm.

The navigator should be ready provided with a representation on tracing paper of a cyclone similar to fig. 22, of a radius equal to 150 miles on the scale of the chart upon which it is to be used. If made for one hemisphere it can be turned over to suit the other. By marking the ship's position on the chart, and placing the tracing over it with one of the arrows correctly corresponding with the direction of the wind at the ship, the direction of the storm's centre will be indicated with certainty, but the distance and track can only be conjectured,—the latter by assuming that it will be similar to those previously ascertained, which may be represented by a pencil line on the chart. If to the south of the 20° N. lat. it will be moving in a westerly direction, if about 30° to the north-west or north, and when about 35° and 40° to the north-east.

It is safer to assume the centre to be nearer than it really is than *vice versa*; the pencil line will run parallel to the storm's course unless the ship be on the track, as at D. It is evidently her duty to run to the west if there be room till the wind veers to the north-east against the sun, when it will be certain that she is to the westward of the storm's track. This is not likely to happen in the North Atlantic when as far north as 30°, as the centre usually passes along the coast or over the continent of America; but when farther south, and when the storm's progress is to the westward, a ship may escape by running to the southward with the wind at north.

If the position with regard to the storm is supposed to be at B, she should run with the wind on the starboard quarter. If at C it will be optional either to run with the wind on starboard quarter or to heave to; for anything in that direction relative to the assumed track will have attained its nearest approach to the centre. When the direction of the wind remains unchanged, the force increasing and barometer falling, the centre must be advancing directly on the ship. When the centre begins to recede the wind will decrease in violence and change its direction, with the sun if the ship is east of the track and against the sun if the centre passed to the eastward of the ship, the barometer will also rise rapidly.

Fig. 22, and the argument upon it, are for the northern hemisphere; the typhoons and all circular storms south of the equator are similar, but the revolutions are reversed, and the track of centre curves off from west to south-west, south, and south-east.[1]

In ordinary heavy gales in the North Atlantic a ship should heave to on the starboard tack, as the wind generally changes from south to west and north-west. On that tack she will be constantly "coming up" and bowing the sea as the wind veers, and will be less liable to be taken aback; and for similar reasons the third anchor for use should be carried on the starboard side. The reverse will hold good south of the equator.

The storm peculiar to the west coast of Africa is called a tornado. It is entirely different from a hurricane; it is not circular; it is very local and of short duration, seldom lasting more than ten or twenty minutes. These storms give good warning by a black cloud first appearing on the horizon, rising quickly. When the cloud is about twenty degrees high a bright arch will be seen under it. The faster it rises and the more distinct the arch the more severe will be the tornado, which bursts suddenly when at an angle of forty-five degrees. During its rise there will be ample time to shorten all sail and turn the ship's stern towards it; she will be driven violently for a short time, when it will fall calm as suddenly as the wind came, and a deluge of rain will wash the decks.

Along the coast of California and the west coast of Mexico and Central America voyages can be made to the south-east with westerly and south-westerly winds and favourable current, except during the latter part of May, June, and July, when the trade winds are strongest through the West India Islands; the wind is then off shore at the southern part of the track mentioned, and easterly, and passages along shore to the south-east are not easily accomplished. With the exception of the time last named, when ships are bound from Central America to California they must stand out into the trade wind, run down the meridian, and then make northing.

Along the west coast of South America light southerly winds and northerly current prevail, therefore ships bound south from Central America should stand well out from the land. On the southern part of Chili south-west winds prevail. On the west side of North America, beyond the tropic, westerly winds are most frequent, as in a similar belt across the Atlantic.

Ships bound to the East Indies will find, after rounding the Cape of Good Hope, the south-west monsoon from April till October giving them a fair wind and fine weather through the Mozambique to Bombay or Calcutta. The reverse is the case during the English winter months, that is, from October till April. In the Indian Ocean, as in the northern hemisphere, the most unsettled and stormy weather is about the time of each equinox, but more especially about the end of September, when circular storms of incredible violence called typhoons are sometimes experienced. When south of the equator, ships should always receive them on the port side, or run with the wind on the port quarter, if there be sea room; if north of the equator, keep the wind on the starboard side, as described above.

Bad weather is frequent on the coast of Malabar during May, and in the Bay of Bengal during October. When running up the Bay of Bengal in May or June before a south-west gale, with heavy rain and falling barometer, there will be reason to fear being overtaken by the centre of a typhoon; it will be advisable to heave to, or run to the eastward, till the barometer rises and weather improves.

In the Red Sea the wind is generally from the south, except during June, July, and August, when it is north, calm, or on shore by day, and off shore at night.

From the Cape of Good Hope to Australia and New Zealand ships have usually westerly winds and a favourable current, which is a good reason for returning to Europe by way of Cape Horn.

About 60 to 100 miles off the south-east extremity of Africa the Agulhas current sets to the westward, sometimes as much as 60 miles a day; its progress is not checked by a westerly gale, and consequently one of the most dangerous seas ever experienced is to be found there. About the year 1850, ships making long voyages were frequently navigated upon or approaching a great circle, which led the Australian ships into danger on account of the icebergs which were met in great numbers. In 1866 the Admiralty published ice-charts of the southern hemisphere for the guidance and warning of seamen. Every ship should be provided with wind and current charts for the sea to which she is going, and every officer should help to perfect these by means of careful observations.

When a ship is to leeward of her port, or a chase, it is advisable to work up on a direct line towards it, tacking as frequently as convenient, as then all flaws and changes in the wind will be in her favour. By the contrary mode of action ships have been known to sail round an island, *e.g.*, the Bermudas.

A useful graphic method has been devised for shaping a course which will intercept another ship with the least loss of time, or for shaping a course across a current the direction and velocity of which can be estimated (see fig. 23, which for use should be more than twice as large, with a circle for every mile).

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[1] For full description of circular storms, see Lieut.-Col. W. Reid, *Law of Storms*, 1850; Henry Piddington on *Typhoons*, Calcutta, 1840; and W. H. Rosser, *The Law of Storms*, &c., 1876.

Ex. 1.—A ship bore N.E. 13 miles, steering S.S.E. 10 knots. Being nearly on a wind, which was E. by N., she could not alter course from her pursuer without loss of speed; the pursuer being a steamship only able to go 9½ knots, if he allows the chase to cross his bows she will escape.

Make a spot on the N.E. line, 13 miles from the centre, at A; place the parallel ruler to the course the chase is steering, S.S.E., and, with the distance representing her speed (10 knots) in the compasses, mark where it will reach on that bearing, from the N.E. line to a position between the circles representing 9½ knots, which will be from *a* to *b*. Then a line from the centre through *b* shows the course the pursuer must take, S.E. by E. ½ E., which continued will cross the S.S.E. line from A in E, where the vessels will meet. The distance and time of meeting may be measured on the diagram or calculated by trigonometry. The two ships will continue on the same relative bearings.

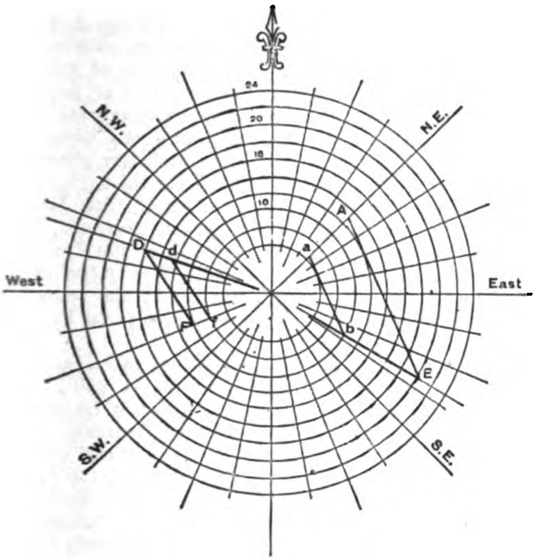

Fig. 23.

Ex. 2.—A point of destination bore W.S.W. 10 miles; a current ran S.E. by S. 4 miles an hour; the boat can pull at the rate of 6 miles an hour. It is convenient to consider that the object is moving in the opposite direction to the current and at the same speed. As the diagram is so small the proportionate speeds are doubled. Eight miles in the compasses will extend on a line parallel to S.E. by S. from the 12-mile circle at *d* to the W.S.W. bearing at *f*. A line from the centre through *d* will indicate the course to be steered, W. by N. ¾ N. From the point F on the 10 mile circle and S.S.W. bearing, a line drawn N.W. by N. will cut the former line in D, the place the boat would have reached had there been no current, 16 miles from the centre, occupying 2ʰ 40ᵐ; while DF represents the space through which the water has passed—10½ miles in the same time. When a distant object can be seen in a line with the point steered for, and if the strength of the current be equal all the distance, the same bearing should be preserved. As an example of crossing a river or channel where the tide will change at a known time, we may take that part of the Bristol Channel where it is 12 miles wide, say north and south, and the tide runs 5 knots. Suppose the boat can only pull 5 knots. By leaving one shore at an hour and twelve minutes before high water, and steering directly north or south during 2ʰ 24ᵐ, regardless of first being carried east and then west, the boat will reach its destination, having passed through 12 miles of water only.

Though so much has been done to increase the efficiency of ships, in point both of size and of equipment, a sea voyage is still attended with considerable peril, both by stranding and collision. In the year ending April 1882 there were 4367 vessels damaged, including 606 total wrecks, with the loss of 1097 lives, round the coast of Great Britain alone. The number entering or leaving British ports during the same period was 676,358, of 139,443,790 tons burthen. The number of vessels at the same time above 50 tons under the English flag was over 22,000. Ships on long voyages were formerly content to make good one degree a day; now steamships occasionally run 400 miles in one day. In September 1883 the "Alaska" (Guion Line) made the voyage from Queenstown to New York in six days twenty-one and three-quarter hours, and returned in six days twenty-one hours. During the same month the "Oregon" made 20 knots an hour during her trial trip on the Clyde. The "Ionic" (White Star Line) arrived at Plymouth August 4, 1883, from New Zealand, through the Straits of Magellan, in forty-five days, including stoppages for coal. Her passage out, round the Cape of Good Hope, was performed in forty-three days. This voyage round the world is the quickest yet accomplished, having occupied less than eighty-eight days at sea. In May 1883 the "British King" returned from performing a similar voyage, and discharging or receiving 6000 tons of cargo, in less than four months.

Of late years, with the hope of diminishing the number of collisions, an international code of regulations has been drawn up by the Board of Trade and Admiralty, under the authority of the privy council, and sanctioned by nearly all maritime nations. The following is an abridgment of the law as now in force:—

Art. 1. Every ship under sail only is considered a sailing ship, but if any steam be used she is a steamship.

Art. 2. The lights hereafter mentioned, and none other, shall be carried from sunset to sunrise.

Art. 3. A steamship under way shall carry a bright white light before the mast at least 20 feet above the deck, a green light on the starboard side, and a red light on the port side.

Art. 4. A steamship towing anything shall carry an extra bright light before the mast, *i.e.*, two vertical lights.

Art. 5. A telegraph cable ship at work, or others not able to steer, to carry three red lights vertically, and by day three balls. Side lights with the above, only when making way through the water.

Art. 6. Sailing ship under way, or being towed, the green light on starboard side, and red on port side only.

Art. 7. Small vessels may carry portable lights similar to the above.

Art. 8. All ships at anchor shall carry a white light, not exceeding 20 feet above the deck.

Art. 9. Pilot vessels to carry a white light at the mast head only, and a flare-up every fifteen minutes.

In lieu of Art. 10. Open fishing boats or other open boats may carry one lantern, green one side and red the other. Such boats when at anchor or fast to nets to exhibit a bright white light.

Art. 12. Steamships must be provided with an efficient steam whistle, fog-horn, and bell; sailing ships with the last two. Turkish ships to carry a drum instead of a bell.

a. In fog, mist, or snow, by day or night, a steamship must make every two minutes or less a prolonged blast.

b. A sailing ship at similar intervals with fog-horn to make one blast on starboard tack, two on the port tack, and three if the wind be abaft the the beam.

c. All ships at anchor in a fog, &c., shall ring a bell every two minutes or less.

Art. 13. Every ship in fog, &c., to "go at a moderate speed."

Art. 14. *a*. A ship running free shall make way for one which is close hauled.

b. Ships on the port tack make way for those on the starboard tack.

c. Similarly if running free.

d. When running free with the wind on the same side, the ship which is to windward shall keep out of the way.

e. A ship which has the wind aft shall keep out of the way of any other.

Art. 15. If two steamships are meeting nearly end on so as to involve risk, they shall both alter course to starboard.

Art. 16. When two steamships are crossing, the one which has the other on her port side is to keep out of the way.

Art. 17. A steamship shall keep out of the way of a sailing ship.

Art. 18. Steamships shall slacken speed, stop, or reverse if necessary.

Art. 19. Optional signals by the steam whistle:—one short blast means, "I am altering course to starboard"; two short blasts, "I am going to port"; three short blasts, "I am going full speed astern."

Art. 20. When one ship overtakes another, the faster ship is to keep out of the way.

Art. 21. In narrow channels ships shall keep on the starboard side.

The books on navigation in general use are those of Norrie, Inman (especially his tables), Riddle, Raper, Jeans, and Evers, and Harbord's *Glossary*. (H. A. M.)

NAVIGATION LAWS. These laws are a branch rather of municipal law than of the general maritime law (for which see **Sea Laws**). They are based upon the right of a state to regulate the navigation of its own waters and to protect its own commerce, and may be divided into two classes.

The first class includes all those laws, once so numerous, designed to secure a commercial monopoly to the state which enacted them. By laws of this kind trade with Goa was formerly confined to Portuguese subjects. In Great Britain the object was attained by the Navigation Acts, the earliest of which were the 5 Rich. II. stat. I, c. 3, 14 Rich. II. c. 6, ordaining that no merchandise should be shipped out of the realm except in British ships on pain of forfeiture. The principal Navigation Act was the 12 Car. II. c. 18 (Scottish, 1661, c. 45). Up to 1854 coasting trade was wholly restricted to British ships, and a British ship must have been navigated by a master who was a British subject, and by a crew of whom a certain proportion must have been British subjects. The impolicy of such legislative restrictions, clearly shown by Adam Smith, was at last acknowledged by parliament, and since 1854 the only relics of such restrictions are to be found in the provisions of the 16 & 17 Vict. c. 107, § 324, by which, in order to secure reciprocity, prohibitions or restrictions may by order in council be imposed upon the ships of any country in which British ships are liable to similar prohibitions or restrictions. Subject to these exceptions, a foreign ship is in the same position as a British ship with regard to British trade. This right of foreign ships is expressly recognized by the Customs Law Consolidation Act, 1876; by § 141 of that Act foreign ships engaged in the coasting trade are not to be subject to higher rates than British ships. Any advantages which a British ship has, *e.g.*, the right of claiming protection for her flag, the non-attachment to her of a maritime lien for necessaries supplied in a British port, are not directly connected with the policy under which the Navigation Acts have become obsolete. These advantages are not secured to a British ship until she is registered. American law agrees with British in this respect. "The United States have imitated the policy of England and other commercial nations in conferring peculiar privileges upon American-built ships and owned by our own citizens. . . . The object of the Registry Acts is to encourage our own trade, navigation, and shipbuilding by granting peculiar or exclusive privileges of trade to the flag of the United States, and by prohibiting the communication of those immunities to the shipping and mariners of other countries" (Kent, *Comm.*, iii. 139). It may be noticed that an alien is generally incapable of becoming the owner of a ship. This incapacity is specially preserved in the case of British ships by the Naturalization Act, 1870.

The second class of navigation laws includes those which deal with the navigation of any waters over which a state has any control, and embraces all that is necessary for the due use of such waters, as rules of the road, management of harbours and lighthouses, and licensing and control of pilots. Such laws may deal with (1) the high seas, (2) tidal waters other than the high seas, (3) non-tidal waters.

1. The claims of various nations to dominion over parts of the high seas have now become matters of merely historical interest. Such claims have been at different times advanced by Great Britain, Holland, Spain, and Portugal, and were once sufficiently important to evoke the *Mare Liberum* of Grotius and the *Mare Clausum* of Selden. But, though such claims upon the high seas have long been relinquished, rules for the navigation of the high seas may still be promulgated by any Government. In Great Britain such rules have been made by order in council under the powers of the Merchant Shipping Act, 1862; the rules at present in force are those contained in the order of 14th August 1879. To these rules all the states of Europe except Turkey, and in America the United States, Chili, Brazil, and Ecuador, have assented, so that as far as the assenting states are concerned they are of universal validity. Japan and Turkey have assented to them with certain modifications. In the case of a state which has not assented to them, the only rules enforceable are the general rules of the sea, gradually ascertained by individual cases before courts of admiralty.

2. For the navigation of its tidal waters—so far as they are territorial—a state may legislate without the assent of other states. An example of such legislation is afforded by the Territorial Waters Jurisdiction Act, 1878, a measure passed in consequence of the celebrated case of the Queen v. Keyn (the "Franconia" case) in 1876. Under the head of territorial waters would fall the "narrow seas" (as the Bristol Channel, Great Belt, or Straits of Messina), bays and harbours, estuaries and arms of the sea, navigable tidal rivers, and the sea for the distance of a marine league from the shore. Such waters being *res publicæ*, though not *res communes* as are the high seas, are *prima facie* subject to the jurisdiction of the state. In England the soil under such waters, or at least under all but the last kind, is *prima facie* vested in the crown, subject to the public rights of fishery and anchorage. For the distance of a marine league the crown has certainly jurisdiction for police and revenue purposes. This is a rule of general international law. In England the navigation of most of the principal tidal waters is governed by rules contained in Acts of Parliament and orders in council, the latter for the most part promulgated under the authority given by the Merchant Shipping Act, 1862. Thus the navigation of the Thames is governed by the order of 18th March 1880, of the Mersey by the Mersey Sea Channels Act, 1874, and the order of 5th January 1881, of the Tyne by the order of 12th December 1867, of the Tees by the order of 5th September 1870, of the Humber by the order of 23d December 1881, and of the dockyard ports by the order of 6th March 1868.

3. Non-tidal waters, even though navigable, are in Great Britain *prima facie* private waters, in which the right of navigation does not exist as a public franchise, but can only be acquired by prescription, founded on a presumed grant by an owner. In Roman law and in the Code Napoléon it is otherwise. Navigable rivers in those systems are always *publici juris*, whether tidal or non-tidal. Navigation of non-tidal waters in the United Kingdom, whether natural or artificial, is now almost entirely regulated by various Navigation and Conservancy Acts, *e.g.*, the Thames Conservancy Acts, the Shannon, Trent, Lee, &c., Navigation Acts, and the various Canal Acts. It may be noticed that the crown is empowered by the Merchant Shipping Act, 1862, to make rules for the navigation of inland waters, even when artificial, on the application of the proprietors. Examples of such rules are the orders in council regulating the Mersey and Irwell navigation and the Bridgewater navigation, 18th May 1870. Such waters being private property, the application for the rules by the proprietors is recited in the order in council.

The distinction drawn in the United States between navigable and boatable rivers seems to be peculiar to that country, unless indeed it is analogous to the "fleuves et rivières navigables ou flottables" of the Code Napoléon, § 538. It is at least unknown in Great Britain.

Remedies for Obstruction.—These may be either criminal or civil,—the criminal by indictment or information, the civil by action for damages or for an injunction, in addition to the criminal remedy, where special damage has been sustained. It seems to be a good defence that the obstruction was for the public benefit. This obviously leaves a considerable discretion in the hands of the court.

International Law.—The international law as to the navigation of the high seas has been sketched above. As to territorial waters, it is the general though not the universal opinion of jurists that the state to which the territorial waters belong has a right to forbid their navigation by foreigners. The free navigation of rivers has often been the subject of treaties, almost necessarily so where a river is the boundary between two states. In such a case, if a state were to maintain the strict letter of its rights, navigation would be almost impossible, as each state is proprietor down to the middle line of the bed of the river, the *medium filum aquæ*. By the treaty of Vienna in 1815 it was provided that the navigation of all rivers separating or traversing the states that were parties thereto should be open for commercial purposes to the vessels of all nations, subject to a uniform system of police and tolls. The treaty of Paris, 1856, extended this principle to the Danube. In America the cases of the Mississippi and the St Lawrence are important. By the treaty of Versailles, 1783, it was provided that "the navigation of the Mississippi shall for ever remain free and open to the subjects of Great Britain and the citizens of the United States." But the United States afterwards acquired Louisiana and Florida; and, the stipulation as to British subjects not being renewed in the treaty of Ghent, 1814, the United States maintain that the right of navigating the Mississippi is vested exclusively in their citizens. As to the St Lawrence, after disputes for a long period between Great Britain and the United States, the right of free navigation for purposes of commerce was secured to the United States by the treaty of Washington, 1871. There are some waters, such as the Bosphorus and the Suez Canal, which are subject to peculiar engagements by treaty or agreement. But as a rule it may be said that in time of peace the territorial waters of a state are open to foreigners for commercial purposes, subject to observance of any rules as to police, pilotage, &c., imposed by the state. For instance, a system of compulsory pilotage is in existence in many ports, and a vessel refusing to conform to the pilotage regulations might incur serious liabilities. Most of the general law of England on this subject is contained in Part V. of the Merchant Shipping Act, 1854. Tolls may be imposed by the state upon foreigners. This right is expressly recognized in most commercial treaties. A notable instance was the claim of Denmark to charge what were called the "Sound dues" from all vessels passing Elsinore, though the Sound was not strictly her territorial water. The right was not universally recognized, though it had prescription in its favour, and was invariably paid. In 1857 the dues were abolished, and compensation paid to Denmark for the loss of her alleged right. (J. W. †)

NAVIGATORS' ISLANDS, or SAMOA, a group in the southern Pacific, 420 miles north-east of the Fiji Islands, lying between 13° 30′ and 14° 20′ S. lat., and between 169° and 173° W. long. It numbers in all thirteen islands, but most of these are little more than barren rocks, and three only—Sawaii (Pola), Upolu (Oyalava), and Tutuila (Mauna)—are large enough to be of any importance. Sawaii (700 square miles) is almost entirely occupied by lofty and barren mountains. It has no rivers or streams, the water filtering away through the porous soil; and there is but one harbour. Upolu (550 square miles) is also mountainous, but it is well-wooded and fertile, and possesses several considerable streams. Apia, the chief town, lies at the head of an oval bay on the north coast. Since 1879 it has been under a municipality directed by the consuls of Germany, Great Britain, and the United States. Tutuila (55 square miles, 17 miles long and 5 broad) is almost cut in two by the harbour of Pago-pago (Pango-pango), one of the best in the South Pacific. In general character the island is like Upolu. The Samoans are physically a fine race of men, and those on Upolu are all nominally Christian; but they discover a great lack of industry and perseverance. Both Upolu and to some extent Tutuila have attracted a considerable number of American and European (mostly German) capitalists, and a large portion of the land has passed into the hands of foreign residents (who number about three hundred). The bulk of the foreign trade belongs to the successors of the famous Hamburg firm of J. C. Godeffroy & Son. Cotton, cocoa-nuts, and breadfruit are cultivated for export, and maize, sugar, coffee, &c., for local consumption. Copra or cobra (*i.e.*, dried cocoa-nuts) is the most important article of trade. In 1881 the planters had about 1800 labourers from the Line Islands, New Britain, New Hebrides, &c., the Samoans being too independent to hire themselves out. A series of petty wars, continued with little intermission from 1868, has greatly interfered with the prosperity of the native population, whose numbers have decreased from 56,600 in 1840 to 35,000 in 1872 and 30,000 in 1880.

The Samoan group are possibly the Baumann's Islands of the Dutchman Roggeveen (1722); but it was Bougainville who made them definitely known and who called them Îles des Navigateurs, owing to the skill with which the natives managed their canoes. At Asu or Massacre Bay La Pérouse lost two of his assistants—De Lamanon and De Langle—and a boat's crew. Christianity was introduced by John Williams in 1830.

See Meade, *New Zealand and the South Sea Islands* (1870), which has views of Pango-Pango and Apia; Dr Forbes in *Proc. Roy. Geog. Soc.*, 1877; *Journal des Museums Godeffroy*, Hamburg, 1871-74.

NAVY

THE beginnings of the British navy may be traced back to the long-continued struggle of Alfred and his successors with Danish invaders and pirates. Alfred has been called the first English admiral, as he was, it is supposed, the first English sovereign who commanded his own fleet in battle; and it was still to check these marauders, and protect the coasts of the kingdom, that William I., in 1066, established the Cinque Ports, and gave them certain privileges, on condition of their furnishing 52 ships, with 24 men in each, for fifteen days, in cases of emergency. We should not, perhaps, be far amiss in dating the period of English naval architecture from the Conquest; but there is little to record of the navy till the period of the French wars. In these very numerous fleets were sometimes engaged. King John is said to have fitted out 500 ships in 1213 against Philip of France; and in 1293, in the reign of Edward I., a battle took place in mid Channel where both the French and English fleets met in force, and about 240 ships of the former were captured. In the reign of John a close approach was made to a regular naval establishment, and encouragement given to foreign commerce by a declaration of safe-conduct to all foreign merchants to pass to or repass from England.

There cannot be any doubt that the earlier fleets comprised many private ships pressed into the king's service. A fleet of Edward the Confessor in 1049 consisted partly of "king's ships," partly of "people's ships." In the Black Book of the Admiralty (which is a collection of sea-laws and customs drawn up for the use of the judge of the Court of Admiralty) it is provided that "in case a man be indicted that he hath broken the arrest of his ship, arrested for the king's service, and be thereof convicted by twelve men, he shall lose his ship unless he obtaineth pardon of the king or the high admiral." Richard I. at Grimsby expressly combated by an ordinance the notion that ships were not liable to be pressed; and in a mandate of Sir Thomas Beaufort, admiral of England, Ireland, and Aquitania, temp. Hen. IV., are to be found instructions to his lieutenant of the North to arrest twenty-four vessels for service abroad, "upon certain weighty matters." Orders were sent at the same time to press mariners for one of the king's barges.

In an action with the French fleet off the harbour of Sluys (1340), Edward III. is said to have slain 30,000 of the enemy, and to have taken 200 great ships, "in one of which only there were 400 dead bodies." All writers agree in describing the battle as one of the most sanguinary and desperate sea-fights ever known. The same monarch, at the siege of Calais, is stated to have blockaded that port with 730 sail, having on board 14,956 mariners, 25 only of which were of the royal navy, bearing 419 mariners, or about 17 men each.

The earlier and middle parts of the reign of Edward III. were particularly famous for the power of the English fleet, and for the dread which it inspired. After a splendid victory over the Spanish fleet in 1350, the title of "king of the sea" was bestowed on the sovereign. Towards the end of that reign, however, naval as well as other affairs were neglected, the seas were left unguarded, the coasts were insulted, and acts of piracy were committed in English waters which a few years before had been impossible. Complaints were loud and frequent. The duke of Lancaster, Edward's brother, was charged with having misspent a sum of money granted to him for the guardianship of the seas, and the anger of the Commons, unable to vent itself upon him, expended itself in a successful impeachment of some of the king's ministers. In the next reign attempts were made to improve matters; but, notwithstanding the levies from the Cinque Ports and other towns, the naval force in 1378 was insufficient to keep even English waters free from pirates, and it was due to the private exertions of John Philpot, a London merchant, who fitted out a squadron at his own expense, that John Mercer, a celebrated Scottish pirate, was captured and his career ended. Plymouth and Hastings were burned, Winchelsea was attacked, and two descents were made, with much damage, upon the Isle of Wight. In one of these descents the French possessed themselves of most of the island, but were finally driven to their ships by Sir Hugh Tyrrel, governor of Carisbrooke, and "a spur of incredible sharpness." Return expeditions were made to French and Spanish towns by the English, who, however, acted rather in the privateer capacity of men who had to take the law into their own hands than as authorized warriors of the English king.

Naval affairs improved under Henry IV., and the reign of Henry V. was most glorious in maintaining the naval superiority over the fleets of France. From a letter of this sovereign to his lord chancellor, dated 12th August 1417, discovered by Samuel Lysons among the records in the Tower, and of which the following is a copy, it would appear that there was something like an established royal navy in his reign, independently of the shipping furnished by the Cinque Ports and the merchants, for the king's own use, on occasion of any particular expedition. The letter appears to have been written nine days after the surrender of the castle of Touque, near Honfleur, in Normandy, whence it is dated.

"*Au reverend pere en Dieu l'Evesque de Duresme Nre Chanceller d'Angleterre.*

"By the Kyng—

"Worshipful fader yn God We sende you closed within this letter a cedule conteyn wᵗ the names of certein Maistres for owr owne grete Shippes Carrakes Barges and Balyngers to the whiche Maistres We have granted annuitees such as is appointed upon eche of hem in the same Cedule to take yerely of owre grante while that us lust at owr Exchequer of Westmʳ. at the termes of Michelmasse and Ester by even porcions. Wherefore We wol and charge yow that unto eche of the said Maistres ye do make under owr grete seel beyng in yowre warde owr letters patentes severales in forme after th' effect and pourport of owr said grante. Yeven under owr signet atte owr Castle of Touque the xij. day of August."

Extract from the Schedule contained in the preceding Letter.

vj li. xiija. iiijd. La Grande Nief appelle I'hc [or "Jehu"] dont John William est Maistre	vj. Mariners poʳ la sauf garde deinz Hannill.
vj. li. xiija. iiijd. La Trinate Royale dont Steph' Thomas est Maistre	vj. Mariners.
vj. li. xiija. iiijd. La Holy Gost dont Jordan Brownyng est Maistre	vj. Mariners.
vj. li. xiija. iiijd. La Carrake appellee le Petre dont John Gerard est Maistre	vj. Mariners.
vj. li. xiija. iiijd. La Carrake appellee le Paule dont William Payne est Maistre	vj. Mariners.
vj. li. xiija. iiijd. La Carrak appellee le Andrewe dont John Thornyng est Maistr'	vj. Mariners.
vj. li. xiija. iiijd. La Carrak appellee le Xpofre dont Tendrell est Maistr'	vj. Mariners.
vj. li. xiija. iiijd. La Carrak appellee le Marie dont William Richeman est Maistr'	vj. Mariners.
vj. li. xiija. iiijd. La Carrak appellee le Marie dont William Hethe est Maistre	vj. Mariners.
vj. li. xiija. iiijd. La Carrak appellee le George dont John Mersh est Maistr'	vj. Mariners.

The remainder, to the masters of which pensions were thus granted, consist of 17 "niefs, barges, and ballyngers," some with three, and others two mariners only. But history informs us that about this time Henry embarked an army of 25,000 men at Dover on board of 1500 sail of ships, two of which carried purple sails, embroidered with the arms of England and France,—one styled the "King's Chamber," the other his "Saloon," as typical of his keeping his court at sea, which he considered as a part of his dominions.

The general orders for the admiral of a fleet, contained in the Black Book of the Admiralty, lay it down that "the admirall ought by his office to elect and order for the king's person, if he be present, otherwise for his lieutenant, the best and most able shipp of the kingdome, which shall be called the chamber of the king or of his lieutenant; and if the king be present then the Comptroller of his household is to make choice of some of the best shipps of the whole fleete (that is to say, one shipp for the Hall, another for the Wardrobe, the third for the Larder, and the fourth for the Kitchen." Froissart, writing of the battle of L'Espagnols sur Mer, in 1350, speaks of a ship called "la Salle du Roi, où tous ses hôtels étoient." It would appear from a very curious poem,[1] written in the early part of the reign of Henry VI. (between 1426 and 1438), that the navy of his predecessor was considerable, but that, by neglect, it was then reduced to the same state in which it had been during the preceding reigns.

Shortly after the time when this poem must have been written, it appears from the parliament roll (20th Henry VI., 1442) that an armed naval force, consisting only of eight large ships, with smaller vessels to attend them, was to be collected from the ports of London, Bristol, Dartmouth, Hull, Newcastle, Winchelsea, Plymouth, Falmouth, &c.; and, of course, the royal ships of 1417, the names of which are contained in the foregoing schedule, were then either gone to decay or dispersed. We are not to judge of the size of the ships from the few mariners appointed to each. These were merely the ship-keepers, or harbour-duty men, placed on permanent pay, to keep the ships in a condition fit for sea when wanted.

The classes of ships and vessels mentioned in the records of what may be called the first period of the British navy are very numerous, varying with the use for which they were designed. Thus there were "cogs," or large, swift vessels, sometimes of 250 tons, carrying 130 seamen besides archers and soldiers; "barges," or small cogs, which carried 60 to 80 men; "balingers," or boats resembling modern barges; "caraks," large vessels, chiefly used in Continental navies; "crayers," transport vessels, seldom over 60 tons; "doggers and lodeships," fishing and pilot boats, with 30 men, which were occasionally impressed into the king's service; "fluves," two-masted vessels, used for conveyance of troops (Edward III. commanded the burgesses of Kingston-upon-Hull to build him a "fluve"); "galleys" and "galiots"; "hoc-boats," cargo or store ships. There were also "lynes," "persouers," and "pikards," or large boats. "Pinnaces," with 35 men, figured at Sluys, and at the battle of L'Espagnols sur Mer in 1350; and in 1339 two "espinaces" were given to Sir Richard Talbot for the defence of Southampton.

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[1] "The English Policie, exhorting all England to keep the Sea, and namely the Narrow Sea; showing what profit cometh thereof, and also what worship and salvation to England and to all Englishmen"; it is printed in the first volume of Hakluyt's *Collection of Voyages.*

It is very probable that, until English merchants engaged in the Mediterranean trade, and the attention of the Government was turned, in the reign of Henry VII. (about 1496), to imitate Portugal in making foreign discovery, under the skilful seaman Sebastian Cabot, very little was added to the capacity or the power of British ships of war. In his reign was built a ship called the "Great Harry," the first on record that deserved the name of a ship of war, if it was not the first exclusively appropriated to the service of the state. This is the ship which Camden called the "Henry Grace de Dieu," but erroneously,—the vessel so named not having been built till the reign of Henry VIII. The "Great Harry" is stated to have cost £14,000; there is reason to suppose that she was renamed the "Regent" on the accession of Henry VIII.

We now come to that period in which England might be truly said to possess a military marine. Some curious details have been preserved in the Pepysian collection at Magdalene College, Cambridge, from which papers it appears that in the thirteenth year of Henry VIII. the following constituted the royal navy:—

	Tons.		Tons.
Henry Grace de Dieu	1,500	Sovereign	800
Gabriel Royal	650	Catherine Forteleza	550
Mary Rose	600	John Baptist	400
Barbara	400	Great Nicholas	400
Mary George	250	Mary James	240
Henry Hampton	120	Great Bark	250
The Great Galley	500	Less Bark	180

There were besides two row-barges of 60 tons each, making in all 16 ships and vessels, measuring 7260 tons.

The "Henry Grace de Dieu" is stated in all other accounts, and with more probability, to have been only 1000 tons.[1] This ship, the better-known "Great Harry," appears to have been begun at Erith, in August or September 1512, to replace the "Regent," which was burned in the former month in action with the French fleet, when carrying the flag of the lord high admiral. There is a drawing of the ship in the Pepysian papers. From these papers it appears that she carried fourteen guns on the lower deck, twelve on the main deck, eighteen on the quarter-deck and poop, eighteen on the lofty forecastle, and ten in her stern-ports, making altogether seventy-two guns. Her regular establishment of men is said to have consisted of 349 soldiers, 301 mariners, and 50 gunners, making altogether 700 men. The war ships of this period were awkward to manœuvre: on the appearance of the French fleet at St Helens, the "Great Harry," the first ship built with two decks, had nearly been sunk; and the "Mary Rose," of 600 tons, with 500 or 600 men on board, was actually sunk at Spithead, as Raleigh informs us, in consequence of "a little sway in casting the ship about, her ports being within 16 inches of the water." On this occasion the fleets cannonaded each other for two hours; and it is remarked as something extraordinary that not less than three hundred cannon-shot were fired on both sides in the course of this action. From the drawings still extant it is quite surprising how the vessels could be trusted on the sea at all, their enormous poops and forecastles making them appear loftier and more awkward than the large Chinese junks, to which, indeed, they bear a strong resemblance.

Henry VIII. may justly be said to have laid the foundation of the British navy as a permanent or standing force. He established the dockyards at Deptford, Woolwich, and Portsmouth; he appointed certain commissioners to superintend the civil affairs of the navy, and settled the rank and pay of admirals, vice-admirals, and inferior officers, thus creating a national navy, and raising the officers to a separate and distinct profession. The principal officers of the navy then were—the vice-admiral of England, master of the ordnance, surveyor of the marine causes, treasurer, comptroller, general surveyor of the victualling, clerk of the ships, and clerk of the stores. Each of these officers had his particular duties, but they met at their office on Tower Hill once a week, to consult, and make their reports to the lord high admiral. Henry also established the fraternities or guilds of the Trinity House at Deptford, Hull, and Newcastle for the improvement of navigation and the encouragement of commerce, and built the castles of Deal, Walmer, Sandgate, Hurst Castle, &c., for the protection of his fleet and of the coast.

At the death of Henry VIII. in 1547, the royal navy consisted of about 50 ships and vessels of different sizes, the former from 1000 to 150 tons, and the latter down to 20 tons, making in the whole about 12,000 tons, and manned by about 8000 mariners, soldiers, gunners, &c. Thus, as has been well said, "everything was leading up to a time when the perils of the seas should claim all that was most heroic in England's most heroic age." In the short reign of his son Edward little alteration seems to have taken place in the state and condition of the royal navy. But the regulations which had been made in the reign of his father for the civil government of naval affairs were revised, arranged, and turned into ordinances, which form the basis of all the subsequent instructions given to the commissioners for the management of the civil affairs of the navy. In the reign of Mary the tonnage of the navy was reduced to about 7000 tons; but her lord high admiral nobly maintained the title assumed by England of Sovereign of the Seas, by compelling Philip of Spain to strike his flag that was flying at the main-top-mast head, though on his way to England to marry Queen Mary, by firing a shot at the Spanish admiral. He also demanded that the whole fleet, consisting of 160 sail, should strike their colours and lower their top-sails, as a homage to the English flag, before he would permit his own squadron to salute the Spanish monarch.

Elizabeth not only increased the numerical force of the regular navy, but established many wise regulations for its preservation, and for securing adequate supplies of timber and other naval stores. She placed her naval officers on a more respectable footing, and encouraged foreign trade and geographical discovery, so that she acquired justly the title of the Restorer of Naval Power, and Sovereign of the Northern Seas. The greatest naval force that had till then been called together was that which was assembled to oppose the Invincible Armada, and which, according to the notes of Pepys, consisted of 176 ships, with 14,992 men; but these were not all "Shippes Royall," but consisted largely of the contributions of the Cinque Ports and private persons. The number actually belonging to the navy is stated by the commissioners of 1618 in their report (several manuscript copies of which exist) to have been 34 ships of 12,190 tons, carrying 6225 men. Sir Edward Coke (4 Inst. 50) "thinks it matter of boast that the royal navy of England then consisted of 33 ships" (Blackstone). At the end of Elizabeth's reign, however, the navy had greatly increased, the list in 1603 consisting of 42 ships of various descriptions, amounting to 17,000 tons, and manned with 8346 men. Of these, two were of the burden of 1000 tons each, three of 900 tons, and ten of from 600 to 800 tons.

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[1] The rules for the measurement of tonnage were probably very imperfect.

James I. was not inattentive to his navy. He warmly patronized Phineas Pett, to whom we undoubtedly owe the first essential improvements in the form and construction of ships. The cumbrous top-works were first got rid of under his superintendence. "In my owne time," says Raleigh, "the shape of our English ships hath been greatly bettered; in extremity we carry our ordnance better than we were wont; we have added crosse pillars in our royall shippes, to strengthen them; we have given longer floors to our shippes than in older times," &c. In 1610 Pett laid down a ship named the "Prince Royal"; her burden was 1400 tons, her keel 114 feet, and she was armed with sixty-four pieces of great ordnance, "being in all respects," says Stowe, "the greatest and goodliest ship that was ever built in England."

The state of the navy at the king's death is variously given by different writers; but on this subject the memoranda left by Pepys are most likely to be correct. From them we learn that in 1618 certain commissioners were appointed to examine into the state of the navy, and by their report it appears there were then only 39 ships and vessels, whose tonnage amounted to 14,700 tons; while in 1624, on the same authority, the number had decreased to 32 or 33, but the tonnage increased to about 19,400 tons. The commissioners had, in fact, recommended many of the small craft to be broken up or sold, and more ships of the higher rates to be kept up.

Charles I. added upwards of 20 sail to the navy, generally of the smaller kind; but one of them, built by Pett, was of a description, both as to form and dimensions, far superior to any that had yet been launched. This ship was the celebrated "Sovereign of the Seas," launched at Woolwich in 1637. The length of her keel was 128 feet, the main breadth 48 feet, and the length from stem to stern 232 feet. In the description of this ship by Thomas Heywood it is said that she "bore five lanthorns, the biggest of which would hold ten persons upright; had three flush-decks, a forecastle, half-deck, quarter-deck, and round-house. Her lower tier had thirty ports for cannon and demi-cannon; middle tier, thirty for culverins and demi-culverins; third tier, twenty-six for other ordnance; forecastle, twelve; and two half-decks, thirteen or fourteen ports more within board, for murthering pieces; besides ten pieces of chace ordnance forward, and ten right aft, and many loopholes in the cabins for musquet-shot. She had eleven anchors, one of 4400 ℔ weight. She was of the burden of 1637 tons." It appears, however, that she was found, on trial, to be too high for a good serviceable ship in all weathers, and was therefore cut down to a deck less. After this she became an excellent ship, and was in almost all the great actions with the Dutch; she was rebuilt in 1684, when the name was changed to that of "Royal Sovereign," and was about to be rebuilt a second time at Chatham in 1696 when she was totally destroyed by fire. In this reign the ships of the navy were first classed, or divided into six rates, the first being from 100 to 60 guns, the second from 54 to 36, &

In 1642 the management of the navy was taken out of the king's hands, and in 1648 Prince Rupert carried away twenty-five ships, none of which ever returned; and such, indeed, was the reduced state of the establishment that at the beginning of Cromwell's government he had only fourteen ships of war of two decks, and some of these carried only 40 guns; but, under the careful management of very able men in different commissions which he appointed, such vigorous measures were pursued that, in five years, though engaged within that time in war with the greatest naval power in Europe, the fleet was increased to 150 sail (of which more than a third part had two decks, and many had been captured from the Dutch), while upwards of 20,000 seamen were employed in the navy. The military marine was, indeed, raised by Cromwell to a height which it had never before reached.

Though Cromwell found the navy divided into six rates or classes, it was under his government that these ratings were defined and established in the manner nearly in which they were till the middle of the present century; and it may also be remarked, that under his government were constructed a large number of frigates, or vessels designed specially for speed and having a peculiar sharpness of form. The first built in England was the "Constant Warwick." "She was built," says Pepys, "in 1640, by Mr Peter Pett (son of Phineas), for a privateer for the earl of Warwick, and was sold by him to the state. Mr Pett took his model of this ship from a French frigate which he had seen in the Thames."

We know comparatively little about ships' armaments up to this period. It appears, however, that they were furnished about the year 1337 with espringalds, haubergeons, bacinets, bows, arrows, jacks, doublets, targets, pavises (or large shields placed at the side, and serving the double purpose of protection against the sea and the enemy), lances, and "firing barrels." It also appears that as early as 1338 cannon formed part of the armament of ships, and that about 1372 guns and gunpowder were commonly used. Among the stores belonging to the "Christopher of the Tower" in June 1338 were three iron cannon with five chambers, a hand gun, and three old stone bags, probably for shot. The "Mary of the Tower" had an iron cannon with two chambers, and one of brass with one chamber. The precise character and description of the earlier guns are difficult to be found, but among the "crakys of war" mentioned as most used on board ship are "cannon-paviors," or stone-shot throwers, and "murtherers," which were smaller and threw any kind of shot. There were also in the first period of naval history basilisks, port pieces, stock-fowlers, sakers, and bombards. The last-named were large instruments of hammered iron, made of bars welded and bound together with iron bands. They threw stone shot of 140 ℔, and even of 195 ℔ weight. A battery of these erected on a slip of land at the naval battle of Chioggia (1380), between the Venetians and the Genoese, did great damage. They were loaded over night and fired in the morning—one discharge per diem being considered enough for the gun, if not for the enemy. Froissart mentions a bombard at the siege of Oudenarde by Philip van Artevelde, that "might be heard five leagues off in the daytime, and ten at night. The report of it was so loud that it seemed as if all the devils in hell had broken loose." According to Lord Herbert, brass ordnance were first cast in England in the year 1535. They had various names, such as cannon, demi-cannon, culverins, demi-culverins, sakers, mynions, falcons, falconets, &c. What the calibre of each of these was is not accurately known, but the cannon are supposed to have been about 60-pounders, the demi-cannon 32, culverins 18, falcons 2, mynions 4, sakers 5, &c. Many of these pieces of different calibres were mounted on the same deck, which must have occasioned great confusion in action in finding for each its proper shot.

On the restoration of Charles II. the duke of York was immediately appointed lord high admiral, and by his advice a committee was named to consider a plan, proposed by himself, for the future regulation of the affairs of the navy, at which the duke presided. By the advice and able assistance of Pepys as a principal officer of the navy, great progress was speedily made in the reparation and increase of the fleet. The duke remained lord high admiral till 1673, when, in consequence of the test required by parliament, to which he could not submit, he resigned, and that office was in part put in commission, and the rest retained by the king. Prince Rupert was put at the head of this commission, and Pepys appointed secretary of the Admiralty. By his able and judicious management there were in sea-pay, in the year 1679, and in excellent condition, 76 ships of the line, all furnished with stores for six months, 8 fire-ships besides a numerous train of ketches, smacks, yachts, &c., with more than 12,000 seamen; and also 30 new ships building, and a good supply of stores in the dockyards. But this flourishing condition of the navy did not last long. In consequence of the dissipation of the king, and his pecuniary difficulties, he neglected the navy on account of the expenses; the duke was sent abroad, and Pepys to the Tower. A new set of commissioners was appointed, without experience, ability, or industry; and the consequence was, as stated by the commissioners of revision, that "all the wise regulations formed during the administration of the duke of York were neglected; and such supineness and waste appear to have prevailed that, at the end of not more than five years, when he was recalled to the office of lord high admiral, only 22 ships, none larger than a fourth rate, with two fire-ships, were at sea; those in harbour were quite unfit for service; even the 30 new ships which he had left building had been suffered to fall into a state of great decay, and hardly any stores were found to remain in the dockyards."

The first act on the duke's return was the reappointment of Pepys as secretary of the Admiralty. In 1686, finding the principal officers unequal to the duties required of them, he appointed a special commission to restore the navy to its former strength and condition. Sir Anthony Deane, the most experienced of the shipbuilders then in England, was joined with the commissioners. He is said to have introduced important improvements in ships of the line, his model being the "Superbe," a French ship of 74 guns, from which he built the "Harwich" in 1664. Others, however, are of opinion that no advance was made on the model of the "Sovereign of the Seas" after she was cut down. The commissioners undertook, in three years, to complete the repair of the fleet, and furnish the dockyards with a proper supply of stores, on an estimate of £400,000 a year, to be issued in weekly payments; and in two years and a half they finished their task to the satisfaction of the king and the whole nation, 108 sail of the line being repaired and under repair, besides smaller vessels. At the time of the king's abdication, the list of the navy amounted to 173 sail, of 101,892 tons, carrying 6930 guns and 42,000 seamen.

The naval regulations were wisely left unaltered at the Revolution, and the business of the Admiralty continued to be carried on for a short time, under the immediate direction of King William, by Pepys, till the arrival of Admiral Herbert and Captain Russell from the fleet, into whose hands, he says, "he silently let it fall." Upon the general principles of that system, thus established with his aid by the duke of York, the civil government of the British navy has been carried on ever since.[1]

In the second year of William III. (1690), no less than 27 ships were ordered to be built, of 60 and 80 guns each; and in 1697 the king, in his speech to parliament, stated that the naval force of the kingdom was increased to nearly double what he found it at his accession. It was now partly composed of various classes of French ships which had been captured in the course of the war, amounting in number to more than 60, and in guns to 2300,—the losses by storms and captures being about half the tonnage and half the guns acquired. At the commencement of William's reign, the navy, as already stated, consisted of 173 ships, measuring 101,892 tons; at his death it had been extended to 272 ships, measuring 159,020 tons, being an increase of more than one-half both in number and in tonnage. The ships of the line numbered then 130, and this continued to be the average number till the middle of the 18th century.

The accession of Queen Anne was immediately followed by a war with France and Spain, and in the second year of her reign she had the misfortune to lose no less than 13 of her ships by one of the most tremendous storms that was ever known; but every energy was used to repair this national calamity. In the course of this war there were taken or destroyed about 50 ships of war, mounting 3000 cannon; and about half that number were lost. At the death of the queen, in 1714, the list of the navy was reduced in number to 247 ships, measuring 167,219 tons, being an increase in tonnage of 8199 tons.

George I. left the navy pretty nearly in the state in which he found it. At his death, in 1727, the list consisted of 233 ships, measuring 170,862 tons, being a decrease in number of 14, but an increase in tonnage of 3643 tons.

George II. was engaged in a war with Spain in 1739, in consequence of which the size of ships of the line ordered to be built was considerably enlarged. On the restoration of peace in 1748 it was found that England's naval strength had prodigiously increased. The loss had been little or nothing, while the English had taken and destroyed 20 French and 15 Spanish sail of the line, besides smaller vessels. The war with France of 1756 added considerably to the list, so that at the king's decease in 1760 it consisted of 412 ships, measuring 321,104 tons.

In the short war of 1762, George III. added no less than 20 sail of the line to the navy. At the conclusion of the American war in 1782, the list of the navy was increased to 600 sail; and at the signing of the preliminaries in 1783 it amounted to 617 sail, measuring upwards of 500,000 tons, being an increase of 185 ships and 157,000 tons and upwards since the year 1762. At the peace of Amiens the list of the fleet amounted to upwards of 700 sail, of which 144 were of the line. The number taken from the enemy, or destroyed, amounted nearly to 600, of which 90 were of the line, including 50-gun ships, and upwards of 200 were frigates; the English loss amounted to about 60, of which 6 were of the line and 12 frigates.

The recommencement and long continuance of the revolutionary war, the glorious successes of England in naval actions, and the protection required for the extended commerce, of which, in fact, Britain might be said to enjoy a monopoly, and for the security of the numerous colonies, contributed to raise the British navy to a magnitude to which the accumulated navies of the whole world bore but a small proportion. From 1808 to 1813 there were seldom less than from 100 to 106 sail of the line in commission, and from 130 to 160 frigates, and upwards of 200 sloops, besides bombs, gun-brigs, cutters, schooners, &c., amounting in the whole to about 500 sail of effective ships and vessels, to which may be added 500 more in the ordinary, and as prison, hospital, and receiving ships,—making at least 1000 pennants, and measuring from 800,000 to 900,000 tons. The commissioners appointed to inquire into the state and condition of the woods, forests, and land revenues of the crown state, in their report to parliament, in the year 1792, that, "at the accession of his majesty (George III.) to the throne, the tonnage of the royal navy was 321,104 tons, and at the end of the year 1788 it had risen to no less than 413,467 tons." In 1808 it had amounted to the enormous total of 800,000 tons, having nearly doubled itself in twenty years. It must not, however, be supposed that the effective navy consisted of more than half this amount of tonnage.

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[1] Up to this time merchantmen, hired and armed, but commanded by officers of the navy, formed more or less a part of every fleet sent out. Now, however, the navy became independent for fighting purposes, while the development of commerce and colonial trade made the establishment of a system of convoys and cruisers an absolute necessity.

Since the conclusion of the war with France, it would appear that at least one-half of the ships had been sold or broken up as unfit for service; and as, by the list of the navy at the beginning of the year 1821, the number of ships and vessels of every description, in commission, in ordinary, building, repairing, and ordered to be built, had been reduced to 609 sail, we may take the greatest extent of the tonnage at 500,000 tons; but the greater part, if not the whole, of this tonnage was efficient, and in a state of progressive efficiency.

According to the printed list of the 1st January 1821, the 609 sail of ships and vessels appear to be as under:—

1st rates, from 120 to 100 guns	23
2d „ „ 86 „ 80 „	16
3d „ „ 78 „ 74 „	90
4th „ „ 60 „ 50 „	20
5th „ „ 48 „ 22 „	107
6th „ „ 34 „ 24 „	40
Sloops „ 22 „ 10 „	186

making a total of 432; to which have to be added 177 gun-brigs, cutters, schooners. tenders, bombs, troop-ships, store-ships, yachts, &c.

In the year 1836 the total number of ships of war, including every description mentioned in the above list, amounted to about 560 sail; of which 95 were ships of the line in a state of efficiency for any service, or capable of being speedily put into a fit state for sea; and many of them were of a very superior class to any employed in the war. In 1846 there were 671 ships, including every description; and in 1857 there were on the list of the royal navy 735 ships, exclusive of those appropriated to harbour service, and of the coastguard cruisers, making a grand total of 888 ships and vessels of all classes.

Soon after the commencement of Queen Victoria's reign steam began to assert its superiority over sail-power for the propulsion of ships of war. It has now to a great extent usurped the place of manual labour also in ships, and it has been the main cause of the revolution which has been effected in their type.

The paddle-wheel was first adopted as the means of utilizing the power of steam for propulsion. The first ship of war of any importance fitted with the paddle was the 46-gun frigate "Penelope." In 1843 she was cut in two, lengthened, and furnished with engines of 650 horse-power. A number of ships were also built expressly for the paddle, of which class the "Terrible," a powerful, frigate-built ship of 21 guns and 800 horse-power, may be taken as a type. The "Valorous" is almost the only remaining example of it in 1888, and she has been relegated to dockyard service.

The success of the screw, however, as a means of propulsion soon made it evident that this must be the system of the future for war-ships. By its use the whole motive power could be protected by being placed below the water-line. It interfered much less than the paddle with the efficiency and handiness of the vessel under sail alone, and it enabled ships to be kept generally under sail. Great importance was attached to this, as the handling of a ship under sail was justly thought an invaluable means of training both officers and men in ready resource, prompt action, and self-reliance. For this reason masts and sails have been retained long after they were admitted to be detrimental to the fighting qualities of battle ships.

The screw was therefore eagerly adopted, and rapid progress was made in the conversion of ships into screw steamers,—some being cut in two and lengthened, others being razéed or having decks removed, while new ships were building, so that the Russian war, which broke out in 1854, found Great Britain in possession of a powerful steam fleet. Of this fleet the three-decker "Duke of Wellington," of 700 horse-power (nominal) and 131 guns, the two-decker "Agamemnon," of 600 horse-power (nominal) and 91 guns, and the frigate "Shannon," of 600 horse-power (nominal) and 51 guns, may be taken as the finest examples; a powerful flotilla of steam gunboats was built for the occasion. Henceforth ships propelled only by sail were obsolete for war purposes.

In this war mechanical mines or torpedoes were used by the Russians for the defence of their harbours, but with not much effect.

The advance of gunnery, and the disastrous effect of explosive shells, which were new weapons since the great naval wars of forty years before, operated to the disadvantage of ships with wooden walls. The fleets were unable to do much more than blockade, and it became necessary to furnish means by which they might also attack.

The French were the first to apply in a practical shape the idea (which appears to have originated in the United States) of reviving the use of armour, and placing it on the sides of ships. They constructed five floating batteries clad with 4½ inches of iron, on an oak backing 8 inches thick. Of these the first was the "Tonnante," mounting 16 guns. She was launched at Brest in March 1855, and was quickly followed by the others. Three of them took part in the bombardment of Kinburn in the Black Sea on the 17th October following.

The British Admiralty at once put in hand similar vessels, and with such diligence that the "Erebus" and "Terror" arrived at Kinburn on the 24th October. They were hastily constructed for work in shallow water, and were difficult to manage; but the results were sufficiently satisfactory to induce the French to convert a wooden line-of-battle ship on the stocks into a frigate armoured all over with 4½ inches of iron. She was launched at Toulon under the name of "La Gloire" in November 1859, and was of 5600 tons displacement and 800 horse-power (nominal).

In December 1858 a committee was appointed under the administration of Lord Derby, because the attention of the cabinet had been drawn to the very serious increase which had taken place of late years in the navy estimates, while, at the same time, it was represented that the naval force of the country was far inferior to what it ought to be with reference to that of other powers, and especially of France, and that increased efforts and increased expenditure were imperatively called for to place it on a proper footing. One of the main causes assigned for a prospective increase was the comparative state of preparation of France, in respect of powerful screw steamers, and the expenditure which had taken place and was still going on in her dockyards.

The committee, in its report, January 6, 1859, directed its remarks principally to the increase in the estimates of 1858 as compared with those of 1852, and omitted the disturbed period between those dates. They say that in 1852 the navy estimates were revised and increased, and measures taken to supply what were supposed to be deficiencies in former years, and to adapt the navy to the altered state of things occasioned by the application of the screw to ships of war. They remark that no one probably in the year 1852 could have anticipated the wonderful progress which a few years had exhibited, superseding practically the use of sailing vessels in the navy, and introducing the use of screw steamers of immense size and power, and involving a more than commensurate additional expense. The total amounts voted were—in 1852, £5,835,588, and in 1858, £8,851,371. They say, at the outbreak of the French revolutionary war England possessed 145 sail of the line, France 77. These comparative numbers were reduced in 1850 to—England 86, and France 45. "At this latter period the effective strength of the two navies in line-of-battle ships exclusively, and almost exclusively in frigates, consisted of sailing vessels; but, the French having subsequently decided on, and nearly carried out, the conversion of all their sailing ships that were fit for it into steamships, as sailing vessels could not be opposed to steamships with any chance of success, the latter must now be considered as the only ships really effective for the purposes of war, and the following is at present the relative strength of the two navies in steam line-of-battle ships and frigates, including ships building and converting":—

December 1858.	Line-of-battle Ships.		Frigates.	
	English.	French.	English.	French.
Complete, hull and machinery	29	29	Screw, 17 Paddle, 9 } 26	Screw, 15 Paddle, 19 } 34
Receiving engines	4	2	2	3
Converting	7	4	0	1
Building	10	5	6	8
	50	40	34	46
Iron-plated ships building	...	4	...	—

It is curious to observe what happened as a consequence of this report and the circumstances of the time. The committee did not recommend building an iron-plated line-of-battle ship or frigate, although the "Warrior" was commenced a few months later. They recommended converting 19 sailing ships of the line into steamships of the line and steam frigates. Two years later there were 67 wooden steamships of war building and converting for the royal navy, and navy estimates had gone up to twelve millions and a half; unhappily all these wooden line-of-battle ships and frigates were soon found to be no real addition to the force of the navy, and many of them were not completed. The four iron-plated ships appearing so ominously at the foot of the French list had completely changed the situation.

At this date iron had been gradually encroaching on wood as a material for the hulls of British merchant ships. It was thought at one time to be unsuitable for war-ships on account of the irregular holes made by shot passing through it, and the difficulty of plugging them, but the use of armour tended to prevent shot, or at least shell, from passing through. Iron presented also the advantage of permitting the use of water-tight bulkheads. (The system of subdivision has been largely developed within the last few years by the use of double bottoms and of longitudinal as well as transverse bulkheads, and has added much to the security of ships against perils of the sea or acts of the queen's enemies.) By the use of iron the country was, moreover, relieved from all anxiety on the score of the supply of timber of suitable dimensions and quality.

The Admiralty therefore determined to build their first sea-going ironclad ship, the "Warrior," of iron, and the decision has been amply justified by the event. Her displacement was 9200 tons, and the indicated horse-power 5470. The central part of the ship was protected by 4½-inch armour from the upper deck to 5 feet below the water-line,—the main deck battery being enclosed at its foremost and after ends by armoured transverse bulkheads. She cost, including engines, £357,000, and was able to withstand the fire, at 200 yards, of the heaviest gun of the day, the 68-pounder of 95 cwts. Her own armament consisted of thirty-six of these guns. She was similar in appearance to the frigates of her day, on a large scale. She was launched in December 1860.

Much discussion ensued as to the relative merits of the rival ships "La Gloire" and "Warrior." The latter was the faster ship, but her great length (380 feet between perpendiculars) had made it desirable to leave 85 feet at each end entirely unprotected, and, as she had only a single propeller, the steering geer was necessarily by this arrangement exposed to shot. Her length also limited her power of manœuvring.

In the meantime the "Black Prince," a sister ship, had been built; the "Defence" and "Resistance" soon followed on a smaller scale. In 1861 eleven iron-clads were ordered; five of them were converted from wooden ships on the stocks, and these no longer appear in the *Navy List*. The "Hector" and "Valiant" followed the "Warrior," but the armour on the main deck extended further. In the "Achilles" the battery remained as in the "Warrior," but the armour was extended as a belt, at the suggestion of Mr Reed, all round the water-line. The "Minotaur," "Agincourt," and "Northumberland" were armoured from end to end, the thickness being increased to 5½ inches. This additional armour, with the desired fineness of form, involved a length of 400 feet, and a displacement of 10,690 tons. They had five masts. Like the "Warrior" they were unhandy, and were thought liable to fall a prey to smaller and nimbler antagonists. The belt type of the "Achilles" has survived except where it has been replaced by submerged armoured decks, as in the "Shannon," "Nelson," "Inflexible," and following ships.

During this time the comparative impotence of artillery had suggested recourse to a weapon of the galleys of the Middle Ages. The ram was revived, the French again setting the example. England followed, without however at first making it so prominent a feature as the French. The weapon has since become general, or at least the bows are strengthened to stand the shock of ramming.

After the Russian war torpedoes and submarine mines and counter-mines, mechanical and electrical, attracted much attention. Schools were established for the instruction of officers and men in their use. For the British navy, the "Vernon" was set apart for this purpose. In 1871 the secret of the celebrated Whitehead fish torpedo was purchased by the Admiralty. It has since been acquired by nearly all foreign nations. It was designed to attack ships below water, since their batteries were deemed practically invulnerable. At first it was only arranged to project the torpedoes from a submerged tube in the line of keel ahead, but it was found that they could be effectively projected from the broadside above water, and this plan has been extensively adopted. The Whitehead torpedo is projected by means of an impulse of compressed air or steam, and is propelled through the water by means of a screw and pair of engines actuated by compressed air, carried within it. The head carries the explosive, which is fired on contact, and a secret chamber contains the mechanism regulating the depth below the surface at which it is to travel. It now forms part of the armament of most war-ships. A torpedo invented by Captain Harvey, R.N., was in use for some years till superseded by the Whitehead. It was towed on the broadside or quarter.

Fast screw torpedo boats to use the Whitehead or the spar torpedo were introduced by Mr Thornycroft of Chiswick, and they were at once acquired or copied by all foreign powers.

The superiority of the defence due to armour was short-lived. Apart from the introduction of new weapons for attack, the artillery continued to advance in power and weight.

With the rivalry between guns and armour sprang up designs for the best mode of defence combined with the most powerful means of attack. Captain Coles advocated for masted ships the turret system, and Mr Reed (now Sir Edward Reed) the broadside system, each striving to give the utmost protection armour could afford to the battery and other vital parts, whilst enabling the largest guns to be worked safely under these defences. The broadside system armoured the battery and the water-line, whilst the sides and upper portions of the ships remained much as in the older frigates. The turret aimed at lower sides as offering less target to the enemy, whilst a deadly fighting power had all-round sway from behind armoured cover. In 1862 the "Enterprise," "Favourite," and "Research" were adapted to Mr Reed's principle,—the belt and battery,—upon which also, with the addition of indented ports at the corners of the battery to give a wider range of fire, were built the "Pallas," "Penelope," "Bellerophon," and "Hercules." In the "Sultan" an upper deck battery was added with four guns. On the "Sultan" pattern the "Audacious" and several other vessels were built. As the guns increased in size, the batteries decreased and the guns became fewer, but the belt remained.

In 1862 also the first turret ship was produced in the shape of the "Royal Sovereign," a three-decker cut down and converted, the "Prince Albert," built of iron, followed. Both these ships were without sail-power, and calculated for coast defence only.

The "Monarch," ordered in 1865, was designed as a sea-going rigged turret ship, having 7-inch armour, a free-board of 14 feet, and an armament of four 25-ton guns in two turrets plated with 10- and 8-inch armour. Then came the "Captain"—a ship designed by Captain Coles and Messrs Laird in rivalry of the "Monarch," and built by Messrs Laird at Birkenhead in 1869. She was intended to combine the low freeboard of the "Royal Sovereign" with the qualities of a sailing frigate; and for a time she was thought to give promise of such a combination. The calamity of her capsizing, on the night of the 6th of September 1870, with 500 men, of whom only 18 were saved, will not be forgotten while the annals of the navy are preserved.

At this date (1870) a sea-going mastless turret ship type had been devised under the administration of Mr Childers, and there were three such ships building, the "Devastation," "Thunderer," and "Fury," designed by Mr Reed for service as battle ships at sea. They were, after the loss of the "Captain," strongly condemned by anticipation by most eminent naval men. But their design has since been fully approved by experience.

The important questions arising out of these changes in types of ships, and especially as to the "Devastation" class, were discussed in 1871 by a very distinguished committee, known as the Committee on Designs. They said in their report:—

> "A perfect ship of war is a desideratum which has never yet been attained, and is now further than ever removed from our reach. Any near approach to perfection in one direction inevitably brings with it disadvantages in another From the time when ships of war first carried artillery, and were thus converted from mere vehicles for the transport of armed men into engines of war, naval architects have been compelled, in designing them, to content themselves with a more or less satisfactory compromise. The difficulty, always great, of bringing into harmony the conflicting features which are desirable in a ship of war was much increased by the adoption of steam-power throughout the navy; the form of hull which was thought to be requisite for obtaining the best results under steam alone being very different from that most suitable for sailing. When to this was added the still more serious embarrassment arising from the introduction of armour-plating, the problem presented to naval architects became one of extreme difficulty and complexity.
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> "For some time, indeed, after the necessity of using armour-plating had been recognised, but before the penetrative power of artillery had reached its present stage of development, the question how to unite in one ship the power of sailing, steaming, and carrying both heavy guns and armour, although difficult, did not appear to be insoluble, and was met with remarkable ability, and a very large measure of success, by the constructive department of the navy. In the meantime, however, a rapid progressive increase in the power of artillery led to a corresponding augmentation in the thickness and weight of the armour borne by ships, until the point had been reached at which it became impossible to combine in one vessel all the qualities which it is desirable a ship of war should possess, consistently with the attainment of a very high degree of efficiency in any of the more important of them.
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> "The necessity, in some cases at least, of altogether sacrificing some one desirable feature, in order that another may be secured in a higher degree than would otherwise be possible, was recognised by their lordships when they adopted the design of the 'Devastation' class, in which the power of sailing was entirely given up in favour of that of carrying thick armour and very powerful guns, of moving under steam at a fair although not very high speed, and, finally, of carrying a sufficient quantity of coal to admit of voyages across the Atlantic being made without the aid of sails. In the 'Inconstant' class a compromise of a similar character, but in a different direction, had previously been sanctioned, the protection of armour being altogether abandoned in order to secure very high speed under steam, combined with as efficient sail-power as could be attained without interference with the essential feature of great speed under steam alone. Each of these types possesses valuable features which are totally wanting in the other. Each in our opinion meets a part of the requirements of modern warfare, and must (subject to modification and improvement) continue to be represented in the British navy." . . . .
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> "After making every allowance for the disadvantages that attend the use of an enormous dead weight of very costly armour, which after all is not absolutely impenetrable to certain special guns, we cannot lose sight of the indisputable fact that in an action between an armour-clad and an unarmoured ship (assuming that they carry guns of equal power) the former has, and must have, an immense advantage in being able to penetrate the sides of her adversary at a distance at which she is herself impenetrable, and, further, in being able to use with effect those most destructive projectiles 'common' shells, which would fall harmless from her own armoured sides. Even assuming that absolute impenetrability to shot proves to be unattainable, it is still our opinion that the time has not come to throw off armour altogether, but that it is necessary that the first ranks of our ships of war should continue to carry armour of as great resisting power as possible.
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> "Before quitting this part of our subject, we desire to remark that, although, as before pointed out, there are serious difficulties in the way of increasing to any very material extent the thickness of armour applied in the usual manner to sea-going ships, viz., in the form of a complete belt round the ship, from stem to stern, at the water-line, besides local protection for guns, men, &c., it is not

> by any means certain that some method may not be devised of securing the requisite reserve of buoyancy by other means than armour-plating. Were this accomplished, the area of the armour might be diminished, and its thickness increased in a corresponding degree. The ship would then comprise a very strongly plated central citadel, surrounded and supported by an unarmoured raft constructed on a cellular system, or containing some buoyant substance such as cork, which, without offering any material resistance to the passage of projectiles, would not be deprived of its buoyancy by penetration." . . . .
>
> "At present we find ourselves compelled to regard the attainment of a very high degree of offensive and defensive power united with real efficiency under sail as an insoluble problem; and we believe that our transmarine possessions, and other important interests in distant parts of the world, will be more efficiently protected by the establishment, where requisite, of centres of naval power, from which vessels of the 'Devastation' class may operate, than by relying upon cruising ships of such limited fighting power as the 'Monarch.' We think, however, that a class of vessel in many respects resembling the 'Monarch,' although much smaller and less costly, ought to form part of the British navy."

In 1873 Italy was contemplating the construction of the "Duilio" and "Dandolo," large turret ships of the "Devastation" type, but intended to mount four very heavy guns which were being constructed by Sir William Armstrong & Co., to be protected by armour 22 inches in thickness. It was necessary that England should not be behind, and the "Inflexible" was laid down. She was to carry four 60-ton guns in two revolving turrets, similar to the "Devastation," except that, in order to obtain right-ahead fire of all four guns, and to meet the objections raised by naval officers and in parliament against the lowness of the upper deck of the "Devastation" class, the turrets were placed "en échelon," the foremost turret on the port side and the after one on the starboard side, and a superstructure was erected between them along the centre of the ship. The belt also beyond the citadel was omitted, and a submerged armour deck, of 3 inches in thickness, replaced it at the ends. This deck descended forward and helped to strengthen the ram. The armour on the sides was to be 24 inches; before the ship was completed, however, compound armour had been introduced, which allowed the thickness on the turrets to be reduced to 16 inches. The total weight of armour was 3155 tons. To enable this great weight to be carried, to provide stability when injured, and to allow all the guns to fire in line of keel, the breadth, which had not before exceeded 60 feet in sea-going ships of war, was increased to 75 feet, the utmost which existing docks allowed. The length was 320 feet, and the displacement reached 11,880 tons. The horse-power was 8000, and this gave her, after she was launched in 1876, a speed of 14¾ knots, and when fully equipped at Malta 13·87 knots. She is rigged as a brig. This is, however, only an arrangement for peace time. In consequence of an important question having been raised in the press and in parliament as to her stability in the event of the unarmoured ends being badly damaged in action, a committee was appointed, who reported that "it cannot be said that the armoured citadel is invulnerable, or that the unarmoured ends are indestructible, although the character of the risk they run is different. But in our opinion the unprotected ends are as well able as the armoured citadel to bear the part assigned to them in encountering the various risks of naval warfare, and therefore we consider that a just balance has been maintained in the design, so that out of a given set of conditions a good result has been obtained."

It was subsequently laid down in parliament, by the responsible minister, as a guiding principle in such questions, that in a ship of war there should be the greatest possible offensive power, and the defensive arrangements should be such as to ensure her as far as possible, and in equal degrees, against all the various modes in which she may be disabled or destroyed. From this it would follow that it should not be in the power of the enemy to disable the ship by one single blow delivered by any means at his command, if this could have been prevented by causing other defences, where he has not this power, to surrender a portion of their strength to succour the weak part.

Amplifying this principle, it may be said that there should be defence for the propelling power, for the steering power, and for the floating power against the gun, the ram, and the torpedo. To a very large extent the defence against the two last named must rest with the officer in command; but to resist them he must retain command of speed and steering gear. He therefore requires that these and his floating power should be equally defended against the gun, which he cannot avoid. The avoidable weapons, the ram and the torpedo, are provided against in all ships, even in the "Inflexible," far less than is the unavoidable weapon, the gun. The equality of defensive power in view of all three weapons is obtained by reckoning as part of the defence against the ram and the torpedo the skill and vigilance of the seaman.

The "Ajax" and "Agamemnon" were laid down in the year the "Inflexible" was launched (1876). They are of the same type but smaller, carrying only 38-ton guns. Of this type also are the "Colossus" and "Edinburgh," commenced in 1879, and now (1883) approaching completion. They are the same length as the "Inflexible," but 7 feet narrower. As they are of later date than the "Iris" (the first war-vessel built entirely of steel), steel is employed almost entirely in their construction, and they have steel-faced armour. They are to be armed with 43-ton breech-loading guns in the turrets, and four 6-inch 4-ton guns on the superstructure. The "Conqueror" is another steel ship, designed especially as a ram, having one turret for two 43-ton guns, and four 6-inch guns unprotected by armour.

The "Collingwood," commenced in 1880, has a different arrangement. In the endeavour to increase the protection of the vital parts, and at the same time to increase the offensive power without going into extravagant dimensions, it was inevitable that the space to be covered should be reduced, and the armour concentrated. The guns being large, it was thought they would not suffer by being mounted "en barbette," the loading being still done under cover. By these means the revolving turrets were got rid of, and the citadel was no longer required to protect the loading apparatus. By placing the barbette towers some distance apart it became possible to mount several broadside guns, not indeed protected from the front, but sheltered from raking fire by an armoured screen extending from the barbette towers to the ship's sides. This then is the design of the "Collingwood" class. The central belt, which rises but little above the water, has 18-inch compound armour, the barbette towers 12-inch, and the screen 6-inch. Communication is maintained by means of armoured vertical hollow cylinders between the towers and the protected part of the ship below, whence the supply of ammunition is derived. She will mount four 43-ton guns in the towers, six 4-ton guns in the broadside, and numerous lighter guns. The "Rodney," "Howe," "Camperdown," "Anson," and "Benbow" are similar to the "Collingwood," but they will carry 63-ton guns instead of 43-ton. Possibly the "Benbow" may have two exceeding 100 tons instead of the four 63-ton guns.

The cruising ironclads have also continued to advance. In 1873 the "Alexandra" was commenced, of the "Sultan" type. In this vessel four powerful guns in the central batteries fire in line of keel ahead, and two astern. She has thicker armour than the "Sultan," and a bulkhead was placed across the main battery, cutting off the two foremost guns from the rest. In the same year the "Temeraire" was commenced. She differed from the "Alexandra" in having barbette towers forward and aft, instead of the upper deck battery, the 25-ton guns mounted in them being made to descend, on being fired within the tower, for loading. The towers communicated with the protected part below by means of hollow armoured cylinders. She fires three heavy guns from her armoured batteries in line of keel ahead. Then came the "Shannon," a much smaller vessel, in which the water-line is protected by an armour belt to within 60 feet of the stem, whence a submerged armour deck extends forward; a bulkhead rises from the same point, which covers two guns firing ahead. The remainder of the guns are unprotected, except from right-ahead fire. She was designed for an armoured cruiser, capable of engaging a second-class ironclad. The "Nelson" and "Northampton" followed, but they have central belts and armoured decks at each end, and armour-covered guns for stern as well as bow fire, with eight broadside guns between.

In 1878, when Russia was threatening Constantinople, three ships then building in England were bought from the Ottoman Government,—the "Belleisle" and "Orion," belted ships with a central battery and a gun at each of the corners, and the "Superb," broadside ironclad. At the same time the "Neptune," a masted turret ship like the "Monarch," building for Brazil, was bought.

The "Impérieuse" and "Warspite," now building, of steel, are the latest type of ironclad cruisers. They are like the "Nelson," but with barbette towers of the French type forward and aft and amidships instead of the partial battery.

Recent ships are furnished with every appliance that modern science can devise to augment their efficiency and power. The turrets and the turn-tables of the barbette ships are moved by hydraulic power; the guns are loaded and worked by the same power, and are fired by electricity if desired. Electricity is used to light the batteries and the ship generally, the old fighting lanthorn, or indeed any other, being extinguished by the shock of discharge of modern artillery. The capstan, the steerage of the ship, the gun, the ram and torpedo, the pumps and ventilation, and electric light all require machinery in every direction, so that the ship has become a factory. A large proportion of the crew are relegated to the stokeholds, and but little is left that recalls the war-ship of our fathers.

The "Polyphemus" is the only other vessel to be here mentioned. She is hardly an ironclad; she comes under the head of special ships, and is described in the *Navy List* as a double screw torpedo-ram of 2640 tons and 5500 horse-power. Her shape is cylindro-conical, of steel—the part above water being covered with 3 inches of steel. She is intended for ramming and to use the Whitehead torpedo. Her only other armament is the machine gun. These guns are mounted in revolving towers.

In this ship the first attempt was made in a sea-going vessel to use the locomotive boiler (working with fresh water) with closed stokeholes and forced draught. Mr Thornycroft and other torpedo-boat builders had used one such boiler in boats with great success. As its weight was very considerably less than the ordinary type of boiler, the experiment seemed to be justified. Great difficulties were, however, found to attend the use of such boilers in numbers sufficient for a sea-going vessel, and while the experiments were in progress it was ascertained that, by using closed stokeholes and forced draught, the ordinary cylindrical marine boiler using salt water could be made as economical of weight as the locomotive type. The ordinary practice up to this date had required a total weight of machinery of about 4 cwt. for each indicated horse-power in a sea-going ship. The employment of forced draught, and concurrent improvements in machinery, made it possible to get a horse-power in such ships with not more than from 2 to 2½ cwt. total weight of engines and boilers, including the water in boilers and condensers. The locomotive boilers have therefore been given up in this ship.

The following extract (with slight variations and additions) from the *Statesman's Year-Book*, 1883, gives a fair idea of the present position and strength of the British ironclad fleet:—

> "The most important division of the navy, the ironclad fleet of war, consisted at the end of 1882 of 74 ships afloat and building, of which number 55 were afloat and described as efficient for sea or for coast defence, while 3 were not strictly British, being built solely for the defence of the colonies, 6 were on the stocks, and 10 had become inefficient for naval warfare. The following is a tabulated list of the 'so-called' efficient ironclads, and of the ironclads still on the stocks, divided into five classes according to the strength of armour and armament and mode of construction.[1] The ironclads marked with an asterisk were not completed at the end of 1882."

Names of Armoured Ships.	Material of Hull.	Single (S.) or Twin (T.) Screw.	Armour. Thickness in Inches.	Guns.		Indicated Horse-Power.	Displacement.
				Number.	Weight.		
FIRST CLASS.							
Turret Ships.							
Inflexible	Iron.	T.	16 to 24 Steel-faced on turrets.	4	80 ton.	8,000	11,880
Dreadnought	,,	,,	11 to 14	4	38 ,,	8,200	10,820
Devastation	,,	,,	10 ,, 14	4	35 ,,	6,650	9,230
Thunderer	,,	,,	10 ,, 14	4	Two 35 ton and two 38 ton.	6,270	9,330
*Colossus	Steel	,,	14 ,, 18 Steel-faced.	9	Four 43 ,, five 80 cwt.	6,000	9,150
*Edinburgh	,,	,,		9	,, 43 ,, ,, 80 ,,	6,000	9,150
Barbette Ships.							
*Collingwood	Steel.	T.	10 to 18 Steel-faced.	10	Four 43 ton and six 89 cwt.	7,000	9,150
*Rodney	,,	,,		10	,, 63 ,, ,, 89 ,,	7,500	9,600
*Howe	,,	,,		10	,, 63 ,, ,, 89 ,,	7,500	9,600
*Camperdown	,,	,,	12 to 18 Steel-faced.	10	,, 63 ,, ,, 89 ,,	7,500	10,000
*Benbow	,,	,,		12	Two 110 ,, ten 89 ,,	7,500	10,000
*Anson	,,	,,		10	Four 63 ,, six 89 ,,	7,500	10,000
SECOND CLASS.							
Turret Ships.							
Agamemnon	Iron.	T.	14 to 18 Steel-faced on turrets.	6	Four 38 ton and two 89 cwt.	6,000	8,500
Ajax	,,	,,	,, ,,	6	,, 38 ,, ,, 89 ,,	6,000	8,500
*Conqueror	Steel.	,,	8½ to 12 Steel-faced	6	Two 43 ,, four 89 ,,	4,500	6,200
Rupert	Iron.	,,	9 to 14	4	,, 18 ,, two 70 ,,	4,600	5,440
Hotspur	,,	,,	8 ,, 11	4	25 ,, ,, 81 ,,	3,060	4,010
Glatton	,,	,,	10 ,, 14	2	25 ton.	2,870	4,910
Corvettes.							
Belleisle	Iron.	T.	8 to 12	4	25 ton.	3,200	4,870
Orion	,,	,,	7 ,, 12	4	25 ,,	4,040	4,870
THIRD CLASS.							
Rigged Ships.							
Superb	Iron.	S.	7 to 12	16	18 ton.	6,580	9,170
Neptune (turret)	Iron. Sheathed.	,,	9 ,, 12	6	Four 38 ton and two 12 ton.	8,000	9,310
Monarch, do.	Iron.	,,	6 ,, 10	7	Four 25 ton, two 12 ton, and one 6½ ton.	7,840	8,320
Hercules	,,	,,	6 ,, 9	14	Eight 18 ,, ,, 12 ,, ,, four 6½ ,,	6,750	8,680
Sultan	,,	,,	6 ,, 9	12	Eight 18 ton and four 12 ton.	7,720	9,290
Alexandra	,,	T.	6 ,, 12	12	Two 25 ,, ten 18 ,,	8,610	9,490
Temeraire (barbette)	Iron. Sheathed	,,	8 ,, 11	8	Four 25 ,, four 18 ,,	7,520	8,540
Nelson	,,	,,	6 ,, 9	12	,, 18 ,, eight 12 ,,	6,640	7,630
Northampton	,,	,,	6 ,, 9	12	,, 18 ,, ,, 12 ,,	6,070	7,630
Shannon	,,	S.	6 ,, 9	9	Two 18 ,, seven 12 ,,	3,370	5,390
Bellerophon	Iron.	,,	6	15	Ten 12 ,, five 6½ ,,	6,520	7,550
Penelope	,,	T.	5 to 6	11	Eight 9 ,, three 40-pounders.	4,700	4,470
*Impérieuse	Steel Sheathed.	,,	8 ,, 10 Steel-faced.	10	Four 18 ,, six 89 cwt.	8,000	7,390
*Warspite (barbette)	,,	,,		10	,, 18 ,, ,, 89 ,,	8,000	7,390
Audacious	Iron. Sheathed.	,,	6 to 8	18	Ten 12 ,, eight 22 ,,	4,830	6,010
Invincible	Iron.	,,	6 ,, 8	14	,, 12 ,, four 71 ,,	4,830	6,010
Iron Duke	,,	,,	6 ,, 8	14	,, 12 ,, ,, 71 ,,	4,270	6,010
Swiftsure	Iron. Sheathed.	S.	6 ,, 8	18	,, 12 ,, eight 22 ,,	4,910	6,910
Triumph	,,	,,	6 ,, 8	14	,, 12 ,, four 71 ,,	5,110	6,640
Special.							
Polyphemus	Steel.	T.	2 to 3 Hard steel.	...	Machine guns only.	5,500	2,640
FOURTH CLASS.							
Turret Ships.							
Cyclops	Iron.	T.	6 to 10	4	18 ton.	1,660	3,480
Gorgon	,,	,,	8 ,, 10	4	18 ,,	1,670	3,480
Hecate	,,	,,	6 ,, 10	4	18 ,,	1,750	3,480
Hydra	,,	,,	6 ,, 10	4	18 ,,	1,470	3,480
Prince Albert	,,	S.	4½ ,, 10	4	12 ,,	2,130	3,880
Scorpion	,,	,,	4½ ,, 5	4	12 ,,	1,450	2,750
Wivern		,,	4½ ,, 5	4	12 ,,	1,450	2,750
Gunboats.							
Viper	Iron.	T.	4½	4	Two 6½ ton and two 24-pounders (howitzers).	700	1,230
Vixen	Iron. Sheathed.	,,	4½	4	,, 6½ ,, ,, 24 ,, ,,	740	1,230
Waterwitch	Iron.	Hydraulic.	4½	4	,, 6½ ,, ,, 24 ,, ,,	780	1,280
FIFTH CLASS.							
Rigged Ships.							
Warrior	Iron.	S.	4½	32	Four 9 ton and twenty-eight 6½ ton.	5,270	9,210
Black Prince	,,	,,	4½	28	,, 9 ,, twenty-four 6½ ,,	5,770	9,210
Achilles	,,	,,	4½	16	Fourteen 12 ton and two 6½ ton.	5,720	9,820
Minotaur	,,	,,	5½	17	12 ton.	6,700	10,690
Agincourt	,,	,,	5½	17	12 ,,	6,870	10,690
Northumberland	,,	,,	5½	27	Seven 12 ton and twenty 9 ton.	6,560	10,780
Hector	,,	,,	4½	18	Two 9 ,, sixteen 6½ ,,	3,260	6,710
Valiant	,,	,,	4½	18	,, 9 ,, ,, 6½ ,,	3,350	6,710
Defence	,,	,,	4½	16	,, 9 ,, fourteen 6½ ,,	2,540	6,270
Resistance	,,	,,	4½	16	,, 9 ,, ,, 6½ ,,	2,430	6,270
Lord Warden	Wood.	,,	4½ to 5½	18	Two 12 ton, fourteen 9 ton, and two 6½ ton.	6,700	7,840
Repulse	,,	,,	6	12	9 ton.	3,350	6,190

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[1] The classification is without authority, and is open to question.

There are three other 18-ton turret ships of the fourth class, viz., the "Cerberus," belonging to the Victorian Government, and stationed at Melbourne, and the "Abyssinia" and "Magdala," belonging to the Indian Government, and stationed at Bombay.

From the experience of the American civil war and the cruise of the "Alabama" was born the modern type of cruiser, the object of these being to overtake and capture the cruisers of the enemy and to destroy his commerce. It is not supposed that they would be charged with a convoy.

The "Inconstant," commenced in 1866, was the first of this class. With a view to retain the advantages of copper sheathing in combination with the iron construction which was necessary in so long a ship, she was built of iron, of 5782 tons displacement, cased with wood in two thicknesses, and coppered. She was heavily armed, and attained a speed of 16 knots at full power. Her coal supply would last two and a quarter days at this speed, but it sufficed without the use of sail for forty-one days at 5 knots an hour. The "Active" and "Volage" were laid down at the same time on a reduced scale, and their speed was 15 knots. The "Shah" and "Raleigh," commenced in 1870, were of the same type as the "Inconstant," while the "Boadicea," "Bacchante," and "Euryalus" were of intermediate type, 4140 tons displacement. They were all built of iron and cased with wood and sheathed.

The "Iris" was commenced in 1875. She is remarkable as the first war vessel constructed entirely of steel. She was intended for an armed despatch vessel, and in order to obtain the highest speed it was imperative to use the lightest, or, in other words, the strongest, material in her construction. There was at this time, moreover, a great difficulty in getting uniformly good iron even at extravagant prices. On these grounds a mild steel was employed, which enabled her designers to put 7700 horse-power into a hull with a load displacement of only 3730 tons, and to attain the speed of 18·572 knots, with a length of only 300 feet. The sister ship, the "Mercury," did even more, realizing 18·876 knots, or nearly 22 miles an hour.

The "Comus" was the first of nine vessels built in 1879, and called the C. class from the initial letter of their names. They have iron or steel bottoms, cased with wood, and iron or steel frames and internal fittings. The engines and boilers are protected by a 1½-inch steel deck over them, as well as by the coal as much as possible. They are smaller than the "Active" class, and are intended for foreign service. They are variously armed; the "Canada" carries ten 6-inch guns on the broadside. The two foremost ones are mounted on central pivot carriages on sponsons or projections from the side. By this method they each cover half the horizon. The "Calliope" and "Calypso" are building on a somewhat larger scale. They will mount four 6-inch guns on sponsons, two forward and two aft, with ten 5- or 6-inch guns between them on the broadside. All are coppered.

There are six of a class called the "Gems," of which the "Ruby" is the type. They are composite vessels, with iron frames and wood planking, and sheathed with copper.

The next is a new class, built entirely of steel on the lines of the "Iris," and described as second-class cruisers. All this class have twin screws, and their armaments are arranged in a similar manner to that of the "Calliope," and in an open battery. The "Leander" of this class is of 3750 tons, 5000 horse-power, carries 700 tons of coal, and will have a speed of 16 knots.

The "Mersey" is rather smaller, being of 3550 tons, but she has 500 horse-power more, and is expected to steam 17 knots. She will mount fourteen 6-inch guns, and has a covered battery.

All the above-named vessels are protected by a steel turtle-back deck. In the "Mersey" class this deck will be carried throughout the length. They will have the Whitehead torpedo and two second class torpedo boats.

There are, besides, numerous sloops and gun vessels, chiefly composite. The floating gun-carriages of the "Staunch" type, designed by Mr Rendel in 1867 to carry an 18-ton gun, are small, low, mastless boats, with a speed of about 8 knots. The gunboats forming the "Mosquito" fleet in 1854 have mostly disappeared.

The accompanying table gives a list of English unarmoured ships. The vessels named in italics have a protecting deck—the "Mersey," "Severn," and "Thames" throughout, the others over machinery and magazines.

Materials of Construction.—Henceforward we have a new departure as regards the material for ships of war. As the iron displaced the wooden walls, so now steel is displacing iron. All the new ships, whether armoured or not, are of steel.

A remarkable economy in cost has been effected by these means. The steel is so uniform in quality, and the manufacture is so precise, that there is fair competition, and therefore a nearly uniform rate all over the country, and this rate is only one-half of what was given for iron for the royal dockyards when the "Iris" and "Mercury" were commenced. At that date (1875) the contract price of Admiralty plates of a standard size was over £20 per ton. Iron plates supplied to the same specification, but not subject to tests, were supplied by different makers at prices differing from each

English Unarmoured Ships.[1]

Name.	Displacement.	Indicated Horse-power.	Length.		Breadth.		When Built.	Material of Hull.	Speed in Knots.[2]
	Tons.		ft.	in.	ft.	in.			
Inconstant	5,780	7,360	337	4	50	3	1868	Iron (sheathed with wood).	16·20
Raleigh	5,200	6,160	298	0	49	0	1873	„	15·22
Shah	6,250	7,480	334	8	52	0	„	„	16·20
Mersey (T)	3,550	6,000	300	0	46	0	Building.	Steel.	17·00
Severn (T)	3,550	6,000	300	0	46	0	„	„	17·00
Thames (T)	3,550	6,000	300	0	46	0	„	„	17·00
Active	3,000	4,010	270	0	42	0	1869	Iron (cased).	14·97
Amethyst	1,970	2,140	220	0	37	0	1873	Wood.	13·24
Bacchante	4,130	5,250	280	0	45	6	1876	Iron (cased).	15·00
Boadicea	4,140	5,290	280	0	45	0	1875	Iron (cased).	14·70
Briton	1,860	2,150	210	0	36	0	1869	Wood.	13·13
Canada	2,380	2,200	225	0	44	6	Building.	Steel and iron cased with wood.	13·00
Caroline	1,420	1,500	200	0	38	0	„	Composite.	13·00
Carysfort	2,380	2,300	225	0	44	6	1878	Steel and iron cased with wood.	13·00
Calliope	2,770	3,000	235	0	44	6	Building.	„	13·75
Calypso	2,770	3,000	235	0	44	6	„	„	13·75
Cleopatra	2,380	2,300	225	0	44	6	1878	Steel and iron cased with wood.	13·00
Champion	2,380	2,300	225	0	44	6	„	„	13·00
Comus	2,380	2,300	225	0	44	6	„	„	13·00
Conquest	2,380	2,300	225	0	44	6	„	„	13·00
Constance	2,380	2,300	225	0	44	6	Building.	„	Est. 13·00
Cordelia	2,380	2,300	225	0	44	6	„	„	Est. 13·00
Curaçoa	2,380	2,300	225	0	44	6	1876	„	13·00
Diamond	1,970	2,150	220	0	37	0	1874	Wood	13·56
Dido	1,760	2,520	212	0	36	0	1869	„	13·50
Druid	1,860	2,270	220	0	36	0	„	„	12·90
Eclipse	1,760	1,960	212	0	36	0	1867	„	12·90
Emerald	2,120	2,170	220	0	40	0	1876	Composite.	13·20
Encounter	1,970	2,130	220	0	37	0	1873	Wood.	12·19
Euryalus	4,140	5,270	280	0	45	6	1877	Iron (cased).	14·73
Garnet	2,120	2,000	220	0	40	0	„	Composite.	13·00
Heroine	1,420	950	200	0	38	0	1878	„	13·10
Hyacinth	1,420	950	200	0	38	0	„	„	13·10
Juno	2,240	1,330	200	0	40	4	1867	Wood.	10·87
Modeste	1,970	2,150	220	0	37	0	1873	„	12·79
Opal	2,120	2,120	220	0	40	0	1875	Composite.	13·37
Pylades	1,420	1,500	200	0	38	0	Building.	„	13·00
Rapid	1,420	1,500	200	0	38	0	„	„	13·00
Rover	3,460	4,960	280	0	43	6	1874	Iron (cased).	14·53
Royalist	1,420	1,500	200	0	38	0	Building.	Composite.	13·00
Ruby	2,120	1,830	220	0	40	0	1876	„	12·28
Sapphire	1,970	2,300	220	0	37	0	1874	Wood.	13·53
Satellite	1,420	950	200	0	38	0	1879	Composite.	13·10
Tenedos	1,760	2,040	212	0	36	0	1870	Wood.	12·80
Thalia	2,240	1,600	200	0	40	4	1869	„	11·14
Thetis	1,860	2,270	220	0	36	0	1871	„	13·39
Tourmaline	2,120	1,970	220	0	40	0	1875	Composite.	12·62
Turquoise	2,120	1,990	220	0	40	0	1876	„	12·32
Volage	3,080	4,530	270	0	42	0	1869	Iron (cased).	15·08
Iris (T)	3,730	7,000	300	0	46	0	1877	Steel.	18·00
Mercury (T)	3,730	7,000	300	0	46	0	1878	„	18·00
Leander (T)	3,748	5,000	300	0	46	0	Building.	„	16·00
Phaeton (T)	3,748	5,000	300	0	46	0	„	„	16·00
Arethusa (T)	3,748	5,000	300	0	46	0	„	„	16·00
Amphion (T)	3,750	5,000	300	0	46	0	„	„	16·00
Scout (T)	1,430	3,200	220	0	34	0	„	„	16·00
Albatross	940	840	160	0	31	4	1873	Composite.	10·51
Alert	1,240	310	160	0	31	11	1856	Wood.	7·68
Cormorant	1,130	950	170	0	36	0	1877	Composite.	11·31
Daring	940	920	160	0	31	4	1880	„	10·64
Dragon	1,140	1,010	170	0	36	0	1878	„	11·52
Dryad	1,630	1,570	187	0	36	0	1866	Wood.	11·57
Egeria	940	1,010	160	0	31	4	1873	Composite.	11·30
Espiègle	1,137	900	170	0	36	0	Building.	„	11·50
Fantome	940	970	160	0	31	4	1873	„	11·06
Fawn	1,050	480	160	0	31	10	1856	Wood.	8·36
Flying Fish	940	840	160	0	31	4	1873	Composite.	10·86
Gannet	1,130	900	170	0	36	0	1878	„	11·33
Kingfisher	1,130	900	170	0	36	0	1879	„	11·60
Miranda	1,130	900	170	0	36	0	„	„	11·50
Mutine	1,137	900	170	0	36	0	Building.	„	12·00
Osprey	1,130	1,010	170	0	36	0	1876	„	11·20
Pegasus	1,130	970	170	0	36	0	1878	„	11·47
Pelican	1,130	1,060	170	0	36	0	1877	„	11·60
Penguin	1,130	760	170	0	36	0	1876	„	10·60
Sappho	940	860	160	0	31	4	1873	„	10·50
Wild Swan	1,130	800	170	0	36	0	1876	Composite.	10·33
Enchantress	1,000	1,330	220	0	28	3	1862	Wood.	14·02
Helicon	1,000	1,610	220	0	28	3	1865	„	13·06
Vigilant	1,000	1,810	220	0	28	3	1871	„	13·27
Hecla	6,400	1,760	301	7½	38	8½	Purchased in 1878	Iron.	11·70
Vesuvius (T)	244	380	90	0	22	0	1874	„	9·71
Bittern (T)[3]	805	850	170	0	29	0	1869	Wood.	10·70
Algerine[4]	835	810	157	0	29	6	1860	Composite.	10·50
Flirt (T)[5]	600	580	155	0	25	0	1867	„	9·68

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[1] Those marked (T) have twin screws. The "Enchantress," "Helicon," and "Vigilant" have paddles.

[2] These are speeds at measured mile, at load draught of water, either ascertained or estimated.

[3] In this class, of tonnage 805, there are 3 gun-vessels.

[4] In this class, of tonnage 720 to 930, there are 16 gun-vessels.

[5] In this class, of tonnage 603 to 756 there are 9 gun-vessels. There are 74 gunboats of tonnage from 180 to 560.

other by more than 100 per cent., according as the makers and the particular brand were supposed to have credit in the market. The steel now in use is absolutely faultless as to surface, stronger and more ductile than iron, and very uniform in quality. That actually employed in the "Iris" and "Mercury," being a new material (Siemens-Martin of special quality), was no cheaper than the highest quality of tested iron. Since then the extension of its use in all directions has brought it down to half the price given at first. Siemens-Martin and Bessemer steel are now employed almost indifferently. Between 1866 and 1876 only three small vessels were built of steel in the United Kingdom. It is now employed in all the shipbuilding establishments in the country. In this case the royal navy gave the start, and private shipbuilders followed, in a most important change in the use of materials of construction.

The use of steel in the navy has not been confined to shipbuilding. The guns took it up first for internal tubes, and now the whole gun is built of it. The armour has also adopted it, wholly or in part. In England a steel face is cast upon an iron back, the steel being about one-third of the thickness of the plate. The hard face has been found very efficacious in breaking up the attacking projectiles. It has been found by experiment, for example, that flat plates of compound armour 12 inches thick are more effective against iron and steel projectiles, fired normally, at high velocity, from a 9-inch gun, than plates of iron 14 inches thick. But the most important point gained is that it has become impossible for iron shell to perforate armour as shell. The hard face of the armour breaks the shell to pieces.

Mercantile Marine.—There has never been a time in British naval history when the merchant service has failed to supply ships and men for the national defence. For some years prior to 1853 it was the practice to insert in mail contracts clauses providing for the armament of the steamships employed in mail service.

Towards the end of 1852 a report was presented to the Board of Admiralty by a committee of four officers on the question of arming the mail contract steam-packets belonging to the Peninsular and Oriental and Royal West India Mail Packet Companies. Their recapitulation of their report is as follows:—

"That the two companies have 53 vessels (23 of iron); that 16 ply between Southampton and foreign ports; that 5 on an average are always at home and fit for sea; that 8 may be rendered available for war purposes on an emergency, if they can be spared from the mail packet service within different periods extending altogether over sixty-six days; that they would not make efficient substitutes for regular men-of-war; that they might be fitted for armed packets and armed troop-ships; that it would be prudent in future that the fittings be executed beforehand; that the fittings necessary to the nature of proposed armaments (including magazines and shell-rooms) would cost from £600 to £800 for first and second class vessels, if attended to while a vessel is in progress of building or undergoing a large repair, and proportionally less for smaller vessels; that guns of such calibre be used as are common in the royal navy (viz., 8-inch guns of 65 cwt., and 32-pounders of 42 cwt.), to facilitate the supplies and render fittings and ordnance stores transferable from ship to ship; that a store of guns be kept at the port of Southampton (or Portsmouth), with a proper proportion of ordnance and gunners' stores laid apart ready for an immediate call; that it would be advisable to introduce a clause in the contracts giving the Admiralty . right of pre-emption, and possibly to prevent their sale (but with permission) to a foreign power."

In a second report from the same committee, dated March 1853, upon the British and North American, the Pacific, the General Screw, the Australian, the South Western, and the African Companies, the report is summed up in the statement that out of 91 vessels—belonging to eight distinct companies—employed in mail contracts, there were only 16 which could be made available on an emergency for auxiliary war purposes. Iron vessels were excluded from those which might be considered available "on account of the material used in their construction," but the committee does not state why the material was considered unsuitable.

To go into the reasons influencing their decision would make it necessary to refer to the experiments and the scientific and political controversies which had then been going on for ten years. During this time it had been decided to create a war navy of iron ships; the ships were commenced; then it was attempted to stop the building of them, but without success; they were then transformed into troop- and store-ships. Of two great parties, one contended that iron had been proved to be unfit for fighting ships, and the other that there had been no such proof, and that in the end wood must be given up.

The officers composing this committee appear to have agreed with the former party; and they do not seem to have thought it necessary to give any reason for their rejection of all the large and fine ships employed in the mail service which, at some small expenditure of money, were suitable for receiving an armament in every particular, except that they were built of iron.

In March 1853 a Treasury minute was issued calling attention to the enormous cost of the mail packet service, and appointing a committee to consider the whole question. Among other things it is said in these instructions:—

> "In reviewing the purposes and stipulations of the contracts, the committee will have to consider and report whether they can learn either that the prospect of a reserve of ships of war, which was at one time confidently entertained, has been realized in any sensible degree under these costly arrangements, or whether there is any probability that it can be realized hereafter compatibly with the paramount purpose for which the packets have been constructed, viz., that of postal vessels. On this point the committee will consult a report which has been presented to the Board of Admiralty by a committee of naval and artillery officers.
>
> "It will also be their duty to observe what provisions have been inserted in the contracts to secure the sufficiency of the ships for the purpose of naval warfare; to ascertain whether the stipulations have been carefully fulfilled; whether, in any cases where they have not been so fulfilled, permission to waive them has been regularly sought and obtained from the proper department of the Government; and whether, in consideration of such non-fulfilment, there has been any adequate remission, or any remission, of the price which the state engaged to pay, not for postal service merely, but for the double purpose of postal service, together with a reserve force in aid of the royal navy."

In July 1853 the committee reported:—

> "The question which appears to us first in the order of consideration is, whether it is desirable to simplify such contracts as may in future be made, by omitting from them all provisions which do not directly bear upon the efficiency of the postal service. In arranging the terms of these contracts, the Government seized the opportunity of requiring that the vessels should be constructed in a manner that would render them as serviceable for national defence in war as steam packets belonging to the crown would have been if employed in their stead. A provision to this effect was first inserted in the contract with the Royal Mail Company in 1840, and in most of the existing contracts stipulations are to be found, requiring that the vessels should be of a construction and strength fit to carry such an armament as the Admiralty may think proper. In several cases they must be built of wood, and not of iron; and there are some contracts which confer on the Admiralty the right of taking the ships at a valuation when it may be thought desirable to do so.
>
> "The surveyor's report upon most of these vessels, as regards their fitness for war purposes, is in the following terms:—'Not fitted for armament, but capable of carrying guns when so fitted.' This report accords with the opinion expressed by the committee of naval and artillery officers upon the vessels which have come under their notice. It appears, however, from the statements of that committee that, although the packets they have examined are for the most part of sufficient strength to carry and fire a certain number of guns, the expense of the alterations which would be necessary before they could be got ready for service would be very considerable, and that, even when such alterations had been made, the efficiency of the vessels would be very small in proportion to their size, and that they could not encounter hostile vessels of equal tonnage without endangering the honour of the British flag.
>
> "With reference to future contracts, we are decidedly of opinion that no expense should be incurred for the sake of imposing conditions for giving a military character to the postal vessels. We believe the imposition of such conditions to be a measure of false economy. Should a war suddenly break out, the immediate demand for mail steamers would probably be greater than ever, and it might be exceedingly inconvenient to withdraw them at such a time from their legitimate use for the purpose of arming them for battle. Moreover, the high charge for the packet service has been borne with the greater readiness, because it has been supposed by some to include a provision, of large but unknown amount, for the defence of the country; while, on the other hand, the naval estimates have sometimes been complained of as excessive, on the ground that the force provided for was in addition to the large reserve of postal war steamers.
>
> "We accordingly recommend that for the future the contracts for the conveyance of the mails should be wholly free from stipulations of the nature we have been describing, though it may be desirable in some cases to retain the power in the Government to take possession of the vessels in the event of national emergency."
>
> They add:—"An erroneous impression appears to have prevailed among the public as to the efficiency of our postal steamers for direct purposes of warfare. We do not believe that those who are charged with the direction of the military affairs of the country have ever regarded them as likely to be of any great service in an engagement, but their advantage as an auxiliary force will be very considerable. They will be available, in the event of the breaking out of hostilities, for the rapid conveyance of despatches, of specie, and, to a certain extent, of troops and stores. Their speed will be such as probably to secure them from the risk of capture, and will render them highly valuable for procuring intelligence of hostile movements. They may also be expected to furnish queen's ships with men trained to steam navigation, and possessing an amount of local knowledge which cannot fail to be valuable in several ways.
>
> "Again, it is not only in a military sense that rapidity of communication between all parts of the British empire tends to increase its security. While the mother country continues to exercise any control over the proceedings of the colonies, the inconveniences attending the delay of correspondence are severely felt, and speedy communication is of the highest consequence to the preservation of satisfactory relations between them."

Within the last few years all references to armament or fitness for warlike services have disappeared from the mail contracts, but there has been in some of them a clause providing that the Admiralty may in cases of great public emergency charter vessels of the company at rates to be agreed on, but in case of difference as to such rates, or damages consequent upon such purchase or hiring, the same is to be settled by arbitration.

Since 1852, when the committee refused to accept vessels built of iron, many changes have taken place. There are no wooden mail steamers left: iron or steel has completely displaced wood as a material of construction for such purposes. The great development of incendiary projectiles in war, such as percussion shell, red-hot shot, and hollow shot filled with molten iron, not only led to the adoption of iron armour, and thus incidentally to iron frames and skin as well, but showed also that wooden ships would be rapidly set on fire in an action. In the ironclad ship the objection raised to iron for the structure of war ships, viz., that the plating and riveting could be driven out in numerous and dangerous fragments by projectiles, does not hold. The experiments on the "Simoom" targets (1849–51) were doubtless in the minds of the officers who made the reports referred to above, and they must not be forgotten.

There are now many ships for fighting purposes built with iron frames and iron skin, and without armour; but in most of these cases there is stout wooden planking wrought over this iron skin, with the express object of obliging projectiles passing right through the ship to punch a hole in the side by which they pass out, instead of driving off masses of plating by the breaking of the rivets. There can be no doubt also that plates are better, and riveting is sounder now, than they were apt to be twenty years ago. The iron ships in the merchant navy have not this protection. It is difficult to estimate the precise gravity of the defect, but there is no doubt that it is sufficiently important to make proper division into compartments imperative, so as to give time to cover a damage in the side under water. But, unfortunately, a proper subdivision into compartments, of which the divisional bulkheads rise a sufficient height above the water, is very rare in merchant ships, even in mail steamers. If the compartments are so large and the tops of the bulkhead so low that, by filling a compartment, the top of the bulkhead is brought below the level of the water outside the ship, the loss of the ship is inevitable. Moreover, these ships are, as a rule, very narrow in proportion to their displacement, and their risk of foundering, by the filling of a compartment, is thereby greatly increased, because a narrow ship loses its stability rapidly under these circumstances, and will turn over.

Another disadvantage is the height of the engines and boilers. In ships of war of the size of the mail steamers, and indeed in nearly all, of whatever size, the engines and boilers are kept below the water, and fairly out of the reach of shot. But in modern mail steamers the engines are worked with their cylinders standing some feet above the load water-line. The advantage of this arrangement, in point of economy of working, is very great, but it involves serious risk in a fighting ship.

In 1856 a most important event occurred seriously affecting this question, viz., the signing of what is known as the Declaration of Paris, a sort of rider to the treaty of Paris of March 1856, by which declaration it was laid down that, "whereas it was formerly legal to grant royal commissions to private owners to equip, arm, and man private cruisers, to capture the commerce of the enemy for their own profit, this shall no longer be legal; that, while the cruisers of the state may capture and destroy private ships belonging to subjects of the hostile state, they may not, as of old, search neutral ships in the open seas to discover and confiscate hostile property contained in them, but only to verify their right to fly the neutral flag, and to discover and confiscate property held to be contraband of war, destined for ports of the enemy."

This was in fact a ratification in perpetuity of an order in council of the 25th of March 1854, by which, on the outbreak of war with Russia, Great Britain consented to "waive her maritime rights" and allow enemies' goods to be carried in neutral bottoms without liability to seizure.

All the parties to the treaty of Paris agreed to this declaration, and the rights it confers on neutrals are rights now common to all the European powers. Under its operation neutrals would doubtless insist on exercising for their own profit the right of carriage into and out of those ports of a belligerent which were not effectively blockaded by the enemy. Privateering being abolished, so far as the European powers are concerned, each maritime nation would seek, on the outbreak of war, to incorporate into the state navy the fastest and most powerful merchant ships it could obtain. Each war navy would become strengthened by the addition of merchant ships capable, at whatever risk to themselves, of mounting guns, of ramming, and of employing the torpedo. By this means the naval power would depend, not only on the strength of the war navy, but also upon the strength and excellence of the national mercantile marine. For this purpose only the fastest ships would be useful, and all the rest would fall a prey, in any encounter, to the fast ships in the hands of an enemy.

The great importance attached to the possession of such fast ships may be seen from the figures given below.

	Tons.
British registered merchant ships, sailing and steam (23,939)—estimated gross tonnage in 1880	10,200,000
Of this the proportion of steamers (6903) was	4,400,000

At the same date the whole number of British ships built and building having an average ocean speed of 12 knots and upwards did not exceed 400; and ships of this speed built and building for all other maritime powers taken together did not reach 100. The only powers possessing such ships were France, Germany, Holland, Spain, United States, Italy, and Belgium.

Between 1875 and 1882 the number of English merchant steamers of 13 knots ocean speed and upwards increased from 25 to 65, of 14 knots and upwards from 10 to 35, and the maximum speed rose from 15 to 17 knots.

Since 1875 the Admiralty have been engaged in forming a list of all ocean-going British ships which, being reasonably divided into compartments, might be armed in the event of war. The number on this list having an average ocean speed of 12 knots and upwards is, in 1883, 112, with a total gross register tonnage of 451,470 tons.

The number of men and boys actually employed in 1880 in registered British sea-going vessels was nearly 200,000, of which nearly 12 per cent. were foreign and the rest British.

Sir Thomas Brassey estimates that there are in the British mercantile marine 407,000 seamen, exclusive of men in British ships in the colonies and abroad. The total number includes—

Masters and mates, certificated	38,200
" " not certificated	10,000
Fishermen	150,000
Other sailor men	181,000
Firemen	14,000
Apprentices	11,000
Boys in fishing boats	13,000

Naval Guns.—From time immemorial smooth-bore guns in cast iron, or bronze for the smaller calibres, had been used for throwing spherical shot with charges not exceeding one-third the weight of the shot.

The first use of rifled guns in the navy was in 1859–60, when Mr (now Sir William) Armstrong's breech-loading 40-pounder and 100-pounder guns were issued to the service. The elongated shot or shell and cartridge were entered from the rear, through a hollow screw. A breech piece in which the vent was formed was dropped through a slot in the breech of the gun, and, being tightened up by the hollow screw, closed the bore. The projectile was coated with lead to take the polygroove rifling. It fired much more accurately than the smooth-bore; but in 1863, the method of closing the breech having proved inefficient on service in Japan, the manufacture was discontinued.

In 1865 muzzle-loading guns were adopted, built on Armstrong's principle of welded wrought-iron coils round a steel tube, rifled on the "shunt" principle, in which a studded projectile was rammed down grooves in the bore, rather deeper than those by which it was afterwards driven out. The guns gradually increased in weight up to the 12-inch 38-ton gun and 16-inch 80-ton gun. In 1876 the 80-ton gun was fired with a projectile of 1700 ℔ and a charge of 425 ℔ at a target composed of four 8-inch iron plates with 5-inch intervals filled with teak, and perforated it. The charge of this gun was afterwards increased to 450 ℔ of prismatic powder.

In 1878 the advantage of an increased diameter of the powder chamber was recognized and adopted in the 38-ton gun, but in order to utilize this chamber in a muzzle-loading gun the cartridge had to be made small enough to pass through the bore and afterwards expand in the chamber. This involved an awkward cartridge. Breech-loading obviated this difficulty. The use of slow-burning powder required a considerably increased length of bore, and made muzzle-loading exceedingly difficult. Breech-loading also offered greater facility for closing the windage of the shot. These causes have led to a return to breech-loading. The system adopted is the French intercepted screw. The plan of reinforcing the steel tube by wrought iron coils has been abandoned, and the approved system of construction is a steel tube, supported by a steel breech, which takes the breech screw and extends to the trunnions, reinforced by one or more layers of steel hoops shrunk on. These guns throw an elongated projectile of about three and a half calibres of the bore in length, with a charge nearly half the weight of the shot, which gives a velocity approaching 2000 feet per second. The powder pressure (17 or 18 tons on the square inch) is no higher than it used to be, but is longer sustained. A few only of these guns are yet afloat.

Boats' guns are similar in type, but of solid steel. The projectiles are the Palliser chilled shell, or cored shot; the common shell, which contains about one-tenth of its weight of powder; the shrapnel shell, which contains bullets and a small charge to liberate the bullets; and the case shot, which is a thin case containing small shot for short ranges.

These guns will be made of all calibres and weights. Those already tried are the 12-inch 43-ton, 10·4-inch 26-ton, 9·2-inch 18-ton, 8-inch 11-ton, 6-inch 4-ton, 5-inch 36-cwt., 4-inch 22-cwt.

The Gatling gun is ten-barrelled revolving. It throws bullets of the same size as the rifle. An improved feed has just been tried, and with it the gun is capable of discharging 1000 rounds a minute. To guard against the attack of torpedo boats a rapid-firing gun of sufficient power to penetrate their sides was necessary, and for this purpose a four-barrel gun, invented by Mr Nordenfelt, was adopted, and is now supplied to all ships. Quick-firing 6-pounder guns are now under trial capable of firing shot or shell.

Cost of the Navy.—Sir Thomas Brassey says, "In considering the general question of our naval expenditure, it is necessary, in justice to those to whom its administration has been entrusted, to look back over a series of years, and to compare the fluctuations in that expenditure with the growth in the value of the trade for the protection of which our navy is maintained. In the year 1858–59 the effective expenditure for the navy was £7,106,100, and non-effective £1,334,000. In 1870–71 the effective expenditure was £7,308,000, while the non-effective had increased to £1,705,000. The estimates for the ensuing year (1881–82) provide for an effective expenditure of £8,434,000, while the non-effective expenditure amounts to £2,068,000. If we compare the expenditure of the army in the same interval, we find that the effective expenditure has grown from £9,337,000 to £12,797,000, with an increase of half a million in the non-effective expenditure.

"The increase in the foreign trade and tonnage of our merchant navy has been out of all proportion with the increase in our naval expenditure. The total tonnage of British merchant ships was 5,711,000 tons in 1860, 7,149,000 tons in 1870, and 8,462,000 tons according to our last returns. Reckoning the carrying power of steamships as fourfold that of sailing ships, we have half the mercantile tonnage of the globe.

"Germany, with a mercantile tonnage of 1,129,000, spends £890,000 on the maintenance and construction of her fleet. France, with 976,000 tons of merchant shipping, expends £2,893,000 on building and repairs, and employs 26,000 workmen in her dockyards. England, with an excess of tonnage over the French mercantile marine of 7 million tons, employs only 16,000 men in her dockyards, at an expenditure, under votes 6 and 10, of £3,323,000. With these figures before us, it cannot be said that England is leading the way in an aggressive policy, or in the direction of extravagance."

Comparative View of Navies.—A comparison of the matériel of modern navies would be very misleading if it only took into account the number and power of the regular ships of war, because for some important services there is but little difference between the value of the ship built for war purposes and of that only adapted to such purposes at need. The increasing vulnerability of the ship of war, however carefully built, to weapons which the adapted merchant ship can employ is one of the most notable features in the modern aspect of maritime warfare. The statesman who desires to estimate the naval resources of empires or states will need to consider the quality and extent of their mercantile marine in fast steamships and trained men as well as the number and efficiency of their regular ships of war, and their actual war personnel. A comparison limited to armoured or ironclad ships is vitiated by the defect that it does not account for the protection afforded to what are called unarmoured ships by other means than that of armouring their sides. This is fast becoming so considerable that a new term has been introduced (protected ships) to distinguish such vessels from ordinary unarmoured fighting ships.

The fairest available approximate measure of the power of the ships is their displacement or total weight. It always represents power of some kind, although in many cases the distribution of the various elements of power in the ship may be badly suited for many phases of war. Taking this as a measure, and reckoning, not only completed or practically completed ships, but also those in various stages of building, the maritime powers named stand as follows, first as to tonnage of armoured ships, secondly as to unarmoured ships, and thirdly as to both taken together:—

	Tons Displacement.		
	Armoured.	Unarmoured.	Total.
France	425,000[1]	291,000	716,000
Italy	127,000	70,000	197,000
Russia	105,000	72,000	177,000
Germany	104,000	74,000	178,000
United States	78,000	38,000	111,000
Turkey	67,000	...	67,000
Austria	60,400	32,600	93,000
Spain	36,000	85,000	121,000
Holland	35,600	...	35,600
Brazil	29,400	14,200	43,600
Denmark	27,900	16,800	44,700
Sweden and Norway	16,600	...	16,600
China	14,800	...	14,800
Japan	10,200	...	10,200
Chili	9,000	7,000	16,000
Argentine Republic	7,300	5,700	13,000
Greece	4,100	8,500	12,600
Portugal	2,500	...	2,500

The following facts are noteworthy in connexion with the above figures. (1) Germany, which launched her first ironclad ship in 1864, has not launched one since 1880, and has not one on the slips. (2) The armoured tonnage launched by Italy (1876–83) is greater than that launched by Germany during the same period. (3) The French armoured ships launched before 1873 are, with insignificant exceptions, built of wood. Every armoured ship the French are now building or completing (1883) is of iron or steel. (4) France has in process of construction, *i.e.*, building or completing, an ironclad navy equal in tonnage to the entire ironclad navy of Germany or Italy built and building; and equal also in tonnage to all the completed ships in her own navy launched during the previous ten years. (5) France expended in building and completing ships for sea in 1873–77 only one-half what was spent by England in those years. Since 1877 her expenditure on this service has usually equalled, and generally exceeded, that of England.

A general survey shows that the great cost of maintaining a regular war navy is tending to limit its production and employment in states which either are not wealthy or are obliged to maintain large armies. This must be an increasing tendency for the following reasons. (1) There is a growing necessity for high speed. Commerce increases its speed, and war must at least equal it. High speeds and fair fuel endurance require large coal supplies. The ship with a high speed and large coal supply is already a large ship. To protect such a ship efficiently with armour demands the highest quality of protective material over considerable areas. There is then a further demand for powerful artillery for the purpose of dealing with such armour in an adversary. The attack is constantly developing new methods, and demanding not only the adoption of its weapons but also the creation and adoption of corresponding defences against them. So it comes about that nothing but a large and costly ship can take first rank in a regular war navy. (2) The ships so produced need high training in officers and men, and the costly matériel must be accompanied by a correspondingly costly personnel. (3) The warlike usefulness of such ships is narrowed perpetually by the rapidly increasing power of fortresses, aided by torpedoes and torpedo boats, to protect harbours and towns against both attack and blockade. It is narrowed also by their inability to compete in speed and coal endurance with ships not protected or armed. (4) Lastly, and more generally, the occupation of the seas by shipping tends to increase, for economical reasons, in proportion as human labour is divided and specialized, and commodities interchanged. This growth in shipping and in the seafaring population will reduce the significance and importance of the single ship of war which it has cost so much to produce.

PERSONNEL OF THE NAVY.

The personnel of the British navy is composed of two different bodies of men, the seamen and the marines, each of which has its appropriate officers. The latter body is the subject of a separate article (see MARINES).

Officers.—The officers of the navy, exclusive of the marines, are divided into two distinct branches—the military and the civil.

1. The military, or executive, branch consists of the undermentioned officers, classed in the order of their rank:—flag-officers, commodores, captains, staff captains, commanders, staff commanders, lieutenants, navigating lieutenants, sub-lieutenants, chief gunners, chief boatswains, chief carpenters, gunners, boatswains, carpenters, midshipmen, naval cadets.

Flag-officers are divided into three ranks, viz., rear-admiral, vice-admiral, admiral. Formerly there were three subdivisions of each grade, according as the officer belonged to the white, blue, or red squadrons, but this distinction has been abolished (see ADMIRAL). There is also the rank of admiral of the fleet: such an officer, if in command, would carry the union flag at the main.

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[1] Of this amount 183,000 tons is built of wood, and 155,000 is incomplete, *i.e.*, is building or completing.

The civil powers and duties of the lord high admiral, or lords commissioners of the Admiralty, are treated of in the article ADMIRAL. Their military powers are more extensive and important. By their orders all ships are built, repaired, fitted for sea, or laid up in reserve, broken up, or sold, put in commission or out of commission, armed, stored, and provisioned, and employed on the home or foreign stations, or on voyages of discovery. All promotion in the several ranks emanates from them; all honours bestowed for brilliant services, and all pensions, gratuities, and superannuations for wounds, infirmities, and long services are granted by them or on their recommendation. All returns from the fleet are sent to the Board of Admiralty, and everything that relates to the discipline and good order of every ship. All orders for the payment of naval moneys are issued to the accountant-general of the navy by the lords commissioners of the Admiralty; and the annual estimate of the expenses of the navy is prepared by them, and laid before parliament for its sanction. All new inventions and experiments are tried by their orders before being introduced into the service; all designs of ships must be approved by them; all repairs, alterations, and improvements in the dockyards, and all new buildings of every description, must be submitted for their decision before they are undertaken.

All flag-officers, commanders-in-chief, are considered as responsible for the conduct of the fleet or squadron under their command. They are bound to keep them in perfect condition for service; to exercise them frequently in forming orders of sailing and lines of battle, and in performing all such evolutions as may occur in the presence of an enemy; to direct the commanders of squadrons and divisions to inspect the state of each ship under their command; to see that the established rules for good order, discipline, and cleanliness are observed; and occasionally to inquire into these and other matters themselves. They are required to correspond with the secretary of the Admiralty, and report to him all their proceedings.

Every flag-officer serving in a fleet, but not commanding it, is required to superintend all the ships of the squadron or division placed under his orders,—to see that their crews are properly disciplined, that all orders are punctually attended to, that the stores, provisions, and water are kept as complete as circumstances will admit, that the seamen and marines are frequently exercised, and that every precaution is taken for preserving the health of their crews. When at sea, he is to take care that every ship in his division preserves her station, in whatever line or order of sailing the fleet may be formed; and in battle he is to observe attentively the conduct of every ship near him, whether of the squadron or division under his immediate command or not; and at the end of the battle he is to report it to the commander-in-chief, in order that commendation or censure may be passed, as the case may appear to merit; and he is empowered to send an officer to supersede any captain who may misbehave in battle, or whose ship is evidently avoiding the engagement. If any flag-officer be killed in battle his flag is to be kept flying, and signals to be repeated, in the same manner as if he were still alive, until the battle shall be ended; but the death of a flag-officer, or his being rendered incapable of attending to his duty, is to be conveyed as expeditiously as possible to the commander-in-chief.

The captain of the fleet is a temporary rank, where a commander-in-chief has ten or more ships of the line under his command; it may be compared with that of adjutant-general in the army. He may either be a flag-officer or one of the senior captains; in the former case, he takes his rank with the flag-officers of the fleet; in the latter, he ranks next to the junior rear-admiral, and is entitled to the pay and allowance of a rear-admiral. All orders of the commander-in-chief are issued through him, all returns of the fleet are made through him to the commander-in-chief, and he keeps a journal of the proceedings of the fleet, which he transmits every three months to the Admiralty. He is appointed and can be removed from this situation only by the lords commissioners of the Admiralty.

A commodore is a temporary rank, and of two kinds,—the one having a captain under him in the same ship, and the other without a captain. The former has the rank, pay, and allowances of a rear-admiral, the latter the pay and allowances of a captain and special allowance as the lords of the Admiralty may direct. They both carry distinguishing pennants.

When a captain is appointed to command a ship of war he commissions the ship by hoisting his pennant; and if fresh out of the dock, and from the hands of the dockyard officers, he proceeds immediately to prepare her for sea, by demanding her stores, provisions, guns, and ammunition from the respective departments, according to her establishment. He enters such petty officers, leading seamen, able seamen, ordinary seamen, artificers, stokers, firemen, and boys as may be sent to him from the flag or receiving ship. If he be appointed to succeed the captain of a ship already in commission, he passes a receipt to the said captain for the ship's books, papers, and stores, and becomes responsible for the whole of the remaining stores and provisions; and, to enable him to keep a proper check upon the ship's accounts, he is allowed a clerk or assistant-clerk.

The duty of the captain of a ship, with regard to the several books and accounts, pay-books, entry, musters, discharges, &c., is regulated by various Acts of Parliament; but the state of the internal discipline, the order, regularity, cleanliness, and the health of the crews will depend mainly on himself and his officers. In all these respects the general printed orders for his guidance contained in the Queen's Regulations and Admiralty Instructions are particularly precise and minute. And, for the information of the ship's company, he is directed to cause the articles of war, and abstracts of all Acts of Parliament for the encouragement of seamen, and all such orders and regulations for discipline as may be established, to be hung up in some public part of the ship, to which the men may at all times have access. He is also to direct that they be read to the ship's company, all the officers being present, once at least in every month. He is desired to be particularly careful that the chaplain have shown to him the attention and respect due to his sacred office by all the officers and men, and that divine service be performed every Sunday. He is not authorized to inflict summary punishment on any commissioned or warrant-officer, but he may place them under arrest, and suspend any officer who shall misbehave, until an opportunity shall offer of trying such officer by a court-martial. He is enjoined to be very careful not to suffer the inferior officers or men to be treated with cruelty and oppression by their superiors. He is the authority who can order punishment to be inflicted, which he is never to do without sufficient cause, nor ever with greater severity than the offence may really deserve, nor until twenty-four hours after the crime has been committed, which must be specified in the warrant ordering the punishment. He may delegate this authority to a limited extent to certain officers. All the officers and the whole ship's company are to be present at every punishment, which must be inserted in the log-book, and an abstract sent to the Admiralty every quarter.

The commander has the chief command in small vessels, such as sloops and gun-vessels. In larger vessels he is chief of the staff to the captain, and assists him in maintaining discipline, and in sailing and fighting the ship.

The lieutenants take the watch by turns, and are at such times entrusted, in the absence of the captain, with the command of the ship. The one on duty is to inform the captain of all occurrences which take place during his watch,—as strange sails that may be in sight, signals from other ships in company, change of wind, &c. He is to see that the ship be properly steered, the log hove, and the course and distance entered on the log-board; and, in short, he is to see that the whole of the duties of the ship are carried on with the same punctuality as if the captain himself were present. In the absence of the captain, the commander or senior executive officer is responsible for everything done on board.

The navigating officer receives his orders from the captain or the senior executive officer. His more immediate duties are those of stowing the ship's hold and attending to her sailing qualities, of receiving and placing the provisions in the ship, so as most conveniently to come at those which may be wanted. He is to take care that the cables are properly coiled in the tiers. The keys of the spirit-room are in his custody, and he is directed to entrust them only to the officer authorized to use them. He has the charge of the store-rooms of the warrant-officers, which he is ordered frequently to visit; and he is also entrusted, under the command of the captain, with the charge of navigating the ship, bringing her to anchor, ascertaining the latitude and longitude of her place at sea, surveying harbours, and making such nautical remarks and observations as may be useful to navigation in general. He keeps the ship's log-book and remark-book.

The warrant-officers of the navy may be compared with the non-commissioned officers of the army. They take rank as follows, viz., gunner, boatswain, carpenter; and, compared with other officers, they take rank after sub-lieutenants and before midshipmen. They are charged with the duty of receiving on board from the dockyards, and examining, the stores of their respective departments, and keeping an account of the expenditure of them.

The gunner has the charge of the ship's artillery, and of the powder magazine. He is to see that the locks and carriages are kept in good order, and that the powder is preserved from damp; he is frequently to examine the musketry and small arms, and to see that they are kept clean and fit for service; and, in preparing for battle, it is his duty to take care that all the quarters are supplied with everything necessary for the service of the guns, and during the action, that there be no want of ammunition served out. He is frequently to exercise the men at the guns, and to see that they perform this part of their duty with correctness. The armourer and his mates are under the immediate orders of the gunner in everything that relates to the great guns and small arms.

The boatswain is charged with all the stores belonging to his department, consisting chiefly of the ropes and rigging, the latter of which he is ordered to inspect daily, in order that any part of it chafed or likely to give way may be repaired without loss of time. He is always required to be on deck at such times as all hands are employed; he is bound to see that the men, when called, move quickly upon deck, and when there that they perform their duty with alacrity, and without noise or confusion. The sailmaker and the ropemaker are under his immediate orders.

The carpenter, when appointed to a ship, is carefully to inspect the state of the masts and the yards, whether in the dockyard or on board of the ship, to see that they are perfectly sound and in good order. He is to examine every part of the ship's hull, magazine, store-rooms, and cabins. He is every day when at sea carefully to examine into the state of the masts and yards, and to report to the officer of the watch if any appear to be sprung, or in any way defective. He is to see that the ports are secure and properly lined, and that the pumps are kept in good order, as also the boats, ladders, and gratings. The caulker, carpenter's mates, and carpenter's crew are placed under his immediate orders.

The midshipmen are considered as the principal subordinate officers, but have no specific duties assigned to them. In the smaller vessels some of the senior ones are entrusted with the watch; they attend parties of men sent on shore, pass the word of command on board, and see that the orders of their superiors are carried into effect; in short, they are exercised in all the duties of their profession, so as, after five years' service as cadets and midshipmen, to qualify them to become lieutenants, and are then rated sub-lieutenants provided they have passed the requisite examination, and are nineteen years of age.

2. The civil branch comprises the following officers, whose relative rank is stated against their names:—

Denomination of Civil Officer.		To rank with
1. Inspector-general of hospitals and fleets	... ...	Rear-admiral, according to the date of commission.
2. Secretary to an admiral of the fleet	... ...	Captain of 3 years' seniority, according to the time served as such secretary.
3. Paymaster-in-chief	... ...	Captain of 3 years' seniority, according to date of commission.
4. Chief inspector of machinery	... ...	
5. Deputy-inspector-general of hospitals and fleets	... ...	
6. Inspector of machinery	Of 3 years' service as such.	Captain of 3 years, whose seniority will reckon from the completion of such 3 years in that rank; that of the inspector of machinery from the completion of 3 years' service as such.
7. Secretary to a commander-in-chief	Of 5 years' service as such.	Captain under 3 years' seniority. The secretary to a commander-in-chief is to reckon his seniority from the date of completing 5 years' service as such.
8. Inspector of machinery	Under 3 years' service as such.	
9. Secretary to a commander-in-chief	Under 5 years' service as such.	Commander, according to time served as secretary to a commander-in-chief.
10. Fleet surgeon	... ...	Commander, according to date of commission. The paymaster, chief engineer, and naval instructor to reckon their seniority from the date of completing 10 or 15 years' seniority in their several ranks respectively; the fleet surgeon from the date of his commission.
11. Paymaster	Of 15 years' seniority.	
12. Chief engineer	Of 10 years' seniority.	
13. Naval instructor	Of 15 years' seniority	
14. Secretary to a junior flag-officer, commodore of the 1st class, or captain of the fleet	... ...	Lieutenant above 8 years' seniority, according to date of commission, but the lieutenant, paymaster, and naval instructor are to reckon their seniority from the date of completing 8 years' seniority in their respective ranks.
15. Staff surgeon	... ...	
16. Paymaster	Of 8 and under 15 years' seniority.	
17. Naval instructor	Of 8 and under 15 years' seniority.	
18. Chief engineer	Under 10 years' seniority.	With but after lieutenant of 8 years' seniority.
19. Secretary to a commodore of the 2d class	... ...	Lieutenant under 8 years' seniority, according to date of commission.
20. Paymaster	Under 8 years' seniority.	
21. Naval instructor	Under 8 years' seniority.	
22. Surgeon	... ...	
23. Assistant-paymaster	Of 8 years' seniority.	With but after lieutenant under 8 years' seniority.
24. Engineer	Of 8 years' seniority.	
25. Assistant-paymaster	Under 8 years' seniority.	Sub-lieutenant, according to date of commission.
26. Engineer	Under 8 years' seniority.	
27. Chief carpenter	... ...	With but after sub-lieutenant.
28. Assistant-engineer	... ...	
29. Carpenter	... ...	With but after gunners and boatswains.
30. Clerk	... ...	Midshipman, according to date of passing.
31. Assistant-clerk	... ...	Naval cadet, according to date of entry.

Chaplains shall not hold any naval rank, but shall retain, when afloat, the position to which their office would entitle them on shore; and the chaplain of Greenwich Hospital shall be considered the head of the chaplains, with the title of chaplain of the fleet.

The engineer, when first appointed to a steam-vessel, carefully examines the engines, screw (or paddles), and the boilers, and reports to the commanding officer any defects he discovers. He takes charge of all the engineer's stores and tools, and keeps account of receipts and expenditure. He is never to quit the engine-room during his watch, and visits it frequently at all times day and night. The engine-room artificers, leading stoker, and stokers are under his immediate control.

The paymaster (formerly purser) has the charge of all moneys belonging to the crown, the conduct of all cash transactions, and the charge of all the ship's provisions, and of the serving them out for the use of the crew. The regulations and instructions for his guidance are minutely detailed in the general printed instructions, with all the various forms established for the keeping of his accounts with the accountant-general of the navy, to whom he is immediately responsible. To assist him in the performance of his duties there are assistant paymasters and clerks. The captain, who is responsible for the strict performance of the duties of all the officers under his orders, acts as a check on the paymaster in many parts of his duty regarding the slop-books, muster-books, &c. He has also to count at uncertain times the cash in charge of the paymaster, and to see that it corresponds with the balance per account. For store duties the paymaster has also a steward under his immediate orders.

The duties of the medical inspectors of hospitals and fleets, the medical officer of a ship and his assistants, the secretary to the commander-in-chief, the chaplain, the naval instructor, and inspectors of machinery afloat are too obvious to require specification.

The petty officers are very numerous; they are classified as chief petty officers and first and second class working petty officers.

The regulations under which candidates for the several branches of officer are received into the navy will be found in the *Navy List*, which is published quarterly under the authority of the lords commissioners of the Admiralty. The limits of age vary with the line chosen. Cadets are entered between the ages of twelve and thirteen and a half, and they must pass after entry two years in study on board the "Britannia" before final examination and transmission to a sea-going training ship. Since the foundation and opening of Greenwich Naval College, on 1st February 1873, very great facilities have been given for the higher education of naval officers of all ranks from sub-lieutenants to captains. Engineer officer students are also received.

By an order in council, the following regulations are established for the promotion of commissioned officers of the navy. Midshipmen are required to serve five years as midshipmen or cadet on board some of Her Majesty's ships to render them eligible to the rank and situation of lieutenant; and they must be nineteen years of age. To qualify an officer for sub-lieutenant, he must have served the time, and passed the examination, required to qualify for a lieutenancy. No lieutenant can be promoted to the rank of commander except for gallantry in action until he has served four years as lieutenant, three of them at sea; and no commander to the rank of captain except for gallantry in action until he has served two years as commander, one of them at sea. Captains become admirals in succession according to their seniority on the list, provided they shall have commanded four years in a rated ship during war, or six years during peace, or five years in war and peace combined. Appointments as navigating lieutenant (formerly master) are no longer made. The old list of masters, now subdivided into staff captains, staff commanders, and navigating lieutenants, will gradually die out, and the duties will be performed by lieutenants and commanders. No person can be appointed gunner unless he shall have served seven years, one of them as gunner's mate or other petty officer, or seaman gunner, on board one or more of Her Majesty's ships; and he must produce a first class certificate in gunnery, and certificates of his good conduct, and undergo the necessary examination. No person can be appointed boatswain unless he shall have served seven years,—one complete year with the rating, and actually doing the duty, of a petty officer in Her Majesty's navy; and he must produce certificates of good conduct, and undergo the necessary examination. No person can be appointed carpenter unless he has been six months a carpenter's mate or caulker, or twelve months with the rating of shipwright or carpenter's crew, on board one or more of Her Majesty's ships. No person can be appointed chaplain to one of Her Majesty's ships until he has received priest's orders. No person can be appointed paymaster or assistant-paymaster unless he shall have been rated and have discharged the duties of a clerk for three complete years, and shall produce good certificates. Admission to this class is by limited competition for assistant-clerkships. Admission to the medical class is by open competition. Promotion from surgeon to staff surgeon is conferred on qualified officers twelve years from date of entry.

The long-continued wars towards the close of last century necessarily created a prodigious increase of the commissioned officers of the navy. Their numbers in the following five peace years were—

	1793.	1803.	1815.	1821.	1836.
Admirals	11	45	70	63	43
Vice-admirals	19	36	78	59	49
Rear-admirals	19	51	77	63	63
Captains	444	666	824	828	735
Commanders	160	410	762	776	823
Lieutenants	1,408	2,461	3,211	3,797	2,976

In the year 1857 there were on the active list of the navy 371 captains, 530 commanders, 1122 lieutenants, and on the retired and reserved list 129 captains, 243 commanders with rank of captain (besides 118 commanders on reserved half-pay), 254 lieutenants with rank of retired commanders (besides 618 on reserved half-pay). The total number of captains was therefore 743, commanders 897, lieutenants 1740. The warrant-officers increased from the average of about 400 in 1793 and 700 in 1821 to upwards of 1000 in 1857. The total number of officers of the royal navy and royal marines in 1857 was upwards of 7800, excluding mates and midshipmen, clerks, warrant-officers, and engineers, who may be computed at 3000,—making a grand total of 10,800 officers of all ranks.

The chronic disproportion between the number of officers on the active list and the number for whom it was possible to find employment led to many difficulties. Promotion stagnated, and officers in the higher ranks remained in the service long after the time when in the ordinary course of things they should have been retired for age or infirmity. Several schemes of naval retirement were proposed to remedy the evil. Mr Childers, when first lord of the Admiralty in 1870, framed a scheme much of which remains in force, although amendments in it have been found necessary. Full details are given in the *Navy List*, and a large body of interesting matter connected with the subject may be found in a parliamentary paper dated 11th July 1872. The active list has been reduced to the number in each rank which is deemed to be sufficient for the purposes of the navy, and provision is made for a regular flow of promotion by requiring the retirement of officers at certain specified ages, or after non-service afloat, irrespective of age, for a given number of years. Improved retired pay has been accorded.

As the regulations stand at present admirals and vice-admirals are compulsorily retired at the age of sixty-five; rear-admirals at sixty, or if their flag has not been hoisted for ten years; captains are retired at the age of fifty-five, "or at any age if seven years have elapsed since they last served"; commanders at the age of fifty; lieutenants at forty-five, "or at any age if five years have elapsed since they last served"; sub-lieutenants (by order in council 5th February 1872) are compulsorily retired at the age of forty. Permission has been given to flag-officers, captains, commanders, and lieutenants to retire some years sooner than the age of compulsory retirement, and arrangements have been made by which they may commute their retired pay, or a part of it, for a lump sum. Staff captains are retired at the age of sixty, "or at any age if they have not served seven years"; staff commanders at fifty-five; and navigating lieutenants at forty-five, or after five years' non-service. Chief engineers are retired at fifty-five, or after five years' non-service. Chaplains and naval instructors are retired at the age of sixty, or in case of non-service by the former after five years, by the latter after three years. Of medical officers, inspectors and deputy-inspectors of hospitals are retired at sixty, or after five years' non-service; fleet surgeons, staff surgeons, and surgeons at fifty-five, or in each case after five years' non-service. Paymasters are retired at sixty. Permission is accorded to these officers also to retire five years sooner than the maximum age.

A maximum establishment of warrant-officers has been fixed, and ages specified at which retirement is compulsory. The object has been to favour promotion, the employment of none but vigorous men, and to reduce the list to the maximum number it is considered desirable to employ.

At present (1883) the total number of the officers of the royal navy and royal marines is about 7900. Of these upwards of 2100 are in the ranks of engineer officers, sub-lieutenants, midshipmen, naval cadets, clerks, &c., and warrant-officers.

All officers of the navy wear a uniform, which is established in pursuance of the pleasure of the sovereign. It consists of blue cloth, with white collars and cuffs to the coats, and various embroidery and epaulets. The epaulets of the officers of the civil branch of the service are embroidered in gold and silver. The full dress, with cocked hats, is worn on state occasions and at courts-martial by all naval officers. The first naval uniform (blue and white) was established in 1748. The identical patterns then issued may now be seen in the United Service Institution. In the reign of William IV. the facings were for a short time changed to red. The last alteration of the uniform was in 1856. The existing regulations may at any time be ascertained by reference to the current number of the *Navy List.*

Men.—The crew of a ship of war consists of leading seamen, able seamen, ordinary seamen, engine-room artificers, other artificers, leading stokers, stokers, coal-trimmers, boys, and marines. The artificers and stokers and the marines are always entered voluntarily, the latter in the same manner as soldiers, by enlisting into the corps, the former at some rendezvous or on board particular ships. The supply of boys for the navy, from whom the seamen class of men and petty officers is recruited, is also obtained by voluntary entry.

The conditions under which boys are entered in Her Majesty's navy are as follows:—All entrants must understand that they are bound to serve continuously for ten years from the time of their attaining the age of eighteen; and they will be required to sign an engagement to that effect; but no boy will be entered without the written consent of his parents, guardians, or nearest relations. The age for entry is from fifteen to sixteen and a half, and the following are the present standards as to height, &c., which, however, are liable to alteration:—

	Height (without Shoes).	Measurement round the Chest.
Boys between 15 and 15½	5 ft.	30 in.
" " 15½ " 16	5 ft. 1 in.	30½ "
" " 16 " 16½	5 ft. 2½ in.	32½ "

They must produce a certificate of birth, or a declaration made by their parents or guardians before a magistrate, to show they are of the proper age. They must also be of sound constitution, not subject to fits, free from any physical defects or malformation, and able to read and write. No boys will be received from reformatories or prisons, or if they have been committed by a magistrate; but boys may be admitted from industrial school ships.

Able and ordinary seamen are seldom admitted direct into the navy, as the system of training boys proves very satisfactory. Volunteers are occasionally entered, especially from the naval reserve, and no doubt a large supply of men could be obtained if sought for. The wages given in the merchant service may be higher, but in all other respects the treatment is far superior in the navy: the men have better provisions, continuous employment, and leave on full pay, are subject to much less fatigue and exposure to the weather, are well taken care of in sickness, and are entitled to pensions after twenty years' service or when disabled.

Merchant seamen are admitted into the royal naval reserve, receive an annual payment by way of retainer, perform drill on board Her Majesty's ships, and are engaged to serve in the navy in case of war or emergency. Including the fishermen and boys, who form the second and third classes of this reserve, it is to consist of about 20,000 men.

The speedy manning of the fleet, on the first breaking out of a war, is one of the most important duties that can fall on the naval administration. A variety of schemes have been brought forward for attaining this end, but all of them have heretofore failed of success, except the compulsory mode of raising men, under the authority of press warrants, issued by the lords commissioners of the Admiralty, by virtue of an order in council, renewed from year to year. On the occasion of the war with Russia in 1855, however, the fleet was manned, for the first time, without recourse to impressment. There likewise issues, on the breaking out of a war, a proclamation from the sovereign, recalling all British seamen out of the service of foreign princes or states; and commanders of all ships of war are directed to search foreign vessels for such seamen.

The impressment of seafaring men, however anomalous under a free constitution like that of Great Britain, is defensible on state necessity, until it can be shown that the fleet, on an emergency, is capable of being manned without resorting to that measure. In consequence of some doubts being raised on the legality of impressment in the year 1676, when the affairs of the Admiralty were managed immediately under the direction of the king and the great officers of state, a discussion was held on this point, when it was decided by the judges and crown lawyers, that the king had an indefeasible right to the services of his subjects when the state required them, and that the power of impressing seamen was inherent in the crown, seeing that without it the trade and safety of the nation could not be secured. In the Black Book of the Admiralty is an order by Sir Thomas Beaufort, high admiral to Henry IV., commanding the impressment of mariners for service in the barge "E. de S.," and punishments were provided for those who failed in service. The statute 2 Ric. II. c. 4 speaks of mariners being arrested and retained for the king's service as of a thing well known and practised without dispute, and provides a remedy against their running away. By statute 2 & 3 Phil. and M. c. 16 any Thames waterman hiding during the execution of a commission of pressing for the royal service is liable to heavy penalties. By 5 Eliz. c. 5 fishermen are exempted from impressment. The subject of impressment is dealt with in many statutes down to the time of George III., and the power to impress in case of necessity is still conferred by the sovereign in the Admiralty patent. At the present stage of the world's history, however, this power would not be enforced, except upon application of the maxim "salus populi suprema lex."

The first instance of impressing men in Ireland seems to have been in the year 1678, when the lord-lieutenant received directions from the privy council to raise 1000 seamen for the fleet. In 1690 the lords-justices of Ireland were directed to assist the officers of the navy in impressing men in that kingdom. In 1697 a register was taken of all the seafaring men in Ireland, which amounted to 4424 men, of whom it is noted 2654 were Catholics. On several occasions, during Queen Anne's reign, the lords-justices of Ireland received directions to raise men to serve in the fleet.

In Scotland the mode of raising men by impressment was unknown before the Union; but in various instances the council of Scotland was directed to raise volunteers for the fleet, each man to have 40s. as bounty.

In 1706 an experiment was tried for the speedy manning of the fleet, by virtue of an Act of Parliament, which required the civil magistrates of all the counties to make diligent search for all seafaring men, and 20s. were allowed to the constables for each man taken up,—the seamen to have pay from the day of delivery to the naval officers stationed to receive them; if they deserted after that, they were to be considered as guilty of felony. By the same Act, insolvent debtors, fit for the service, and willing to enter it, were released, provided the debt did not exceed £30; and no seaman in the fleet was to be arrested for any debt not exceeding £20. The whole proceeding under this Act incurred a very heavy expense, and totally failed.

In the same year the queen referred to the prince of Denmark, then lord high admiral, an address from the House of Lords, relating to the three following points:—(1) the most effectual means for manning the fleet; (2) the encouragement and increase of the number of seamen; (3) the restoring and preserving the discipline of the navy. His royal highness submitted these points to such of the flag-officers and other commanders as could be assembled, who made a report, recommending (1) that a general register should be kept of all seafaring men in England and Ireland, and that all marines qualified to act as seamen should be discharged from the army; and (2) that not fewer than 20,000 seamen should be kept in employ in time of peace. With regard to the discipline of the navy, they observed that, no particular defect being specified, they could pronounce no opinion on that head.

Reserve.—In addition to the seamen and marines borne on the strength of the navy, there are four lines of reserves at the disposal of the Admiralty:—the coastguard, the seaman pensioner reserve, the royal naval reserve, and the royal naval artillery volunteers.

To qualify a seaman for admission to the coastguard he must be under thirty-seven years of age, have completed eight years' continuous service in man's rating, or such period as the lords commissioners of the Admiralty may from time to time direct, be either a seaman gunner or trained man, be in possession of at least one good conduct badge, and be recommended by his captain.

Petty officers and seamen of Her Majesty's navy, on being pensioned for length of service, are eligible for enrolment in the seaman pensioner reserve provided they are either seamen gunners or trained men, and are under forty-five years of age. Men in the seaman pensioner reserve are required to undergo fourteen days' training annually, and on attaining the age of fifty they are granted the Greenwich Hospital age pension and exempted from further drill, provided they have attended drill every year, and not less than six periods of such drill.

The royal naval reserve comprises those officers and men of the mercantile marine and fishermen who are willing, in consideration of a small retaining salary, to undergo each year a certain number of days' training on board a ship of war or at a naval reserve battery. The regulations in force for the appointment of officers to the royal naval reserve are published in each issue of the *Navy List*. The men are divided into three classes. (1) For enrolment in the first class a man must be under thirty years of age, and show proof of at least eight years' sea service in foreign-going or regular coasting vessels within the ten years immediately preceding his application, and must have obtained and held the rating of A.B. three years prior to the expiration of such service, or have completed his indentures as an apprentice for a term of not less than four years, one year of which has been served in foreign-going or regular coasting vessels. Men who have been discharged from the royal navy as able seamen with good characters may be enrolled in the reserve if they are physically fit, provided they do not exceed thirty-five years of age. (2) Candidates for enrolment in the second class reserve must not be under nineteen nor above thirty years of age, and must have followed a seafaring life either in foreign-going, coasting, fishing, or other vessels for three years, of which six months at least must have been as ordinary seaman; they must know the compass, and be able to steer and to pull a good oar. (3) Boys who have been eighteen months under training in a mercantile training ship are eligible for enrolment in the third class reserve at the age of sixteen, provided they are under engagement to join a merchant ship for sea service, are physically and mentally fit, and can show satisfactory proficiency in gunnery drills, as well as in certain elementary subjects connected with navigation and seamanship. They are eligible for promotion to the second class at the age of nineteen provided they have served six months at sea, and afterwards to the first-class reserve when in all respects qualified as above. Every enrolment in the royal naval reserve is for a period of five years, and on promotion from a lower to a higher class the man is required to re-enrol. The force was originated in 1859, and the officers and men are liable to be called out for general service in the fleet in the event of war.

The royal naval artillery volunteers are enrolled under conditions somewhat akin to those attaching to enrolment in volunteer regiments. Brigades of this force have been formed at London, Liverpool, and Bristol, with batteries at Brighton, Hastings, Southport, Birkenhead, Carnarvon, Bangor, and Swansea.

The discipline of the navy, or the government of Her Majesty's ships, vessels, and forces by sea, is regulated by the Naval Discipline Act 29 & 30 Vict. c. 109. The Consolidation Act 22 Geo. II. c. 33 replaced the first parliamentary enactment for the government of the fleet (13 Car. II. § 1, c. 9), and was passed after the peace of Aix-la-Chapelle, "to remedy some defects which were of fatal consequence in conducting the preceding war." Previously to the statute of Charles II. the government and discipline as well as the pay of the navy had depended, like the government and pay of the army, upon the quasi-household orders of the sovereign.

Under the Naval Discipline Act, the lords commissioners of the Admiralty are empowered to order courts-martial for all offences mentioned therein, and committed by any person in and belonging to the fleet and on full pay; and also to delegate the same power to officers in command of fleets and squadrons on foreign stations, which power also may devolve on their successors in case of death or recall. By this Act no court-martial can consist of more than nine or of less than five persons, to be composed of such flag-officers, captains, commanders, and lieutenants, then and there present, as are next in seniority to the officer who presides at the court-martial. Commanders and lieutenants are not required to sit when four officers of higher rank, and junior to the president, can be assembled.

The former penalty of death for cowardice, or other neglect of duty, in time of action, and for not pursuing the enemy, was, by the 19th George III., so far mitigated as to authorize the court-martial "to pronounce sentence of death or to inflict such other punishment as the nature and degree of the offence shall be found to deserve." Under these articles thus mitigated, Admiral Byng would probably not have been condemned to death. The provisions of the present Act (29 & 30 Vict. c. 109) confine sentence of death, without alternative, to cases of traitorous misconduct in the presence of the enemy, and murder. All other offences which were formerly capital may now be dealt with either by sentence of death or by such other punishment as the court may think fit to award under the provisions of the Act; and penal servitude or imprisonment, with dismissal from the service, are now the severest sentences awarded, flogging having been practically abolished.

The discipline of the navy is also maintained by a system of summary punishments, including short terms of imprisonment, which can be awarded by the captains of ships, under the regulations issued from time to time by the lords of the Admiralty.

The first regular code of printed instructions would appear to be that known as the *Duke of York's Sailing and Fighting Instructions*, bearing date about 1660, which formed the basis of all the subsequent ones. Much, however, of the internal discipline of a ship of war depends upon the captain; that officer being empowered to punish the men for minor offences, according to the usage of the service, courts-martial on seamen are rarely found necessary in well-regulated ships. In 1853 a more uniform system, defining the nature and duration of minor punishments, was promulgated by the Board of Admiralty.

By the general printed instructions, the captains of Her Majesty's ships are required to accustom the men to assemble at their proper quarters, to exercise them at the great guns, to teach them to point, fire, &c., under all circumstances of sea and weather. Practice in these respects is obviously much more necessary on board ships than on shore.

At Portsmouth and Devonport regular instruction is given in the theory and practice of gunnery, in the principles which regulate projectiles, in the theory and manipulation of torpedoes, in the use of small arms, and in all the scientific departments of the art of war. Chemistry and electricity as applied to war and warlike stores are also taught practically, and every inducement is given to officers to study and to qualify for the post of gunnery officers in the fleet. Extra rates of pay are given to gunnery lieutenants according to their proficiency. For the training of the men, who up to 1852 were almost devoid of special skill, there was created a class of "seamen gunners" who act as instructors on board ship, under the orders of the gunnery officer. Examinations are held at stated times for the purpose of testing the progress made by officers under training. In the higher education of naval men at Greenwich College gunnery forms one of the principal features.

The necessity for this special training, and for special efforts to induce men to undergo it, will be evident upon comparison between the guns of thirty years ago and those of the present day. The cannon with which the greatest victories of the British navy were won were 12-, 16-, and 24-pounders. Out of 104 guns carried by Nelson's "Victory," 44 were 12-pounders, 30 were 24-pounders, and only 30 were 32's. In the Russian War, 56's and a few 68's constituted the armament of the large war-ships. Now ships go about with 2000-pounder guns—of most scientific make and character. For the proper handling and management of these refined engines of destruction it is clear that very special knowledge and very careful training are required. The issues involved in miss or hit are too momentous to be left to careless or ignorant hands.

The state of health on board of a ship of war is, generally speaking, not exceeded in the most favoured spot on shore; and the sea-scurvy may now be considered as unknown in the British navy, since the universal introduction of lemon juice, or citric acid, without an ample supply of which no ship is permitted to sail on a foreign voyage. From the official returns collected by Sir Gilbert Blane, M. Dupin, a French author well versed in naval subjects, drew out the following table, which exhibits at one view the progressive diminution of sickness, death, and desertion in the British navy, calculated on 100,000 men:—

	Sick sent to Hospitals.	Deaths.	Desertions.
1779	40,815	2,654	1,424
1782	31,617	2,222	993
1794	25,027	1,164	662
1804	11,978	1,606	214
1813	9,336	698	10

Hence it would appear that the diminution of sickness and of deaths was in the proportion of 4 to 1 nearly between the years 1799 and 1813. The diminution of desertions from the hospital in the same period is not less remarkable.

The following returns, of more recent date, show the advance of medical science in this department:—

	Sick sent to Hospitals.	Dead in Hospitals.	Run from Hospitals.
1820	3,564	362	2
1830	3,137	187	2
1840	6,589	225	1
1850	9,743	309	...
1855	11,748	384	2

Annexed is a memorandum showing the invaliding and death-rates in the navy afloat, including the deaths in hospital, from 1856 to 1881. Comparison with the dead lists of former years, even those cited above, will show the wonderful decrease caused by greater medical knowledge and better sanitary arrangements on board ship. This will be the more apparent when it is borne in mind that the old statistics show only the deaths in hospital, not those which occurred on board ship, through disease or the enemy. The high death-rate of 1870 is accounted for by the sad loss of the "Captain"; and those of 1878, 1880, and 1881 by the sinking of the "Eurydice" and "Atalanta" and the blowing up of the "Doterel."

	Average Complements corrected for Time.	Invalided.		Dead.			
		Number.	Ratio per 1000.	From Disease.	From Injury.	Total.	Ratio per 1000.
1856	51,730	998	19·3	629	172	801	15·5
1857	42,470	1,460	34·4	623	196	819	19·4
1858	43,120	1,763	40·9	873	242	1,115	25·8
1859	52,825	1,994	37·7	624	232	856	16·7
1860	64,025	2,844	44·4	712	226	938	14·7
1861	62,485	2,391	38·2	716	224	940	15·
1862	58,870	1,944	33·	684	218	902	15·3
1863	54,090	1,903	35·1	414	205	619	11·4
1864	52,500 53,000	1,881	35·4	461	281	742	14·
1865	50,660 51,210	1,687	32·9	416	164	580	11·3
1866	48,775 49,475	1,698	34·3	393	116	509	10·3
1867	50,110 51,000	1,492	29·2	432	155	587	11·5
1868	50,390 51,220	1,755	34·2	333	127	460	8·9
1869	48,550 48,820	1,574	32·2	358	126	484	9·9
1870	43,350 46,710	1,646	35·2	315	603	918	19·6
1871	47,260 47,400	1,323	28·	302	102	404	8·5
1872	46,710 46,830	1,606	34·3	266	119	385	8·2
1873	45,440	1,686	37·1	274	104	378	8·3
1874	44,530	1,745	39·1	301	121	422	9·4
1875	44,360	1,526	34·4	304	88	392	8·8
1876	45,010	1,636	36·34	270	146	416	9·24
1877	44,940	1,618	35·89	221	96	317	7·05
1878	46,400	1,662	35·81	247	422	669	14·41
1879	44,745	1,475	32·96	279	105	384	8·58
1880	44,770	1,393	31·11	207	356	563	12·57
1881	44,400	1,388	31·26	234	252	486	10·94
Totals...	1,272,515 1,279,935	44,286	34·6	10,888	5,228	16,116	12·59

The encouragement given to the navy from its first regular establishment has marked it as a favourite service. The sea-pay, the half-pay, and other emoluments have generally been superior to those enjoyed by the army, but subject to great fluctuations in every reign, and to frequent changes in the same reign. From the Black Book of the Admiralty it appears that the pay of the navy was fixed as follows in the time of Richard II.:—"If the admirall bee knight batchellor hee shall have every day at sea four shillings for himselfe, and for each chevalier gooing in his company two shillings, and for every escuier arme twelvepence a day; and shall have in consideration of thirty hommes d'armes, at the end of each quarter of a yeare, one hundred markes, and so hee shall have for every one. And shall also have for each archer sixpence a day. And soo everyone of his captains shall have theire wages of him. And if the admirall is a baron he shall have six shillings and eightpence a day; and if hee is an earle hee shall have thirteen shillings and fourpence a day." The admiral had also fourpence in the pound for all wages paid for his fleet; but out of this he had "in the night tyme, all the while that the fleet is at sea, to carry at the topp of his mast two lauthornes, to the end that all the masters of the fleet my know and perceive by the light and the admirall's course, what course they shall steer." "As to the marriners wages upon the voyages of the king or the admirall, each master of a shipp shall have sixpence a day, and every constable (or gunner) of the fleet shall have the same wages by the day. Each marriner shall have threepence halfpenny per diem, and each marriner shall have sixpence per week for consideration" (or bounty), "and each sea boy shall have twopence halfpenny per diem."

The establishment of half-pay was of slow growth. Though the navy, as we have seen, was put upon a regular establishment under the reign of Henry VIII., neither officers nor seamen received any pay or emolument in time of peace until the reign of Charles II., when in 1668 certain allowances were made to flag-officers and their captains out of the £200,000 a year voted for the whole naval service; and in 1674 certain other allowances were granted, by order in council, to captains who had commanded ships of the first and second rates, and to the second captains to flag-officers, on the ground, as assigned in the preamble, that they had undergone the brunt of the war, without sharing in the incident advantages of it, as prizes, convoys, and such like, which the commanders of the small classes of ships had enjoyed. But the first regular establishment of half-pay for all flag-officers, captains, first-lieutenants, and masters was by King William, in the year 1693, provided they had served a year in their respective qualities, or had been in a general engagement with the enemy. A regularly established half-pay was further sanctioned by an order in council of Queen Anne in 1700, the conditions of which were, that no officer should enjoy the benefit thereof who had absented himself without permission of the lord high admiral or lords commissioners of the Admiralty, or who had been dismissed for any misdemeanour or by court-martial, or who had not behaved himself to the satisfaction of the lord high admiral, or who should have leisure to go out of His Majesty's dominions, if employed in the merchant service or otherwise, or who enjoyed the benefit of any public employment. Since the above period the rate of half-pay to the several officers of the navy has undergone various modifications. It has included within its area of benefit a larger number of classes of officers. It has also increased enormously in bulk as a non-effective service charge. So great was the increase in this respect, notwithstanding the subdivision of the half-pay list into "retired" and "reserved" sections in addition to the "active" half-pay list, that in the interest of the officers themselves, as well as of the country, it became necessary in 1869 to make a scheme of retirement, in accordance with which officers on the half-pay list, from whatever cause, for more than a prescribed number of years, were permanently retired, and allowed to draw a retired pay, or to commute for a capital sum the value of their pay. Half-pay is not given to officers below the rank of sub-lieutenant in the military branch, or of paymaster in the civil. For further details see the *Navy List.*

Prize-Money.—This additional incentive to exertion on the part of officers and seamen on board ships of war dates from the earliest time. At an early date rules and regulations were made for the due apportionment of prize of war, a large portion going to the king and his admiral. In 1793 precise regulations, in the present sense of the word, were first issued. By them the proceeds arising from captures from the enemy were divided into eight equal parts, and were distributed by order of ranks. These have been amended from time to time, and were the subject of special orders in March 1854. The existing orders are contained in a royal proclamation dated May 1871, and direct, subject to the under-mentioned provisos, that one-thirtieth part of the value of prizes shall go to the admiral in command of the capturing vessels (if two admirals they are to divide the thirtieth, the senior taking two-thirds, the junior one-third), and of the remainder, or of the whole if no flag share is payable, the captain is entitled to a tenth of the entire proceeds. After these deductions the remainder of the net proceeds is to be distributed in ten classes, so that each officer, man, and boy assisting in the capture of the prize shall receive shares, or a share, according to his class. Officers in the first class, including inspectors-general of hospitals afloat, inspectors of steam machinery, secretary to commander-in-chief, are to receive forty-five shares each; in the second class, including senior lieutenant, staff surgeon, and certain paymasters, thirty-five shares each; in the third class, lieutenants, surgeons, captain of marines, and some others, thirty shares each; in the fourth class, including lieutenants of marines, sub-lieutenants, and warrant-officers, twenty shares each. To the fifth class twelve shares each are assigned; to the sixth, ten shares each; to the seventh, seven shares; to the eighth, including able seamen, four shares; to the ninth, including "idlers," two shares; and to the tenth, boys, one share. Another source of emolument is the percentage charged upon treasure, which, for security's sake, may be conveyed in ships of war on merchants' account.

Another great encouragement for young men to enter the naval service arises from the honours bestowed by the sovereign for any brilliant exploit. Exclusive of peerages and baronetcies, the honours bestowed for gallant conduct in the naval service at present (1883) are the titles of knights grand-crosses of the military order of the Bath, and knights commanders and companions of the Bath, in addition to which there are the civil order of the Bath, and, for colonial services, the order of St Michael and St George. Royal medals have also been granted of late years for various naval services, and distributed alike to the officers, seamen, and marines; and a number of officers, seamen, and marines have received the Victoria Cross. Good-service pensions are also awarded to a certain number of flag-officers, captains, and general and field-officers of marines. These are selected according to their standing, and length and nature of services, a statement of which is given, in each case, in the annual naval estimates presented to parliament. The amount of the good-service pension ranges from £100 to £300, according to rank and service. There are also naval and Greenwich Hospital pensions established for the relief of retired officers of long service, who are old, infirm, wounded, or disabled. Some of these pensions are allotted to each class of officers.

The cost of the British navy has necessarily varied with the times, with the materials used in the construction of ships, and with the number of men borne on the strength of the fleet. The highest number of men borne in the navy was in 1813—when 147,047 seamen and marines were borne, and when the total charge was £21,212,012, and the year ended with a navy debt of £8,562,291. This was the largest charge ever made for the navy, except in 1855 (the year of war with Russia), when the charge was £21,394,216.

Below is a statement showing the number of men voted, the number actually borne, and the charge, for typical years between 1690 and 1881:—

	Men Voted.*	Total borne on Ships' Books.†	Grant for Ordinary Naval Services.‡	Navy Debt at End of Year.
1691	29,270	25,317	£1,640,760	...
1700	7,000	7,764	638,142	£1,334,232
1710	40,000	46,493	2,096,000	5,655,535
1720	13,500	21,188	1,321,572	1,503,687
1730	10,000	9,086	837,786	1,396,723
1740	35,000	37,181	1,938,704	1,301,525
1750	10,000	11,691	995,521	1,716,923
1760	70,000	86,626	4,926,630	5,228,695
1780	85,000	97,898	6,782,284	10,372,678
1800	110,538	123,527	11,366,579	8,705,886
1810	145,000	146,312	15,801,184	5,591,822
1820	23,000	23,985	6,340,771	1,193,435
1830	29,000	31,160	5,134,955	1,314,060
1840–41	37,456	37,665	5,742,871	...
1850–51	39,000	39,093	5,772,652	...
1860–61	84,100	79,018	12,644,570	...
1868–69	66,770	66,278	10,806,690	...
1880–81	58,800	57,946	10,321,435	...

* Including marines, who first appear in 1702 to 1712, and disappear between 1713 and 1738.

† Including marines on shore.

‡ After excluding ordnance and conveyance of troops.

In reviewing her resources generally for manning the navy, England may, as Sir Thomas Brassey says, fairly look to the reserves, no less than to the number of men actually borne for fleet service. The coastguard on shore has been maintained for many years at an average strength of 4000 men. The naval reserves have averaged, between 1868 and 1881, 15,785 men. The same authority gave the following figures in 1882:—pensioner reserve, 1560; first class royal naval reserve, 11,800; second class, 5600; third class, 150; and naval artillery volunteers, 1400. The total reserve for manning a war navy was considered by him to be not less than 40,000 men.

Personnel of Modern Navies Compared.

In any comparison of the personnel of modern navies, the question of the strength of the mercantile marine is more important than it is in relation to the matériel. Sir T. Brassey reminds us that, of the 140 English ships which were assembled to oppose the Spanish Armada, only 28 belonged to the royal navy, and that Drake, Hawkins, and Frobisher, who commanded the fleet under Lord Howard, were masters in the merchant navy; also that Howe's victory of 1st June 1794 was gained by the merchant seamen of the kingdom. It is estimated by the same authority that, if the system of naval conscription existing in France were applied to England so as to include, as it does in France, the crews of coasters, fishermen, boatmen, and the workmen in the private shipbuilding yards and the dockyards, there would be a roll of from 700,000 to 800,000 men.

France.—The system here was established under Louis XIV., and it comprises a term of compulsory service, by means of which France inscribes on her rolls some 170,000 men, of whom the great majority are fishermen.[1]

The personnel of the navy below the rank of officer is recruited, (1) by the men of the maritime inscription, (2) by voluntary engagements, and (3) in the case of an insufficiency of men of the first two categories, by a contingent from the general recruiting of the country told off for the navy.

1. Every individual, having completed eighteen years of age, who has made two long voyages (*au long cours*) either on Government or on merchant ships, or who can count eighteen months of navigation or two years of coast fishing, and who declares his intention of continuing a seafaring life, is inscribed as a sailor, and

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[1] See *The Armed Strength of France*, published (1877) under the superintendence of H.M. Stationery Office.

can be levied for the service of the fleet. Every sailor who is inscribed is called into active service on completing twenty years of age. During the month in which he accomplishes his twentieth year, or during the month which follows his return to France, he is bound to present himself before a commissary of the maritime inscription. He is then enrolled, sent to a port which is the chief town of an arrondissement, and incorporated in a division of sailors of the fleet. If he be considered fit for service, he can, from the age of eighteen years, forestall his call to active service. The young sailor who joins at eighteen years of age performs his service in two periods. During the first, which lasts for five years, he may, when in France, be given renewable furlough without pay, and can then devote himself to navigation of any description. After this first period he remains for two years longer in the same conditions, on renewable furlough. The time passed in this position of renewable furlough is counted as service to the state for every sailor who engages to navigate only in coasting voyages or in home fishing. After this latter period the sailor cannot again be called out except by decree in case of emergency. After serving for three years, the sailor who has not been sent on furlough is entitled to an increase of 2d. to his daily pay. The levies of sailors for duty with the fleet are first made amongst those who have not hitherto rendered any service to the state, then, in case of insufficiency, amongst those who have the least service, or, in case of equal service, those are taken who have been longest on furlough. Inscribed sailors have alone the right of carrying on maritime navigation or coast fishing, and enjoy various other privileges and immunities. The minimum age for the engagement of naval apprentices is eighteen years, the privilege of making an engagement at sixteen years being reserved to young men leaving the school for ship boys, and to those specially selected by the minister. The maximum age for young men who have not rendered any service to the state is fixed at twenty-four years. This is increased to thirty for musicians, stokers, carpenters, sailmakers, and caulkers who can count at least five years' previous service since the age of sixteen. For pupils and quartermaster mechanicians (*quartiers-maîtres mécaniciens*) and working mechanicians (*ouvriers mécaniciens*) the minimum limit of age is eighteen and the maximum twenty-five, if they have not previously served the state, or thirty if they belong to either of the callings above mentioned and have rendered previous service to the state.

2. Voluntary engagements are only allowed according to the requirements of the service. They cannot be made in the colonies. The conditions are the same as for the army. The engagement is made for five years. Re-engagements can be made by sailors of the fleet for three, four, or five years. They are without conditions of age or service, provided only that their length would not retain warrant officers (*officiers mariniers*) in the service beyond the age of fifty-five, and quartermasters and sailors beyond fifty, if they can unite with this age a service of twenty-five years.

3. For men of the navy who do not belong to the maritime inscription, the time of service is five years and in the reserve four years. They then pass immediately into the reserve of the territorial army, in which they remain until they attain forty years of age. The contingent is furnished in proper proportion from each canton, and is composed of the young men comprised in the first part of the cantonal recruiting list, to whom the lowest numbers have fallen when drawing lots.

The number of men obtained by the general recruiting was 6056 in 1873, 7040 in 1874, 6406 in 1875, and 4326 in 1876.

The sailors on shore are divided into five divisions, of which two (those at Brest and Toulon) are of the first class and three are of the second class. In each division there is a council of administration, entrusted with clothing and pay duties, and, in fact, with all administrative questions. Each first class division consists of a staff and of depôt companies, as follows:—one company of seamen gunners (*matelots canonniers*), one company of seamen fusiliers (*matelots fusiliers*), one company of mechanicians and stokers, three companies of sailors of the maritime inscription, one company of sailors from the general recruiting. The divisions of the second class are each composed of a staff and depôt companies as follows:—one company of special branches, two companies of sailors of the maritime inscription and from the general recruiting. Each of these companies is divided into two sections. The division at Lorient comprises, in addition, an instruction battalion of fusilier apprentices. In each division there is an elementary school, a school for teaching bookkeeping to quartermaster-serjeants, a gymnasium, a fencing school, and a swimming school. In the two first divisions there are also music schools. The first masters and second masters belonging to the different special branches and professions form the cadre of the warrant officers of the fleet. When of equal grade, they are classed in the following order:—navigation, gunnery, musketry, steering, mechanicians, carpenters, sailmakers, and caulkers. When not serving afloat or in the divisions, these masters are placed in *disponibilité* at their homes, with reduced pay, and are recalled to active service according to roster. The budget for 1878 shows that eighty-nine *officiers de vaisseau* are to be employed with the shore divisions of crews and with the establishment for pupils. The number of men provided for is as below (bandmasters, officers, quartermasters, sailors, boys, and supernumeraries):—on shore, 8438; afloat, 25,063; reserve, 1607; total, 35,108.

The marine infantry is not employed in service on board men-of-war in the same manner as the marines of the British navy. Its duties are to garrison the five military ports and the colonies, and to take part in maritime and other wars. When necessary, it furnishes detachments on board ships belonging to the state.

Germany.[1]—The whole of the maritime population, inclusive of the technical personnel, are absolved from land duties, but are liable to serve in the fleet. The distribution of the annual levy is dependent upon the seafaring population, the quota contributed by each state being deducted from its whole liability for the land and sea forces. It used to be the practice to draw exclusively from the seafaring population of the provinces of Prussia, Pomerania, Hanover, Schleswig-Holstein, and other federal states, but it has been found necessary to draw upon the land population of the above provinces in order to make up the required quota.

The personnel of the navy includes the following officers, non-commissioned officers, and men:—1 chief of the admiralty, 4 rear-admirals, 17 (23) captains, 36 (63) captains of corvette, 65 (165) captain lieutenants, 104 (118) lieutenants, 86 (140) sub-lieutenants, and 100 (229) naval cadets, 83 (147) deck officers, 580 (1546) non-commissioned officers of seamen, 4290 (10,267) seamen, 330 (499) non-commissioned officers. Besides these there are 12 engineers, 90 (304) deck officers (engineers and masters), 110 (189) engineers' mates, 28 engineers' apprentices, 580 (2131) firemen, 154 (570) masters' mates, 450 (698) mechanics, 84 (154) staff sergeants for police purposes.

Every German (except in a few well-defined cases) is liable to service in the army or navy, and is not allowed to provide a substitute nor to purchase exemption. Liability to service commences with the completion of the seventeenth year, and lasts until the close of the forty-second year of age. Of this time, twelve years must be passed in the standing army and landwehr in the case of a soldier, in the fleet and seewehr in the case of a seaman. All men liable to service, who may not be called into the standing army, fleet, landwehr, or seewehr, are liable to be called out in the landsturm in time of war. The estimated seafaring population of North Germany is about 80,000, including fishermen and dock labourers.

Italy.[2]—The annual classification of all individuals fitted for sea service takes place according to fixed instructions. The men who are passed as fit and suited for the navy are divided into two categories by lot. Those of the first category are drawn into the service, and have to serve four years either on board or on shore (they pass the remaining six years on unlimited furlough). The men of the second category, however, are allowed to go at once on unlimited furlough, and are only called up in case of war or similar emergency. They are also liable for service for ten years. Volunteers and boys trained at the various naval training establishments are obliged to serve eight years continuously. The number of men per annum who reach the age rendering them liable for service is about 5050 on an average, of whom 2600 are fit or suited for the service. Of these, from 1500 to 1800 are placed in the first category (200 volunteers). Naval officers are chiefly obtained from the naval schools. Under-officers seldom obtain the rank of officer, and only then after a searching examination. The law on promotion of the year 1871 fixes the rules of promotion for all ranks.

The "corpo reale equipaggi" is divided into three divisions, each of which is under the command of a post-captain, and belongs to a "dipartimento."[3] The total establishment was as follows in 1875:—741 able seamen, 5526 (including 200 boys) seamen and gunners, 704 artificers, 360 employed in "administration," 1187 engineers and stokers, 168 "guardiani," 29 invalids; total 8715 men. A body of men has been lately formed for torpedo defence. The estimated seafaring population of Italy is 225,000, chiefly fishermen.

Russia.[4]—The entire male population, without distinction of class, is liable to military service. The number of men required to complete the strength of the army and navy is fixed by the legislature every year on the recommendation of the minister of war, and promulgated to the senate by an imperial ukase. Admission to the service is determined by lot drawing, in which one class only of the population is annually called upon to take part, namely, that which includes all the males who have reached the age of twenty years on the 1st January of the year in question. Persons who have fulfilled certain educational conditions may relieve themselves from lot drawing by enlisting as volunteers. In the naval forces the ordinary term of service is ten years, namely, seven with the fleet and three in the reserve. The total number of young men who had attained the age of twenty years in 1880 was 794,000. The contingent to join on the 1st (13th) January 1881 was fixed at 235,000, and of this number 231,961 were enrolled. According to the statutes the number of sailors in the navy should be about 50,000. Of these in time of peace there are serving afloat 28,000, and employed ashore 12,000,—the remaining 10,000 being on unlimited furlough. In 1879 the appropriation of the conscripts actually enrolled in the navy was 4504 for the Baltic fleet, 446 for the Black Sea fleet, 72 for the Caspian flotilla, and 418 for the Siberian flotilla. The effective was on January 1, 1880, 2303 below the establishment.

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[1] See *The Armed Strength of the German Empire* (1876), published under the superintendence of H.M. Stationery Office.

[2] See *The Armed Strength of Italy*, published (1875) under the authority of H.M. Stationery Office.

[3] The coast-line of Italy is divided into three regions called *dipartimenti marittimi*.

[4] See *The Armed Strength of Russia*, published (1882) under the authority of H.M. Stationery Office.

Austria-Hungary.[1]—The duty of military service is general, and must be fulfilled personally by every citizen capable of bearing arms. The term lasts for twelve years, of which three are spent in the standing army, seven in the reserve, and two in the landwehr; men who are incorporated in the landwehr at once serve in it for twelve years. In the navy the period of service is for ten years, of which three years are active and seven years reserve service. The conscription is confined to Dalmatia and the coast districts. One-third of the whole complement of officers and men required to man the fleet in time of war is kept continuously afloat in peace; the war complement is 8079 of all ranks, of whom 2700 are actively employed; the war complement comprises (besides rear-admiral and staff of the squadron)—officers, &c., 571; sailors and gunners, 5428; navigating personnel, 362; naval police, 158; engine-room artificers, stokers, &c., 781; sanitary personnel, 53; tradesmen, 202; stewards, cooks, officers' servants, &c., 524,—total, 8079. The peace effective of the corps of seamen is 6152, inclusive of the 400 boys in the training-ship "Schwartzenberg." The total force on the war establishment is 11,532.

To show briefly the general result of all this organization of matériel and personnel, it is perhaps sufficient to state the number of ships in commission at a given date in the present year (1883), and the numbers of their crews.

Including stationary and harbour ships, tenders, training and drill ships, troop and surveying ships, there are from 230 to 240 ships and vessels in commission in the British navy, mounting about 1400 guns, and having a personnel, all told, of about 34,000 officers, men, and boys. Excluding the vessels specially referred to above, and taking only those which may be regarded as fighting vessels, the number in commission falls to about 100, with about 800 guns, and 22,000 officers, men, and boys in the crews. Comparing this with foreign navies, the proportions may be fairly stated as follows:—

	No. of Ships.	No. of Guns.	Complement.
England	100	800	22,000
France	100	500	15,000
Spain	80	320	8,500
Russia	60	260	8,300
Germany	30	230	6,300
United States	30	250	5,400
Holland	40	280	4,800
Turkey	30	220	4,500
Italy	24	100	4,200
Portugal	20	100	2,500

Of works on British naval history, the following, among others, may be consulted:—Nicolas, *History of the Navy from the Earliest Times to* 1422, 2 vols., 1847; Campbell, *Lives of the Admirals to* 1727, 4 vols., 1750, and afterwards continued by Berkenhout and Yorke down to 1816 in 8 vols., the last edition being that of 1870; Southey, *Lives of the British Admirals*, 5 vols., 1833 (from the Restoration); Lediard, *Naval History of England to* 1734, 1735; Beatson, *Naval and Military Memoirs of Great Britain from* 1727 *to* 1783, 1st edition, 3 vols., 1790; Brenton, *Naval History from* 1783 *to* 1836, 2 vols., 1837; James, *Naval History from* 1793 *to* 1827, 6 vols., many editions; Schomberg, *Naval Chronology to* 1802, 5 vols., 1802; *Naval Chronicle from* 1799 *to* 1818, 40 vols.; Allen, *Battles of the British Navy from* 1190 *to* 1840, 2 vols., 1852; Yonge, *History of British Navy from* 700 *to* 1862, 2 vols., 1863. The following deal almost exclusively with the matériel of the navy:—Charnock, *History of Naval Architecture*, 3 vols., 1801; Derrick, *Memoirs of the Navy*, 1806; Perigal, *Chart of Naval History from the Earliest Period to* 1859, 1860. (N. B.)

NAVY OF THE UNITED STATES.

The American navy came into existence shortly after the Declaration of Independence. As early as October 1775 Congress authorized the construction of two national cruisers, and, at the same time, appointed a marine committee to administer naval affairs. The first force, consisting of purchased vessels, badly fitted and built, and insufficiently equipped and manned, embraced two ships of 24 guns each, six brigs carrying from 10 to 12 guns, two schooners each with 8 guns, and four sloops, three of 10 guns and one of 4 guns. On December 22d a personnel of officers was selected, one of the lieutenants being the well-known Paul Jones. Ezekiel Hopkins was made commander-in-chief, but, having incurred the censure of Congress, he was dismissed early in 1777, and since then the title has never been revived except in the person of the president. In November 1776 the grades of admiral, vice-admiral, rear-admiral, and commodore were assimilated in rank and precedence to relative army titles, but they were never created by law until 1862. During the war a number of spirited engagements occurred, but there was a great lack of efficient material at home, and agents abroad were not able to enlist the active sympathies of nations or rulers. Benjamin Franklin did manage to equip one good squadron, but this was rendered almost useless by internal dissensions, and it required the victory of Paul Jones in the "Bon-Homme Richard" over the "Serapis" to bring about any tangible result for the risk taken. During the war 800 vessels of all classes were made prizes, but the navy lost by capture 11 vessels of war and a little squadron of gunboats on the lakes; and, with 13 ships destroyed to avoid capture by the British, 5 condemned, and 3 wrecked at sea, the country was practically without a naval force between 1780 and 1785.

Owing to the depredations upon commerce of the Barbary powers, Congress in 1794 ordered the construction of six frigates, prescribing that four of them should be armed with 44 guns and two with 36 guns; but, the Berbers having made peace, the number of vessels was reduced one half, and no additions were made until 1797, when the "Constitution," "United States," and "Constellation" were built. Trouble with France from 1798 to 1801 resulted in the formation of four squadrons operating in the West Indies; these numbered 21 vessels in all, and, besides capturing nearly one hundred prizes, they gained experience and prestige by many short and decisive single actions. No further increase was made until 1802, when the war with Tripoli was declared; up to this time the navy had cost the country, including sites for navy yards, only £2,000,000. In 1803 the "gunboat policy" was revived, but, though 188 vessels of this class were built, their service was unimportant and their usefulness questionable.

At the breaking out of hostilities with Great Britain in June 1812, the naval force of the United States consisted of a number of gunboats fitted for the protection of rivers and inlets, and of 17 sea-going ships, 9 of which were below the frigate class. From the close of the war in 1815 until the beginning of hostilities with Mexico in 1846, the American navy was engaged in the suppression of the slave-trade and of piracy, and in voyages of exploration and discovery. In 1846 California, after being once relinquished, was seized, and during the war the United States vessels were employed in blockading or capturing the ports upon both seaboards of Mexico, and in co-operating with the army,—all hostilities ceasing in 1847 with the occupation of the city of Mexico. In 1848 Lieutenant Lynch commanded an expedition engaged on the exploration of the Dead Sea and the river Jordan; in 1856 the "Advance" and "Rescue" searched for Sir John Franklin, followed later by the expeditions of Kane and of Hartstene; in 1854 Strain made a partial survey of the Isthmus of Panama; and in 1855 Rear-Admiral John Rodgers, in the "Vincennes," went farther into the Arctic Ocean through Behring's Strait than any previous navigator. In 1858 the Paraguay expedition successfully finished its work; and for many years, earnestly aided by Great Britain, a squadron was employed on the coast of Africa and in the West Indies for the suppression of the slave-trade.

The civil war broke out in April 1861, and its naval character was marked by two leading features: the first was that, while one side had a small force of naval vessels, which were generally good of their kind, the other entered the contest with absolutely nothing that could be called a man-of-war; the second was that, though certain developments in the character and construction of ships and weapons had been foreshadowed before the war, and had even been partially realized, it was during the progress of the struggle that those changes took place in marine warfare which amounted to a revolution. The effect of rifle and shell-fire, the employment of the ram, the destructive energy of torpedoes, the application of armour to the sides of vessels, and the superiority of iron-armoured ships—all taught in practice what theory had in vain asserted. At the commencement of hostilities the number of vessels of all kinds in commission was 76; 136 were purchased in 1861, making the total 264, while the roll of enlisted men increased from 7500 to 22,000. At the close of the war there were 51,500 seamen and 7000 officers of all grades, and over 600 vessels; at the navy yards 6880 artisans were employed; 208 steamers were built, and 313 out of a total of 481 were purchased, all at a cost of over £3,000,000; 340 were afterwards sold for £1,500,000. On the 1st of January 1865 there were 5278 volunteer officers in service, but in 1870 this number had been reduced to 111, excluding 64 out of 305 applicants who had been admitted to the regular service. The Confederate navy was modelled precisely upon that of the Federal States. In the autumn of 1864, when at a maximum, it consisted of 16 ironclads, 3 of which were rated as floating batteries, of 50 wooden vessels, and of the rover "Shenandoah." Abroad cruisers were of great assistance to the Confederacy, the most notable of these being the "Sumter," "Alabama," "Georgia," "Florida," "Rappahannock," and "Shenandoah."

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[1] See *The Armed Strength of Austria*, published (1874) under the authority of H.M. Stationery Office.

Since the close of the war the United States navy has been doing excellent service in the peaceful pathways of science and humanity, the only warlike demonstrations having been that against Formosa in 1867 and that against Corea in 1870. Expeditions have been sent to the Arctic Ocean; ships have been employed in the survey of every sea; deep-sea soundings have been made both in the Atlantic and the Pacific; and five expeditions have tried to solve the problem of the best route for a trans-isthmian and inter-oceanic canal; scientific observers have occupied stations, and with important results, in the transit observations, and to-day the chain of telegraphic measurements of longitude around the whole world is the work of American naval officers.

Administration and Condition.—During the revolutionary war Congress through its committees and agents managed naval affairs. In 1789 these duties were entrusted to the secretary of war, and it was not until 1798 that the "department of the navy" was established. In 1815 a "board of commissioners for the navy" was constituted, but the Act provided that nothing in it should be construed to take from the secretary his control of marine affairs. In 1842 this law was repealed, and the bureau system, under which all the duties were divided specifically among five offices, was established; in 1862 there was a new division of responsibilities, and the eight bureaus now existing were created. Each of these is under the control of a naval officer, nominated by the executive and confirmed by the senate, all chiefs of bureaus having assigned them the temporary rank of commodore, actual or relative, when their own grades are below this. The bureaus are—(1) navigation, which controls all matters relating to pilotage and navigation, with a direct superintendence of the naval observatory and of the hydrographic, signal, naval intelligence, *Nautical Almanac*, war record, compass, and detail offices,—this last having charge of the personnel of the service; (2) ordnance, which administers all artillery, ordnance, and torpedo matters; (3) equipment and recruiting, which is in charge of outfits, equipments, stores, recruiting, and apprenticeships; (4) yards and docks, which superintends the construction of docks, naval grounds, buildings, and all civil-engineering work; (5) medicine and surgery; (6) provisions and clothing, which is responsible for the supplies of food, water, and clothing, and manages the accounts, thus performing under one direction these duties relegated in the army to the quartermaster, commissary, and paymaster; (7) steam engineering, which designs and has the care of engines and boilers; and (8) construction and repair, which performs the same duties for ships. The first four bureaus are under the direction of line-officers of the navy.

There are no maritime districts in the United States, naval authority being limited strictly to the navy-yard government. At present there are seven navy yards and three naval stations, in which the general administration is entrusted to specific departments, all under the direct command of a line-officer of high rank, and each corresponding to a bureau of the central control. It is the intention of the Government to close all but three of the yards, maintaining those at New York, Norfolk, and San Francisco (Mare Island), together with a repair arsenal at Washington.

The judge advocate's office and the Naval Academy are under the special supervision of the secretary. The Naval Academy ranks among the best institutions of the kind in the world. It is situated at Annapolis, Maryland, and is governed by a line-officer superintendent, assisted by an academic board made up of the heads of the departments of discipline and of studies, and with a corps of instructors drawn mainly from the line of the navy, with a few engineer and civilian assistants. All appointments of naval cadets are made by the president upon the nominations of members of Congress; each of the congressional districts, about three hundred in all, is entitled to one representative at the institution, admission after nomination being based upon a rigorous examination. The curriculum is for four years, supplemented by a two years' cruise before final graduation.

Corresponding to Greenwich Hospital in its days of old pensioners is the Naval Asylum, situated at Philadelphia; and at Newport, Rhode Island, are the headquarters of the torpedo station and of the training system for apprentices. The naval experimental battery is at Annapolis, though not a part of the Naval Academy; and in all the large seaboard towns are rendezvous for the shipping of men, and branches of the hydrographic office for the dissemination of maritime information.

The personnel of the active list includes 1410 commissioned officers (602 of whom are at sea and 808 on shore), 7500 men, and 700 apprentices; there is also a corps of marine infantry, with 1887 enlisted men and 75 officers. All enlistments of sailors are voluntary, and for a period of three years, with special inducements for re-enlistment within a fixed period, and with the certainty of a pension or of a billet at the Naval Asylum after twenty-one years' service. There is no reserve, the active list representing the available force. For officers who have attained sixty-two years of age, or who have seen service for a term varying from forty to forty-five years, there is a retired list which entitles them without delay to 75 per cent. of their highest sea pay. Upon this list also there are officers, and in the Naval Asylum there are men, who are incapacitated for active service by reason of physical or other causes. Apprentices are enlisted between the ages of fourteen and eighteen, with obligatory service until the age of twenty-one is attained.

There are five foreign stations, divided geographically,—the North Atlantic, South Atlantic, European, Pacific, and Asiatic. In January 1883 there were 140 vessels of all kinds on the register, 23 of which were in commission for general cruising, and 5 were employed on special service. Three modern steel steamers are being built at a private yard, and Congress has under consideration a new construction plan; by an annual expenditure of $4,283,000 this will give in ten years a modern steel navy of 70 ships, in every way adequate to the demands of the country. The estimates for the fiscal year ending June 30, 1885, require for the ordinary purposes of the navy $16,319,307·62, and for the increase of the navy, including the completion of four double-turreted monitors of the armoured fleet, $7,449,581·76, or a total of $23,768,889·38. The present effective cruising force is composed of 1 first rate, 14 second rates, and 21 third rates, or 36 in all; the available armoured vessels are 13 monitors of the old single-turreted type and 6 double-turreted monitors, lately rebuilt

The coast survey and lighthouse establishment, both mainly in charge of naval officers, the revenue marine, life-saving, steamboat inspection, and marine hospital services, are all a part of the treasury department; the transfer of their control to the navy department is asked of Congress by the secretary of the navy, who also recommends the establishment, under his administration, of a bureau of mercantile marine, the duties of which will be analogous to those of the mercantile marine department of the Board of Trade. (J. D. J. K.)

NAWÁNAGAR, or **Nowanuggur**, a native state lying along the southern shore of the Gulf of Cutch, Bombay Presidency, India, between 21° 44′ and 22° 54′ N. lat. and 68° 58′ and 71° E. long., with an area of 3393 square miles and a population in 1881 of 316,147. The chief, who has the title of jám, is a Hindu of the Járeja Rájput caste, and has powers of life and death over his subjects. The gross revenue is about £182,000; a tribute of £12,000 a year is payable jointly to the British Government, the gaekwár of Baroda, and the nawáb of Junágarh. The principal products of the state are grain and cotton, and cloth and silk are the chief manufactures. Nawánagar, the capital, is a flourishing seaport town, nearly 4 miles in circuit, with a large trade, and a population of 39,668.

NAWAWÍ. Moḥyí al-Dín Abú Zakaryá Yaḥya b. Sharaf al-Nawawí, born at Nawá in Jaulán, October 1233, head of the Ashrafia academy at Damascus from 1267, died at Nawá 20th December 1277, where his grave is still visited as that of a saint. To this honour he has better claims than most Moslem sheikhs, for not only was his life one of the most intense and unselfish devotion to learning, but he had the rare courage to take open part for his oppressed countrymen against Sultan Bibars, and alone among the Syrian doctors refused to sanction the exactions of which the "Holy War" was the pretext. "Thou hast a thousand mamelukes," he said, "each of whom wears a golden girdle, and two hundred female slaves adorned with all manner of jewels. When thou hast spent all this, and thy mamelukes have only girdles of cord and thy slave-girls only clothes without jewels, I will vote for the tax." The angry sultan banished him from Damascus, and, though public opinion compelled this sentence to be revoked, Nawawí refused to return while Bibars was in the city.

Forty-two works of Nawawí are catalogued by Wüstenfeld, *Leben und Schriften des Scheich . . . el Nawawi*, Göttingen, 1849. His biographical "Dictionary of Illustrious Men chiefly at the Beginning of Islamism," forming the first part of the *Tahdhíb al-asmá wal-loghát* (a sort of analytical index to six theological and juristic works), was published by the same scholar, Göttingen, 1842–47. An edition of his manual of Sháfi'ite jurisprudence (*Minháj al-tálibín*), a book of great reputation in the East, has been commenced by L. W. C. van den Berg (vol. i., Batavia, 1882, with French version and notes).

NAXOS, one of the Cyclades, a fertile island in the Ægean Sea, a little to the east of Paros. It was rich in vines and famous for its wine, and in consequence became one of the chief seats of the worship of Bacchus. The god found Ariadne asleep on its shore, when she was deserted by Theseus. From its fertility and wealth Naxos was the most powerful of the Cyclades. A tyrant Lygdamis ruled there for some time during the 6th century B.C. In 501 a Persian fleet unsuccessfully attacked it, but in 490 it was captured and treated with great severity. Four Naxian ships took part in the great expedition of Xerxes, but deserted and fought on the Greek side at Salamis in 480. Naxos was a member of the Delian Confederacy; it revolted in 471, was captured by Athens, and remained in her possession till her empire was destroyed. The history of the island henceforth is obscure. The most remarkable event was its capture, in 1207 A.D., by the Venetian Marco Sanudo, who founded there a state and a dynasty that flourished till the Turks took the island in 1566. Since the War of Independence it has belonged to the Greek kingdom. The chief town occupies the site of the ancient city on the north-west coast. Naxos, Paros, Antiparos, and some little islets form an *eparchia*, with a total population of about 21,000.

NAXOS, the earliest Greek colony in Sicily, was founded from Chalcis in 735 B.C., on the east coast immediately south of the modern town of Taormina. Within a few years it became strong enough to found Leontini and Catana. It is impossible here to enter on the tangled history of its relations with the other Greek cities of Sicily, and with the tyrants Hippocrates, Gelo, &c. Naxos was the warmest ally of Athens in the Sicilian expedition. In 403 B.C. it was completely destroyed by Dionysius, and was never rebuilt. Its place was supplied in 358 by Tauromenium, to which the Naxian exiles flocked.

NAYÁGARH, or Nyagur, a petty state in Orissa, Bengal, India, with an area of 588 square miles. The state is a valuable and well-cultivated territory, abounding in noble scenery, with a splendid range of hills from 2000 to 3000 feet in height running through its centre. The population in 1881 was 114,622, most of them Hindus. The chief receives an estimated annual revenue of £5418, and pays a tribute of £552 to the British Government.

NAYLER, or Naylor, James (1618–1660), a Puritan fanatic, was born at Andersloe or Ardsley in Yorkshire, in 1618. When the civil war broke out in 1641 Nayler, who was then resident in the parish of Wakefield, joined the Parliamentary army, and served as quartermaster under Lambert. In 1651 he adopted Quakerism, and became a zealous advocate of the new principles both as a preacher and writer. Gradually his opinions became tinged with the wildest fanaticism, until he arrived at the seeming conviction that he was a new incarnation of Christ. He gathered around himself a small band of disciples, who followed him from place to place, paying him the homage due to one gifted with supernatural endowments. In October 1655 he, in imitation of Christ's procession into Jerusalem, entered Bristol on horseback riding single—"a rawboned nude figure, with lank hair reaching below his cheeks,"—attended by seven followers, some on horseback, some on foot, he in silence and they singing "Hosanna! Holy, holy! Lord God of Sabaoth!" The procession passed on to the High Cross of Bristol, where Nayler and his followers were apprehended by the authorities. His trial occupied the second parliament of Cromwell for several days, and on December 16, 1656, he was convicted of blasphemy and sentenced to be whipped from the Palace Yard to the Old Exchange, to be branded in the forehead, to have his tongue bored with a red-hot iron, to be whipped through the streets of Bristol, and to suffer imprisonment with hard labour for two years. These stern measures had the effect of convincing Nayler that his pretensions to supernatural powers were the result of delusion, and on May 26, 1657, he, after recantation, received his freedom. He was readmitted into the communion of the Quakers. In October 1660 Nayler set out to visit his long-forsaken family in Yorkshire, but died on the journey in Huntingdonshire.

A collected edition of the *Tracts* of Nayler appeared in 1716; a *Relation of the Life, Conversion, Examination, Confession, and Sentence of James Nayler* in 1657; a *Memoir of the Life, Ministry, Trial, and Sufferings of James Nayler* in 1719; and a *Refutation of some of the more Modern Misrepresentations of the Society of Friends commonly called Quakers, with a Life of James Nayler*, by Joseph Gurney Bevan, in 1800.

NAZARENES (Ναζωραῖοι), an obscure Jewish-Christian sect or "heresy," existing at the time of Epiphanius in Cœle-Syria, Decapolis (Pella), and Basanitis (Cocabe). According to that authority (*Pan.*, xxix. 7) they dated their settlement in Pella from the time of the flight of the Jewish Christians from Jerusalem, immediately before the siege in 70 A.D.; he characterizes them as neither more nor less than Jews pure and simple, but adds that they recognised the new covenant as well as the old, and believed in the resurrection, and in the one God and His son Jesus Christ. He is unable to say whether their christological views were identical with those of Cerinthus and the like, or whether they differed at all from his own. This lacuna is filled up by Jerome (*Ep.* 79, to Augustine), who expressly says that they believed in Christ the Son of God, born of the Virgin Mary, who suffered under Pontius Pilate, and rose again, but adds that, "desiring to be both Jews and Christians, they are neither the one nor the other." They used the Aramaic recension of the Gospel according to Matthew, which they called the Gospel to the Hebrews, but, while themselves adhering as far as possible to the Mosaic economy as regarded circumcision, sabbaths, foods, and the like, they did not refuse to recognize the apostolicity of Paul or the rights of heathen Christians (Jer., *Comm. in Isa.*, ix. 1). These facts, taken along with the name (comp. Acts xxiv. 5) and geographical position of the sect, lead to the conclusion that the Nazarenes of the 4th century were the direct representatives of the Jerusalem Christians of the 1st, who owned the presidency of James. Probably they are intended also by Origen (*Contra Cels.*, v. 61) and Eusebius (*H. E.*, iii. 27) when two classes of Ebionites are discriminated, one of which acknowledged the supernatural origin of Christ. Compare Ebionites; and see Ritschl, *Entstehung d. altkath. Kirche*, bk. i. sec. 3.

NAZARETH, in Galilee, now al-Nasira, the city of Mary and Joseph, and the place where our Lord spent his youth, is pleasantly situated in a hollow on the south slope of the hills (J. al-Síkh) which bound the plain of Esdraelon on the north. Though it had a synagogue (Matt. xiii. 54; Luke iv. 16), and is called in the Gospels a city, Nazareth must have been an obscure place[1] in the time of Jesus, for we find no mention of it outside of the New Testament till Eusebius and Jerome identify it with a "village" which undoubtedly occupied the place of the modern Naṣira. In Jerome's time it was already visited by pilgrims, but as yet we hear nothing of relics or places associated with special incidents in the life of Jesus. The population was mainly Jewish,—exclusively so, we are told by Epiphanius, down to the time of Constantine,—and the Jews, after their manner in modern as in ancient times, seem to have been the inventors of various marvellous relics and identifications which were palmed off upon Christian pilgrims in the 6th century. Such at least is the natural inference from what Antoninus Martyr tells of these wonderfully friendly and communicative Hebrews. A century later Arculphus describes two great churches corresponding to the modern Greek church over the Virgin's Well and the Latin church of the Franciscan monastery over the Grotto of the Annunciation. The place has since passed through various vicissitudes; it was most flourishing in the time of the crusaders, who transferred to it the bishopric of Scythopolis. The Ottomans at length expelled the Christians; but the Franciscans established themselves under the protection of Fakhr al-Dín in 1620. The town has now a Greek, a Latin, and a Moslem quarter, as well as a Protestant mission and orphanage. The population is variously estimated at from 6000 to 10,000.

The Virgin's Well, just outside the town, must have been frequented by the women of ancient as of modern Nazareth; all the other traditional sites are highly dubious. But this hardly affects the interest attaching to the town, for the character of Nazareth must at all times have depended on its position and surroundings. It was a little country town of peasants and handicraftsmen, nestling in olive groves and green meadows, separated and yet not distant from the busy life of the greater Galilæan cities, surrounded on all sides by the pleasantest landscapes of Canaan. The hill above the town commands one of the finest views in Galilee, from Hermon to Mount Carmel.

NAZARITE, or **Nazirite** (נָזִיר), was the name among the Hebrews for a peculiar kind of devotee. The characteristic marks of a Nazarite were unshorn locks and abstinence from wine (Judg. xiii. 5; 1 Sam. i. 11; Amos ii. 11, 12); full regulations for the legal observance of the Nazarite vow are given in Numb. vi., where every product of the grape-vine is forbidden, and the Nazarite is further enjoined to abstain from approaching a dead body, even if it be that of his nearest relative. The law in question is not pre-exilic, and is plainly directed to the regulation of a known usage. It contemplates the assumption of the vow for a limited period, and gives particular details as to the atoning ceremonies at the sanctuary by which the vow must be recommenced if broken by accidental defilement, and the closing sacrifice, at which the Nazarite, on the expiry of his vow, cuts off his hair and burns it on the altar, thus returning to ordinary life. Among the later Jews the Nazarite vow of course corresponded with the legal ordinance, which was further developed by the scribes in their usual manner (Mishna, *Názír*; comp. 1 Mac. iii. 49; Acts i. 23 *sq.*; Joseph., *Ant.*, xix. 6, 1; Id., *B. J.*, ii. 15, 1). On the other hand, in the earliest historical case, that of Samson, and in the similar case of Samuel (who, however, is not called a Nazarite), the head remains unshorn throughout life, and in these times the ceremonial observances as to uncleanness must have been less precise. Samson's mother is forbidden to eat unclean things during pregnancy, but Samson himself touches the carcase of a lion and is often in contact with the slain.[2]

In the cases of Samuel and Samson the unshorn locks are a mark of consecration to God (נזיר אלהים, Judg. xiii. 5) for a particular service,—in the one case the service of the sanctuary, in the other the deliverance of Israel from the Philistines. Since, moreover, the Hebrew root N-Z-R is only dialectically different from N-D-R, "to vow," both corresponding to the same original Semitic root (Arabic N-DH-R), it would seem that the peculiar marks of the Nazarite are primarily no more than the usual sign that a man is under a vow of some kind. To leave the locks unshorn during an arduous undertaking in which the divine aid was specially implored, and to consecrate the hair after success, was a practice among various ancient nations, of which examples may be seen in Spencer, *De Legibus Heb.*, iii. 1, cap. 6; but the closest parallel to the Hebrew custom is found in Arabia. There the vow was generally one of war or revenge (*Ḥamása*, p. 167; ʿAntara, *Moal.*, l. 74; *Moh. in Medina*, p. 201), and till it was accomplished the man who vowed left his hair unshorn and unkempt, and abstained from wine, women, ointment, and perfume. Such is the figure of Shanfara as described in his *Lámíya*. The observances of the *iḥrám* belong to the same usage (see vol. xv. p. 674), and we find that at Ṭáif it was customary to shear the hair at the sanctuary after a journey (*Moh. in Medina*, p. 381). The affinity between the Arabian usage and a case like that of Samson is obvious, and the consecration of Samuel has also its Arabic parallel in the dedication of an unborn child by its mother to the service of the Kaʿba (Ibn Hishám, p. 76; Azraḳí, p. 128); but we have not sufficient data to enable us to trace the further development of the Nazarite vow among the Hebrews. The spirit of warlike patriotism that characterized the old religion of Israel could scarcely fail to encourage such vows (comp. 2 Sam. xi. 11, and perhaps 1 Sam. xxi. 4, 5), and from the allusion in Amos we are led to suppose that at one time the Nazarites had an importance—perhaps even an organization—parallel to that of the prophets, while on the other hand the Canaanized popular religion of the 8th century B.C. made light of an institution that belonged to a very different religious type from Canaanite nature worship. The Nazarites as they appear in Amos have another parallel in the Rechabites.

NEAL, Daniel (1678–1743), author of the *History of the Puritans*, was born in London in December 1678. He received his early education at Merchant Taylors' School and at a Dissenting academy, after which he went to Holland and studied some time at the universities of Utrecht and Leyden. In 1704 he became assistant-minister of the Independent congregation of Aldersgate Street, London, and in 1706 sole pastor. In 1720 he published in two volumes a *History of New England*, which reached a second edition in 1747. His occasional printed sermons also assisted to increase his reputation among Nonconformists, and it was at the request of several influential co-religionists that he undertook to write a *History of the Puritans*, the first volume, which commenced with the Reformation in England, appearing in 1732, and the fourth, bringing the narrative down to the Act of Toleration of 1689, in 1738. The *History* was attacked for unfairness and misstatements by Bishop Maddox, to whom Neal replied in a pamphlet entitled *A Review of the Principal Facts objected to the first volume of the History of the Puritans*. The conscientious accuracy of Neal is indeed beyond praise, although he was undoubtedly strongly prepossessed in favour of his own side of the question, and it has been somewhat happily said of his representations of the Puritans, that he "blanches them into a sweet and almond whiteness." He died in April 1743.

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[1] Even the form of the name is uncertain, Ναζαρέτ, Ναζαρέθ, Ναζαρά. These variations are intelligible in a Hebrew or Syriac name with fem. termination, but hardly enable us to fix the original form. In Syriac and Arabic the ζ is transcribed as sharp ṣ; thus the root of the name Nazareth would be N-Ṣ-R, and so many ancients and moderns suppose that in Matt. ii. 23 the prophecy referred to is that of the Branch (néṣer) in Isa. xi. 1.

[2] John the Baptist is a later example of life-long consecration, Luke i. 15. Compare also the tradition as to James the Just, vol. xiii. p. 553.

Neal's *History of the Puritans*, accompanied with a life of the author, was edited by Toulmin in six volumes, 1793. This edition has been frequently reprinted, and an edition in two volumes, revised and enlarged by John O. Choules, appeared at New York in 1848.

NEALE, John Mason (1818–1866), ecclesiastical historian and hymnologist, was born in London, January 24, 1818, and was educated at Trinity College, Cambridge. He became incumbent of Crawley, Sussex, in 1842, and in 1846 warden of Sackville College, East Grimstead, an appointment which he held till his death, August 6, 1866.

Neale was strongly High Church in his sympathies, and in 1855 founded a sisterhood named St Margaret's. The most important of his publications is his *History of the Eastern Church* (1850–51). He occupies a high place as a hymnologist, but principally as a translator of ancient and modern hymns, his best-known translations being probably "Brief life is here our portion," "To thee, O dear, dear country," and "Jerusalem the golden," which are included in the poem of Bernard of Cluny, *De Contemptu Mundi*, translated by him in full. He also published *Essays on Liturgiology*, 1863; and among his other works are *Mediæval Preachers*, 1857, and *History of the so-called Jansenist Church of Holland*, 1858.

NEANDER, August (1789–1850), one of the most distinguished and influential of the modern theologians of Germany, was born, of Jewish parents, at Göttingen on January 17, 1789. His father, Emmanuel Mendel, is said to have been a common Jewish pedlar; but little seems to be really known of his circumstances and character. His mother was a woman of tender and noble disposition; and from the maternal side, as in so many other cases, the virtues and talents of the son appear to have sprung. While still very young, he removed with his mother to Hamburg; and in the grammar school, or Johanneum, of that city he received his classical education. There, as throughout life, the simplicity of his personal appearance and the oddity of his manners attracted notice, but still more, under all outward peculiarities, his great industry and mental power. From the Johanneum young Mendel passed to the gymnasium, where he attended for a year the prelections in philology, philosophy, and theology. The study of Plato appears especially to have engrossed him at this time. One of his young friends, Wilhelm Neumann, writes of him in 1806—"Plato is his idol—his constant watchword. He sits day and night over him; and there are few who have so thoroughly, and in such purity, imbibed his wisdom. It is wonderful how entirely he has done this without any foreign impulse, merely through his own reflexion and downright study." Considerable interest attaches to his early companionship with the writer of this letter, and certain others, among whom were the afterwards well-known writer Varnhagen von Ense and the poet Chamisso. His letters to Chamisso are singularly interesting. They breathe throughout the most simple and glowing enthusiasm, while the picture of a pure and affectionate nature, and the struggling comprehensiveness of a great spirit, are impressed on every page of them. These letters enable us to understand with some degree of clearness the great change which now took place in Neander's convictions. They reveal a course of spiritual training very much analogous to that which he has described in many cases in his *Church History*. He reached the gospel through Platonism. The influence of his teacher's idealism may be visibly traced in some of his conceptions of Christian doctrine. He was baptized on the 25th February 1806, when he adopted, instead of his Jewish name of David Mendel, that under which he was always afterwards known.

In the same year he went to Halle to study divinity. At Halle Schleiermacher was then lecturing in the first height of his fame as a teacher. Neander met in him the very impulse which he needed, while Schleiermacher found a pupil of thoroughly congenial feeling, and one destined to carry out his views in a higher and more effective Christian form than he himself was capable of imparting to them. But before the year had closed the events of the Franco-Prussian war compelled his removal to the less congenial Göttingen. There, however, he continued his studies with ardour, made himself yet more master of Plato and Plutarch, and especially advanced in sacred learning under the venerable Planck. The impulse communicated by Schleiermacher was confirmed by Planck, and he seems now to have realized that the original investigation of Christian history was to form the great work of his life.

Having finished his university course, he returned to Hamburg, and passed his examination for the Christian ministry with great distinction. He was not fitted, however, for the pulpit, and seems to have preached but seldom. After an interval of about eighteen months he definitively betook himself to an academic career, "habilitating" in Heidelberg, where two vacancies had occurred in the theological faculty of the university, from the removal of Marheineke and De Wette to Berlin. He entered upon his work here as a theological teacher in 1811; and in the year following an extraordinary professorship rewarded his learning and industry. In the same year (1812) he first appeared as an author by the publication of his monograph *On the Emperor Julian*. The fresh insight into the history of the church, and the vivid and striking power of delineation evinced by this work, —vague and sketchy, perhaps, as it now seems in the light of his maturer productions,—at once drew attention to its author, and marked him as a rising theologian. Accordingly, even before he had terminated the first year of his academical labours at Heidelberg, he was called to Berlin as the associate of De Wette and Schleiermacher—an illustrious band, whose labours have left an ineffaceable impress upon German theology.

In Berlin Neander's life was only varied by the successive publications which appeared in such fertility from his pen. In the year following his appointment he published a second monograph *On St Bernard and his Age*, and then in 1818 his work on Gnosticism (*Genetische Entwickelung der vornehmsten gnostischen Systeme*). A still more extended and elaborate monograph than either of the preceding followed, *On Chrysostom*, and again, in 1825, another on Tertullian (*Antignostikus*). He had in the meantime, however, begun his great work, to which these several efforts were only preparatory studies. The first volume of his *General History of the Christian Religion and Church*, embracing the history of the first three centuries, made its appearance in 1826. The others followed at intervals, —the fifth, which appeared in 1845, bringing down the narrative to the pontificate of Boniface VIII. A posthumous volume, edited by Schneider in 1852, carried it on to the period of the council of Basel. Besides this great work he published in 1832 his *History of the Planting and Training of the Christian Church by the Apostles*, and in 1837 his *Life of Jesus Christ, in its Historical Connexion and Development*, called forth by the famous *Life* of Strauss. In addition to all these labours, he gave to the public many miscellaneous sketches from the history of the church and of theological opinion; as, for example, his *Memorabilia from the History of Christian Life* (1822), his volume under the title of the *Unity and Variety of the Christian Life*, his papers on Plotinus, Thomas Aquinas, Theobald Thamer, Pascal, Newman, Blanco White, Arnold, &c., and other occasional pieces (*Kleine Gelegenheitsschriften*, 1829), mainly of a practical, exegetical, and historical character. Since his death a succession of volumes, representing his various courses of lectures, have appeared (1856–64), in addition to the *Lectures on the History of Dogma*, admirable in spirit and execution, which were edited by Jacobi in 1857. The life of Neander, as may be gathered from this mere enumeration, was one of unwearied work in his study and in his lecture-room. He lectured usually three times a day, his lectures embracing almost every branch of theology—exegetics, dogmatics, and ethics, as well as church history. He cherished a warm and affectionate interest in his students—his ungrudging self-denial and benefactions in their behalf forming one of the most kindly traditions which surround his name. He was of a very child-like and yet aspiring nature,—simple and affectionate, yet subtle and comprehensive in his views. He died on July 14, 1850, worn out and nearly blind with incessant study.

Neander's theological position can only be explained in connexion with Schleiermacher, and the manner in which while adopting he modified and carried out the principles of his master. With a mind less restlessly speculative, less versatile, discriminating, and logical, he possessed, in higher union than Schleiermacher, depth of spiritual insight and purity of moral perception with profound philosophical capacity. Characteristically meditative, he rested with a secure footing on the great central truths of Christianity, and recognized strongly their essential reasonableness and harmony. Alive to the claims of criticism, he no less strongly asserted the rights of Christian feeling. "Without it," he emphatically says, "there can be no theology; it can only thrive in the calmness of a soul consecrated to God." And exactly in the same spirit, and proceeding from the same strong recognition of the absolute necessity of this Christian element in all theology, was his favourite motto,—"Pectus est quod theologum facit."

His *Church History* remains the greatest monument of his genius. Defective in graphic personal details, and in a clear exhibition of the political relations of the church, somewhat heavy in style, with a certain vagueness and want of pictorial life throughout, it is yet unrivalled in its union of vast learning and profound philosophic penetration, its varied comprehensiveness and abundant store of materials, its insight into the living connexion of historical events, but especially into the still more living and subtle nexus which binds together the growth and development of human opinion,—in its display of such qualities, with the most simple-hearted Christian piety, the most lively appreciative interest in the ever-varying fortunes of the church, the finest discernment of all the manifold phases of the Christian life, the most genuine liberality and catholic sympathy.

See Krabbe, *August Neander* (1852), and a paper by Kling in the *Stud. u. Krit.* for 1851. (J. T.)

NEANDER, Joachim (*c.* 1650–1680), German hymn-writer, when about twenty years of age came under the influence of a Labadist preacher (see vol. xiv. 163) named Untereyk, in his native city of Bremen. After studying at Heidelberg and Frankfort, where he formed friendships with Spanheim and Spener, he settled at Düsseldorf as rector of the Latin school in connexion with the Reformed Church. His Labadist views were somewhat out of harmony with those of the rulers and of the church, and in 1676 he incurred church censure for abstaining and inducing others to abstain from joining in the celebration of the communion. It was during the term of his suspension from his teaching office that many of his hymns were written. He ultimately renounced his connexion with the separatists, and in 1679 returned to Bremen as one of the preachers of St Martin's church. In the same year he published the *Bundeslieder* and *Dankpsalmen*. He died in 1680. The Neanderthal near Düsseldorf takes its name from him. For his place in hymnology see vol. xii. p. 587.

NEARCHUS, son of Androtimus, one of the most distinguished officers in the army of Alexander the Great, and admiral of his fleet, with which he made an important and interesting voyage of discovery in the Indian Ocean. He was a native of Crete, but settled at Amphipolis in Macedonia, and must have been at an early period of life a person of some consideration, as we find him attached to the court of Philip, where he became the friend and companion of the young Alexander, and when the prince fell into disgrace with his father Nearchus was banished, together with Ptolemy the son of Lagus, Harpalus, and others, for having participated in the intrigues of Olympias and her son against the old king. But after the death of Philip (336 B.C.) he was at once recalled, and rose to great favour with Alexander, which he appears to have fully merited by his abilities and judgment. He did not, however, accompany him in his earlier campaigns into Asia, having been left behind in the government of Lycia and the adjoining provinces, where he remained for five years. But in 329 B.C. he joined the king with a force of Greek mercenaries at Zariaspa in Bactria, and from this time he held an important post in his army, and took an active part in his Indian campaigns. Hence when Alexander had assembled his fleet on the Hydaspes, with a view to descending that river and the Indus to the sea, he confided the chief command of it to Nearchus. This post must, however, have been one of comparatively little importance, so long as the king himself remained with the fleet; but when, after descending the Indus to its mouth, and making a short excursion upon the Indian Ocean, Alexander himself undertook to conduct the army by land through the deserts of Gedrosia to Susa, while he confided the command of the fleet to Nearchus, with orders to conduct it to the head of the Persian Gulf, the position became one of great responsibility, and the success with which he accomplished the task rendered his name for ever famous in antiquity.

He set out in the first instance from a naval station at some point in the delta of the Indus; but, finding, on reaching the mouth of that river, that the monsoon was still blowing with great violence, he remained for twenty-four days in a neighbouring port, to which he gave the name of the Port of Alexander. This is in all probability the same harbour which now forms the well-known seaport of Kurrachee. Sailing thence about the beginning of November (325 B.C.), he proceeded for five days along the coast to the westward as far as the mouth of the Arabis (now called the Poorally), and thence three days further, along the coast of the Oritæ, to a place called Cocala, where he was able to communicate for the last time with the land army of Alexander, and lay in a fresh stock of provisions. From thence he still followed the coast of the Oritæ for three days, as far as a place called Malana, which still bears the name of Cape Malan. It was at this point that the most difficult part of his voyage began, as from hence to the headland of Badis, now called Cape Jask, a distance of above 400 geographical miles, his course lay along the barren and inhospitable shores of the Mekran, inhabited by a very sparse population, who subsisted, as they do at the present day, almost wholly upon fish, for which reason they were termed by the Greeks Ichthyophagi. Hence the crews of the fleet suffered severely from the want of provisions, especially from that of corn or meal of any kind, of which they obtained no supply till their arrival at Badis. In other respects the navigation presented no real difficulties, the coast being free from reefs and other hidden dangers; and at a place called Mosarna they procured a pilot, after which they were able to proceed more rapidly. So slow and cautious had been their previous progress that they took twenty days to accomplish the distance from Malana to Badis, which Nearchus in consequence estimated at 10,000 stadia, or 1000 geographical miles, more than double the true distance. The remainder of the voyage presented comparatively little difficulty. After sighting from a distance the lofty headland of Maceta (Cape Mussendom), which marks the entrance to the Persian Gulf, the fleet put into the river Anamis in the fertile district of Harmozia (Ormuz), where they were agreeably surprised by the tidings that Alexander with his army was encamped at no great distance in the interior, After communicating with the king, Nearchus resumed his voyage along the northern coast of the Persian Gulf to the mouth of the Euphrates, and thence ascended the Pasitigris to Susa.

To conduct a large fleet, consisting principally of war galleys, along so great an extent of an unknown coast was undoubtedly an exploit requiring great prudence and ability on the part of its commander; but the voyage of Nearchus has acquired a much greater celebrity than it really deserves, both in ancient and modern times, from the circumstance that it stood entirely alone in antiquity, the similar expedition of Hanno along the west coast of Africa being almost unknown both to the Greeks and Romans, while in modern days it has attracted a greatly increased amount of attention from the accidental circumstance that a complete and trustworthy record of it has been preserved. Nearchus himself wrote a detailed narrative of his expedition, of which a regular and full abstract was embodied by Arrian in his work on India,—one of the most interesting geographical treatises that has been transmitted to us from antiquity.

The success with which Nearchus had accomplished this arduous enterprise led to his selection by Alexander for the more difficult task of circumnavigating the great peninsula of Arabia from the mouth of the Euphrates to the Isthmus of Suez. But this project was cut short by the illness and death of the king (323 B.C.). In the troubles that followed we hear little of Nearchus, who appears to have assumed no prominent position, but we learn that he attached himself to Antigonus, and probably therefore shared in the downfall of that monarch (301 B.C.).

The narrative of his voyage, as transmitted to us by Arrian, is contained in the editions of that author's works by Raphelius, Schmieder, and Krüger, as well as in the more recent edition by Dr C. Müller (Paris, 1846), which forms part of Didot's *Bibliotheca Græca*. But by far the most valuable edition of the original text is that published by the same author, with copious geographical notes, in the first volume of his *Geographi Græci Minores* (Didot, Paris, 1855). An English translation, with a very elaborate commentary, was published by Dr Vincent in his *Commerce and Navigation of the Ancients in the Indian Ocean* (4to, London, 1807). But much of his geographical information is now obsolete. (E. H. B.)

NEATH, a municipal and parliamentary borough and market-town of Glamorganshire, South Wales, is prettily situated near the mouth of the Neath, and on two railway lines, 8 miles north-east of Swansea and 39 west-north-west of Cardiff. The older streets are narrow and ill-paved; but there are several handsome villas on the slopes bordering the town. The principal buildings are the parish church of St Thomas, a large and plain structure with an ancient tower; the new church of St David's; the town-hall, with corn exchange in the basement story; and the new market-house. There are slight remains of the castle of Jestyn-ap-Gwrgan, situated about a mile from the town, and rebuilt in 1111 by Richard de Granville. Of the Cistercian abbey—Abbaty-Glyn-Nedd—which he also founded, and which was at one time the finest abbey in Wales, there still exist the external walls, with parts of the chapel, vaulted chapter-house, refectory, and abbot's house. The town is situated in the midst of an important mineral district, and possesses very extensive tinplate works, as well as blast furnaces, iron foundries, steam-engine factories, copper-works, and chemical manufactures. In the neighbourhood there are large coal-mines. Vessels of 300 or 400 tons can reach the quays at high tide, and parliamentary powers have been secured to erect new docks. With Abernant and Swansea there is water communication by means of canals. There is a large export trade in coal, copper, iron, and tin, the principal imports being timber and general merchandize. Neath is included in the Swansea parliamentary district of boroughs. The population of the municipal borough (1486 acres) in 1871 was 9319, and in 1881 it was 10,409. That of the parliamentary borough (1629 acres) in 1881 was 11,216.

The town occupies the site of the ancient Nidus or Nidum of the Romans. It was given by Richard Fitz-Hamon to his brother Richard de Granville, the ancestor of the Granvilles, marquises of Bath. It is a borough by prescription, and received its first charter from Edward II.

NEBRASKA, a central State of the American Union, lies between 40° and 43° N. lat.; the Missouri flows along its eastern side, the most easterly point being 95° 25′ W. long., and the boundary line separating it from Wyoming on the west is 104° W. long. It is bounded on the S. by Colorado and Kansas, on the E. by Missouri and Iowa, on the N. by Dakota, and on the W. by Wyoming and Colorado. The width of the State from north to south is 208½ miles, the length from east to west 413 miles, and the area 76,647 square miles, or 49,054,080 acres.

The greater part of Nebraska is a plateau. The lowest point is at the mouth of the Nemaha, in the south-eastern part of the State, where the elevation is 880 feet; the highest spot is Scott's Bluffs, in the extreme western part of the State (6000 feet). The eastern half of the State has an average elevation of 1400 feet; and the whole State averages 2312 feet above the sea.

There are no mountains, but in the northern and western parts there are some ridges and a few lofty hills. Generally the slopes are gentle, but occasionally precipitous, and in rare cases there are cañons with perpendicular sides. The lands of three-fourths of the State are gently rolling. The surface owes its present form mainly to erosion. Between all the forms of upland surface the transition is gradual. The bottom lands and valleys are the most conspicuous modifying features of the surface. They are huge shallow troughs, varying in breadth from a quarter of a mile on the smaller streams to 23 miles on the Platte and the Missouri. Their numerous terraces, like broad steps, gradually lead to the bordering uplands, which in turn are varied in height and form. Occasionally it is hard to determine where the bottom ends and the bordering bluffs begin, but generally both forms are clearly outlined. The innumerable tributaries that creep quietly into the main bottoms greatly complicate and beautify the forms of landscape. The number of these valleys is very great, the Republican alone having more than four hundred tributaries. Not less than 25 per cent. of the entire surface of the State is composed of well-watered valleys. The few destitute of water are regaining the streamlets of former times through the climatic changes brought on by the settlement of the State. Most of these bottom lands, though composed of the richest vegetable mould and alluvium modified by loess materials, are perfectly dry, and rarely subject to overflow. A clear conception of the topography can only be obtained by crossing the State at right angles to the courses of the valleys. The rolling lands bordering the valleys gradually disappear as the divide is approached which separates one drainage system from the next. Here the land swells out into a gently undulating plain that varies in extent from 1 to 30 miles. Some of these higher uplands have a great number of shallow basin-like depressions where soil and grasses closely resemble those of the bottom lands. They are the sites of small lakes that recently existed here, and some of them still retain this character, being filled with fresh water from 1 to 15 feet in depth. South of the valley of the Niobrara, and commencing in 100° W. long., are the noted sand-hills. They vary in height from a few yards to several hundred feet. Almost every form of wind sculpturing is found, but the conical predominates. Though formerly naked, these hills have recently become covered with grasses which are fixing the sands, and preserving

their curious crater-like forms. They extend to the head of the forks of the Loup river, covering an estimated area of 8000 square miles.

The average mean temperature of the summer months—June, July, and August—in eastern Nebraska is 73° Fahr. At the North Platte it is slightly higher. Excepting a small section in the north-western part, the whole State is included between the summer isotherms of 72° and 76°. The mean temperature of the autumn months—September, October, and November—is 49°. As excessive rains rarely fall during these months, the comparatively high mean temperature renders the autumn season long and delightfully mild. The isotherm of 20° during the winter months—December, January, and February—embraces all of Nebraska except the north-west corner, where the temperature is slightly lower, and the south-east corner, where it is slightly higher. The spring months—March, April, and May—have a mean of 47° Fahr. The mean of the whole year is in the southern half of the State 55°, in the northern half 52½°. Rarely does the temperature in midsummer rise to 100°. In twelve years the thermometer fell below zero on an average thirteen times a year. The lowest point ever reached was 32° below zero. The heat of summer is constantly modified by breezes. Owing to the dryness of the atmosphere the cold is not felt more when the thermometer registers − 20° than in moist regions when it marks only zero. In winter the prevailing winds are from the north-west, changing, as spring advances, to the south-west, from which direction they mainly blow through summer and autumn. During some winters there are occasional wind-storms of great severity, preceded by a fall of snow, and followed by very low temperature. Such storms last from one to three days, and when they cease the temperature reaches the lowest point experienced in this region. The extreme cold continues for a few days only. Fortunately the severe types of such storms are rare even here, and the winters on the whole are remarkably adapted to continuous labour in the open air. The atmosphere is wonderfully clear and pure throughout the year; objects can be seen at a great distance, and clouds when formed are outlined with exceptional clearness.

The rainfall in eastern Nebraska is abundant. At the Missouri it averages 40 inches a year; 100 miles farther west 32 inches; 200 miles west of the eastern boundary 30 inches. Beyond this point it more rapidly lessens until the North Platte is reached in western Nebraska, where the average is only 20 inches. In the end of May, or in early June, when the "big rise" of the Missouri and the Platte occurs, a rainy season invariably commences which lasts from three to eight weeks. As this is the time when crops most need rain, destructive droughts are rare in eastern Nebraska. After the wet season rains still occur, but at longer intervals. During winter rain rarely falls. Snow ranges in depth from 1 to 10 inches. There are many facts that show a constantly increasing rainfall in the State. One reason for this is believed to be the great depth of the soil, and the great increase of absorption produced by cultivation. The loess soils, of which the surface of Nebraska is largely composed, only need the native sod to be broken up to be transmuted into a huge sponge absorbing all the moisture that falls on it.

Nebraska is exceptionally healthy, especially for persons of consumptive tendency. This is owing to its elevation above the sea, the dryness of the atmosphere, and the great amount of ozone in it, the prevalence of winds, and the fine natural drainage of the State. The diseases incident to the climate are rheumatism, neuralgia, and in isolated spots malaria. With the progress of settlement, and a lessening exposure, these ailments are gradually disappearing.

In striking contrast to past geological times, there are now no large lakes in Nebraska. There are, however, a great number of small lakelets. Many of these have been formed by "cut offs" on the Missouri, Platte, Elkhorn, Blue, and other rivers. At the head of the Elkhorn river is a region containing over thirty small lakes, many of which are of great beauty, with pebbly bottoms, and water clear as crystal. A still more extensive region of small lakes is at and between the heads of the Loup rivers. At the head of Pine Creek, a tributary of the Niobrara, there are many saline lakelets and ponds. A large saline bog, fed by a vast number of saline springs, covers about 500 acres, 2 miles west of Lincoln. Many smaller ones exist in the same vicinity. Salt has been manufactured here in considerable quantity by solar evaporation. Springs are abundant along most of the river bluffs and on the rolling lands of eastern Nebraska. On the long reaches of nearly level land springs occur at longer intervals, and on the watersheds still more rarely. Even here water can readily be obtained by wells, from 15 to 50 feet deep, excepting in a few counties like Clay, Fillmore, Adams, and Phelps, where, owing to the great thickness of the superficial deposits in some localities, shafting must be much deeper. Artesian wells have been successful, the depth at which flowing water has been obtained varying from 500 to 1000 feet.[1]

The name Nebraska signifies land of broad rivers. Chief of all is the Missouri, which flows in a tortuous course for 500 miles along its eastern boundary, and is navigable for 2000 miles above Omaha. Next in importance is the Platte, which flows through the whole length of the State from west to east. Rising in lakelets in the Rocky Mountains, fed by snows, its entire length approximates 1200 miles. When it enters the State it is already a broad and rapid, though shallow, river, flowing over a sandy bed. At North Platte it forks, one branch being known as the South and the other as the North Platte. The Loup is the first large tributary. It rises among the sand-hills south of the Niobrara, in a group of small lakes. It has three main branches, known as the South, Middle, and North Loups, each of which in turn has many tributaries. The Middle Loup, whose main direction is south-east, is 250 miles long. The Elkhorn, which empties into the Platte a short distance above the latter's junction with the Missouri, is one of the most beautiful streams of the State. It too has its source in a region of small lakes near 99° 30′ W. long. Here it has a remarkably broad bottom, with low bordering uplands. It flows over a rocky bottom in a south-easterly direction about 250 miles. Its principal tributaries are the North Fork and the Logan, the latter having an extraordinary number of tributaries. Near the south line of the State the Republican river and its numerous affluents drain a large area. It rises in the Colorado plains, but flows 216 miles through the State. Near the northern boundary is the Niobrara river, which rises in Wyoming, and flows 263 miles through the State before uniting with the Missouri. It is the most rapid and turbulent stream in the State. In 102° 30′ W. long., where it is 80 yards wide, it enters a deep cañon with high and often perpendicular walls, which extend for 180 miles. After emerging from the cañon it remains a broad, rapid, and sandy river to its mouth. The most important of its numerous tributaries are the Keya Paha and the Verdigris. Many other rivers in Nebraska are remarkable for the beauty and fertility of the sections which they drain, the most important being the Bows, the Big and Little

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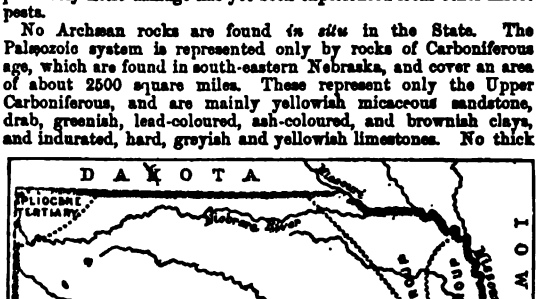
[1] An artesian well in the Government Square in Lincoln struck brine at 250 feet, and at 550 feet a heavy flow was encountered. The source of the brine was the reddish sandstone of the Dakota group (Cretaceous), which here underlies the superficial deposits.

Blue, the Great and Little Nemaha, and Salt Creek. The water-power of the State is enormous. Though the streams meander through broad bottoms, places can be found every few miles where the fall is from 3 to 10 feet to the mile.

Nebraska is the meeting-place of two rather distinct floras—that of dry regions from the west, and their relatives from the moister east. Even many native Rocky Mountain plants have crept down to the plains of Nebraska. Of plants indigenous to the State 2000 species have been collected; among these, 1671 species are flowering plants. The *Compositæ* are represented by the largest number of species, there being 244 within the State. The sedges are represented by 151 species, though there are comparatively few individuals. The grasses are the leading vegetable forms in the number of individuals, though as yet only 147 species have been detected. Originally the short buffalo grass (*Buchloe dactyloides*) was everywhere abundant, but it has almost entirely disappeared from the eastern half of the State and from large sections in its western portions, the taller blue-joint (*Andropogon furcatus*, &c.) grasses taking its place. Nothing can surpass the beauty of the prairies during the summer season when covered with rank grasses and myriad flowers. Of forest trees 71 species are native. The leading variety in the number of individuals and forests is the cotton-wood (*Populus monilifera*), which grows luxuriantly on river bottoms and many uplands. The ash-leaved maple, soft maple, elms, various species of ash, lindens, and willows are in various parts of the State about equal in abundance. The most valuable tree is the noble black walnut, which is extremely hardy and grows luxuriantly. The red cedar is abundant in some sections, and grows well everywhere. Two species of spruce and two of pine are found on tributaries of the Niobrara and Loup, and in the extreme western part of the State. Shrubs are represented by 91 species. Wild fruits abound, among which plums and grapes are most conspicuous, the former represented by three species and an endless number of varieties. The grapes are limited to timber belts, where they sometimes grow so luxuriantly as to make an almost impenetrable thicket of vines. The smaller wild fruits are widely distributed over the State.

Before the advent of the white man Nebraska was a paradise for wild animals,—the buffalo, elk, deer, antelope, beaver, wolves, lynx, foxes, &c. The buffalo has been banished, but the rest are still found in the sparsely settled sections of the State. The bird fauna is well developed, being rich in genera (156); the species number at least 261. Many species of fish, mollusca, and a few reptiles are present in the streams. During a few years, and notably in 1874, 1876, and 1877, the migrating locust (*Caloptenus spretus*), whose native habitat is beyond Nebraska, did considerable damage. It does not appear on the average more than once in a decade, and owing to the continually increasing area brought under cultivation the damage from its visitations is continually growing less. Comparatively little damage has yet been experienced from other insect pests.

No Archæan rocks are found *in situ* in the State. The Palæozoic system is represented only by rocks of Carboniferous age, which are found in south-eastern Nebraska, and cover an area of about 2500 square miles. These represent only the Upper Carboniferous, and are mainly yellowish micaceous sandstone, drab, greenish, lead-coloured, ash-coloured, and brownish clays, and indurated, hard, greyish and yellowish limestones. No thick beds of coal have yet been discovered. The lower coal horizon is about 800 feet below the surface along the Missouri as far south as Richardson county, where the upper strata indicate a possible lower level geologically than is exposed elsewhere in the State. Thin beds of coal, from 6 to 18 inches thick, are found near the surface in Cass, Otoe, Nemaha, Johnson, Pawnee, and Richardson counties; in the last occurs the best coal yet found in the State. At Aspinwall and on the State boundary it is 24 inches thick in places. In the south-western part of the county a bed occurs from 20 to 28 inches thick, from which at least half a million bushels have been taken within two years to supply local demands. This bed has been traced from east to west about 20 miles, and from north to south 4 miles. The coal is of good quality. On the west side of the Carboniferous formation, and commencing at the mouth of Salt Creek, is a narrow strip of Permian rocks which on the Kansas line is about 15 miles broad. The rocks are mainly variously-coloured magnesian limestone, full of geode cavities, the entire thickness ranging from 20 to 100 feet. The Jura Trias is entirely wanting in eastern Nebraska. Resting conformably on the Permian are the various strata of the basal members of the Cretaceous system. Variegated clays are overlaid by reddish brown conglomerates and sandstones which form the Dakota group, whose thickness ranges from 20 to 300 feet. Above this group occur blackish and ash-coloured shales; then a yellowish limestone; then a layer of whitish limestone full of shells called the *Inoceramus* bed; and then on top towards north-eastern Nebraska a great thickness of impure chalk rock varying in hue from greyish white to a blueish pink and yellow. These beds constitute the Colorado group, or the Fort Benton and Niobrara groups of Meek and Hayden, and vary in thickness from 100 to 500 feet. Next above occur the shales containing selenite that constitute the Fort Pierre Cretaceous, which are only found in Nebraska in Holt county and on the upper Republican river. At the close of the Fort Pierre epoch Nebraska was again a dry land surface, and remained so through the Fox Hills (Upper Cretaceous) epoch. In extreme south-western Nebraska a small area is covered in isolated spots by the shales and sandstones of the Laramie, or transition group between the Cretaceous and Tertiary. No Eocene beds exist in Nebraska. Miocene beds exist in the north-western part of the State, but during this period the remainder of Nebraska continued to be a land surface which supported a gigantic forest vegetation and an abundant mammalian animal life. The deposits in the Miocene section are mainly indurated grits, silicates of lime, sandstones, conglomerates, and tabular limestones. Towards the close of the Miocene a further subsidence of the region of the plains inaugurated the Pliocene epoch. The great lake now extended as far east as Columbus, covering at least three-fifths of the State and an immense tract outside of its present boundaries. The Pliocene beds are made up of sandstones, conglomerates, marls, and variously-coloured clays. Between the Niobrara and the Loup rivers there are in many places immense quantities of loosely compacted sands, which some geologists, from the abundance of the fossils, have called the *Equus* beds. On the Republican river curious beds of flour-like geyserite occur. During Pliocene times this was a great geyser region whose activity commenced in the Cretaceous and continued through the Tertiary into the Quaternary. This flour-like material equals for polishing purposes the best tripoli. The thickness of the Pliocene beds in Nebraska ranges from 10 to 700 feet. There is evidence of increasing cold in the upper deposits of the epoch: warm-temperate were gradually displaced by cold-temperate vegetable forms. The lake itself was drained before the end of the Pliocene.



Geological Map of Nebraska.

The memorials of the Glacial epoch are here undoubted. Along the lower Platte, and on the Missouri wherever hard limestone constitutes the surface rocks, they are worn smooth and crossed by glacial scratches in a direction averaging 17° east of south. On the surface rock occur—(1) blue clay from 1 to 30 feet thick; (2) modified drift, gravel, and clay from 1 to 9 feet thick; (3) gravel and boulders 1 to 6 feet thick; (4) occasionally black soil containing large quantities of silicified wood; (5) gravel, sand, and drift boulders; (6) calcareous sand; (7) loess from 2 to 200 feet thick; (8) black surface soil from 1 to 30 feet thick. On the return of mild conditions at the close of "the Great Ice Age" a freshwater lake covered much of Nebraska and the adjoining region on the east and south-east. The sediments brought down by the Missouri in the course of ages filled it up. Thus originated the loess deposits which are the source of the great agricultural wealth of the State. The rising of the land or the removal of barriers effected the drainage of the loess lake. Through the old lake bed the present rivers commenced to cut channels which at first filled the whole of their present valleys. That the loess was a subaqueous deposit is evident from the vast number of freshwater shells entombed in it. It is composed of 81 per cent. of extremely fine siliceous matter, over 3 per cent. of ferric oxide, 10 per cent. of the carbonates and phosphates of lime, and a small amount of carbonates of magnesia, soda, and potash, clay, and organic matter. It forms one of the best soils in the world, and can never be exhausted until the hills and valleys of which it is composed are worn away. The loess and alluvium of the river valleys have a larger amount of organic matter combined with them, especially at the top, where the black soil is frequently from 5 to 30 feet thick, than is found on the uplands, where it ranges from 2 to 5 feet. The source of this black soil is the swampy condition that prevailed here towards the close of the loess age. The rivers often stood long at the same level before the upward movement was resumed, and thus the many terraces were formed that characterise the valleys.

That, as explained above, the soils of the State are among the best in the world, chemical analysis and experience alike confirm. Experience has not yet settled the question whether the alluvium of the valleys or the loess of the uplands is the more valuable. Grasses and corn (maize) are the principal products. Corn, especially, is a rarely failing crop. The root crops that grow in temperate latitudes thrive amazingly. Eastern Nebraska is eminently adapted to the growth of apples, which here attain a size, colour, and flavour rarely equalled elsewhere. Grapes, plums, and cherries do equally well. Peaches, though not so sure as the former, are successfully grown south of the Platte. The strawberry nowhere reaches a better size or more luscious flavour than here. Other small fruits do almost equally well. The spontaneous growth of nutritious grasses, the ease with which cultivated varieties are grown, and the enormous yield of corn render the State peculiarly adapted for the raising of cattle, horses, sheep, and hogs. The stock industry is growing rapidly, and is at present doing most to enrich the people. No industry promises better results, however, than the planting of new forests, to which many people are devoting themselves with the most gratifying success.

The assessed valuation of the State in 1882 (being only one-third of the real value) was $98,537,475. The cereals produced in 1882 were—wheat, 16,405,500 bushels; maize, 82,995,146; oats, 13,437,950; barley, 1,919,880. The following amount of stock was reported (a few counties not being returned):—cattle, 815,933; sheep, 376,257; hogs, 821,049; horses, 232,942; mules, 31,314. Tree culture is reported thus:—fruit trees, 2,038,111; grape vines, 305,389; forest trees, 40,502,584. Many of the lesser products of the State are not included in this statement.

By the completion of the Union Pacific Railroad in 1869 a highway was made to the Pacific across Nebraska. The Burlington and Missouri River Railroad, begun in the same year, was completed to its junction with the Union Pacific at Kearney in 1872. It extended its main line during 1882 through the Republican valley to Denver, Colorado. In connexion with both these main lines there are important branches; and in 1883 2000 miles of railway had been constructed in the State. Before the Union Pacific was made, freighting across the plains was a large and profitable business. Omaha was conspicuous for its energy in securing this traffic, and grew to be the first city in Nebraska, and has ever since led the State in commerce and in manufacturing enterprises.

A basis for a free school system was laid by Congress in the Act constituting Nebraska a Territory, by which two sections of land (1280 acres) in each township were set aside for this purpose. The State constitution of 1875 provided that all fines, penalties, and licence moneys arising under the general laws of the State should be transferred to the school fund, and that the legislature should provide for the free instruction in the common schools of the State of all persons between the ages of five and twenty-one years. The census of 1880 shows that only 2·5 per cent. of the population of Nebraska over ten years of age are unable to read—a smaller proportion of illiteracy than that of any State in the Union, with one exception (Iowa, 2·4 per cent.).

A State normal school was established at Peru in 1867, and a State school for the deaf and dumb in Omaha in the same year. The State institution for the blind was established in Nebraska City in 1875; a regular course of study, extending from eight to ten years, is provided. A State university and agricultural college was established in 1869 at Lincoln, a building being erected at a cost of $150,000, and opened in September 1871, when the population of the State was only 133,000. It provides classical, scientific, and literary courses of instruction. Provision has just been made to open a medical department with a three years' course in October 1883. The higher State institutions of learning, as well as the common schools, are open to both sexes, and free. The Insane Hospital was opened at Lincoln in December 1870; the present building, exclusive of the wings approaching completion, cost $165,000. The State penitentiary, established at Lincoln in 1870, was erected at a cost of $312,000.

The population of the State in 1880 was 452,402 (249,241 males, 203,161 females). In 1870 it was 122,993; in 1860, 28,846. Of the population in 1880, 95,790 were born in Nebraska, 259,198 in other States of the Union, and 97,414 in other lands—the largest number of immigrants being from Canada, Bohemia, Scandinavia, and Germany. In 1860 the population per square mile was 0·4; in 1870, 1·6; in 1880, 5·9. The population has been increasing so rapidly since 1880 that the lowest estimates do not make it less than 675,000 by the end of 1883.

The following are the chief towns and their populations in 1880:—Omaha, 30,518; Lincoln (the State capital), 13,083; Nebraska City, 4183; Plattsmouth, 4175; Beatrice, 3836; Grand Island, 3550; and Hastings, 2817. All these towns have greatly increased, and some of them, like Hastings, have doubled their populations since 1880.

History.—Nebraska was probably first visited by Europeans in 1541, in July of which year the Spanish general and explorer Coronado penetrated from New Mexico to a country which he called Quivira, and described as lying about the 40th parallel, and abounding in buffalo, which corresponds with the region of the Platte. It was then occupied by powerful Indian tribes, whose chief ruler was Tatarax. It was subsequently revisited by Padilla, a Franciscan friar who had accompanied Coronado, and who here lost his life. No more records of visits to this region are chronicled for two hundred years. About the middle of the 18th century French missionaries from Canada came to the Missouri, and still later a few traders found their way here. It constituted a portion of the Louisiana territory which was purchased by Jefferson from France in 1803. At that time Indian tribes still occupied the whole region. At some earlier period a more civilised race lived here who made pottery and skilful carvings, built houses and fortifications, and reared mounds which often contain the ashes of their dead. When Nebraska came into possession of the United States the Sioux Indians were most numerous. The Pawnees, Otoes, and Omahas were next in numbers and in importance. These powerful tribes have all become reduced in numbers by disease, constant wars, and privations. The Sioux, who early gained the ascendency over the other tribes, resided in north-eastern Nebraska. The eastern part of the South Platte region was occupied by the Otoes, and the western part by the Pawnees, between which tribes there were constant boundary disputes.

The first settlement by whites was made in 1847 at Bellevue on the Missouri, 9 miles south of Omaha. Here a trading post of the American Fur Company was conducted by Colonel Peter A. Sarpy, a Frenchman distinguished by his knowledge of the Indians, his courage, and his enterprise. The Mormon emigration, begun in 1847, traversed several paths, one of which lay through Nebraska, which thus first became generally known throughout the country. During the overland traffic to California that commenced in 1849, depôts of supply were established at Bellevue, Plattsmouth, Nebraska City, and in the interior at Fort Kearney.

The Act constituting Nebraska a distinct Territory, and opening its lands to settlement, was approved May 30, 1854. Its area then embraced 351,558 square miles, extending from the 40th parallel to British America on the north, its eastern line connecting the Missouri river on the south-east with the Red River on the north, and its western line being the summit of the Rocky Mountains. In 1861 Nebraska was shorn of its extended territory by the cutting off of portions of it to form Dakota and Colorado Territories. In 1863 it was still further reduced by the formation of Idaho Territory. These curtailments left Nebraska a purely prairie State. During the first five years after the organization of the Territory the settlements rapidly increased along the Missouri. Great numbers who rushed to Pike's Peak in 1859 when the gold excitement was at its height, on their return, disappointed and disgusted, stopped and opened farms in the State. This had the effect of starting settlements in the interior. The bottom lands of the Missouri and its tributaries had first been occupied, and it was supposed that the uplands were of inferior fertility. Now, however, these so-called "bluff lands," composed of loess materials, began to be cultivated, cautiously at first, until experiment proved them to be of the choicest character. Pioneers then began to push out from the rivers, at first only a few miles, but finally wherever lands could be obtained, without regard to the presence or absence of bottom lands. In 1863 the Union Pacific Railroad and in 1864 the Burlington and Missouri River Railroad began to sell portions of their lands in Nebraska, received from the general Government; and this became a most potent factor in turning a tide of emigration into the State.

At the breaking out of the civil war in 1861 the population of the Territory comprised less than 30,000. Yet Nebraska furnished to the Union army during the war 3307 officers and men, including two companies of scouts, partly composed of Indians.

In 1866 the legislature prepared a constitution for a State government, which a vote of the people confirmed by a small majority, though the opponents of the measure claimed that it was obtained by fraud. The first legislature under the State constitution met July 4th, 1866. The bill to admit Nebraska as a State was passed over the president's veto, and proclaimed on March 1st, 1867.

The first capital of Nebraska was at Bellevue. It was removed to Omaha in 1855, where it remained until Nebraska became a State, when it was taken to Lancaster, a town of half a dozen houses, whose name was then changed to Lincoln,—now (1883) grown to be a city of 16,000 inhabitants. The present State constitution was framed in 1875, and was ratified in the same year by the people. The first legislature under the new constitution met in January 1877. The house of representatives consists of eighty-four, and the senate of thirty members; and the legislature meets biennially. (S. A.)

NEBUCHADNEZZAR is the familiar form, transcribed from the Hebrew נְבוּכַדְנֶאצַּר, of the name of the great Babylonian king who carried the Jews captive, and whose reign marks the highest point of the Chaldæan empire. Another Biblical form of the word is Nebuchadrezzar (Jer. xlix. 28), and similarly Greek authors write Ναβουκοδρόσορος. These forms are nearer to the original name as it is found on the cuneiform monuments, viz., Nabu-kudurri-uṣur, "Nebo, defend the crown." To what has been said of Nebuchadnezzar in the article Babylonia (vol. iii. p. 188; comp. Daniel and Israel) it may be added that a fragment of a cylinder with an inscription relating to a war with Egypt in the thirty-seventh year of his reign has been published by Schrader (*Aegypt. Ztschr.*, 1879; *K.A.T.*, 2d ed., p. 363 *sq.*), that an inscription of Nebuchadnezzar has been observed by Sayce on the north bank of Nahr al-Kalb near Beyrût (*Proc. Soc. Bib. Arch.*, 1881), and that two large inscriptions have also been found by Pognon in Wádi Brissa, near Hermel, in the Lebanon (see Cl. Ganneau in *The Times*, December 29, 1883).

NEBULA. See Astronomy, vol. ii. p. 820.

NEBULAR THEORY. The nebular theory is a famous hypothesis which has been advanced with the view of accounting for the origin of the solar system. It is emphatically a speculation; it cannot be demonstrated by observation or established by mathematical calculation. Yet the boldness and the splendour of the nebular theory have always given it a dignity not usually attached to a doctrine which has so little direct evidence in its favour. It will also be admitted that from the very nature of the case a theory of the origin of the solar system must be devoid of direct testimony. All we could expect to find would be features in that system whose existence the theory would account for; or possibly by looking at other systems we might observe them in phases suggesting the early phases of our own system. It is hard to see what other kind of evidence would be attainable. Now as a matter of fact our system does present many most striking features which could be accounted for by the nebular theory, and the theory also derives as much corroboration from the study of other systems as we could reasonably expect. Hence, as all attainable evidence is on the whole in favour of the nebular theory (though here and there there are exceptional phenomena), astronomers have generally regarded this theory with considerable approval.

There are very remarkable features in the solar system which point unmistakably to some common origin of many of the different bodies which it contains. We must at once put the comets out of view. It does not appear that they bear any testimony on either side of the question. We do not know whether the comets are really indigenous to the solar system or whether they may not be merely imported into the system from the depths of space. Even if the comets be indigenous to the system, they may, as many suppose, be merely ejections from the sun, or in any case their orbits are exposed to such tremendous perturbations from the planets that it is quite unsafe from the present orbit of a comet to attempt any estimate of what that orbit may have been countless ages ago. On all these grounds we must put the comets on one side for the present, and discuss the nebular theory without any reference thereto. But even with this omission we still muster in the solar system from two to three hundred bodies, almost every one of which pronounces distinctly, though with varying emphasis, in favour of the nebular theory. The first great fact to which we refer is the common direction in which the planets revolve around the sun. This is true not only of the great planets Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune; it is also true of the host of more than two hundred small planets. All these bodies perform their revolution in the same direction. It is also extremely remarkable that all the great planets and many of the small ones have their orbits very nearly in the same plane, and nearly circular in form. Viewed as a question in probabilities, we may ask what the chance is that out of two hundred and fifty bodies revolving around the sun all shall be moving in one direction. If the direction of movement were merely decided by chance, the probability against such an arrangement is of stupendous magnitude. It is represented by the ratio of unity to a number containing about sixty figures, and so we are at once forced to the conclusion that this remarkable feature of the planetary motions must have some physical explanation. In a minor degree this conclusion is strengthened by observing the satellites. Discarding those of Uranus, in which the orbits of the satellites are highly inclined to the ecliptic, and in which manifestly some exceptional though unknown influences have been at work, we may say that the satellites revolve around the primaries also in the same direction; while, to make the picture complete, we find that the planets, so far as they can be observed, rotate on their axes in the same manner.

The nebular theory here steps in and offers an explanation of this most remarkable uniformity. Laplace supposed that our sun had once a stupendous nebulous atmosphere which extended so far out as to fill all the space at present occupied by the planets. This gigantic nebulous mass, of which the sun was only the central and somewhat more condensed portion, is supposed to have a movement of rotation on its axis. There is no difficulty in conceiving how a nebula, quite independently of any internal motion of its parts, shall also have had as a whole a movement of rotation. In fact a little consideration will show from the law of probabilities that it is infinitely probable that such an object should really have *some* movement of rotation, no matter by what causes the nebula may have originated. As this vast mass cooled it must by the laws of heat have contracted towards the centre, and as it contracted it must, according to a well-known law of dynamics, rotate more rapidly. The time would then come when the centrifugal force on the outer parts of the mass would more than counterbalance the attraction of the centre, and thus we would have the outer parts left as a ring. The inner portion will still continue to contract, the same process will be repeated, and thus a second ring will be formed. We have thus grounds for believing that the original nebula will separate into a series of rings all revolving in the same direction with a central nebulous mass in the interior. The materials of each ring would continue to cool and to contract until they passed from the gaseous to the liquid condition. If the consolidation took place with comparative uniformity we might then anticipate the formation of a vast multitude of small planets such as those we actually do find in the region between the orbit of Mars and that of Jupiter. More usually, however, the ring might be expected not to be uniform, and therefore to condense in some parts more rapidly than in others. The effect of such contraction would be to draw into a single mass the materials of the ring, and thus we would have a planet formed, while the satellites of that planet would be developed from the still nascent planet in the same way as the planet itself originated from the sun. In this way we account most simply for the uniformity in the direction in which the planets revolve, and for the mutual proximity of the planes in which their orbits are contained. The rotation of the planets on their axes is also explained, for at the time of the first formation of the planet it must have participated in the rotation of the whole nebula, and by the subsequent contraction of the planet the speed with which the rotation was performed must have been accelerated.

There is quite a different method of approaching the subject, which leads in a very striking manner to conclusions practically identical with those we have just sketched. We may commence by dealing with the sun as we find it at the present moment, and then reasoning back to what must have been the case in the earlier epochs of the history of our system. The stupendous daily outpour of heat from the sun at the present time is really, when properly studied, a profound argument in support of the nebular theory. The amount of the sun's heat has been estimated. We receive on the earth less than one two-thousand-millionth part of the whole radiation. It would seem that the greater part of the rest of that torrent flows away to be be lost in space. Now what supplies this heat? We might at first suppose that the sun was really a mightily heated body radiating out its heat as white hot iron does, but this explanation cannot be admitted in face of the notorious fact that there is no historical evidence that the sun is growing colder. We have not the slightest reason to think that the radiation from the sun is measurably weaker now than it was a couple of thousand years ago, yet it can be shown that, if the sun were merely radiating heat as simply a hot body, then it would cool some degrees every year, and must have cooled many thousands of degrees within the time covered by historical records. We therefore conclude that the sun has some other source of heat than that due simply to incandescence. We can also conceive that the heat of the sun might be supplied by something analogous to combustion. It would take 20 tons of coal a day burned on each square foot of the sun's surface to supply the daily radiation. Even if the sun were made of one mass of fuel as efficient as coal, that mass must be entirely expended in a few thousand years. We cannot therefore admit that the source of the heat in the sun is to be found in any chemical combination taking place in its mass. Where then can we find an adequate supply of heat? Only one external source can be named: the falling of meteors into the sun must yield some heat just as the flash of a shooting star yields some heat to our atmosphere, but the question is whether the quantity of heat obtainable from the shooting stars is at all adequate for the purpose. It can be shown that unless a quantity of meteors in collective mass equal to our moon were to plunge into the sun every year the supply of heat could not be sustained from this source. Now there is no reason to believe that meteors in anything like this quantity can be supplied to the sun, and therefore we must reject this source as also inadequate.

The truth about the sun's heat appears to be that the sun is really an incandescent body losing heat, but that the operation of cooling is immensely retarded owing to a curious circumstance due jointly to the stupendous mass of the sun and to a remarkable law of heat. It is of course well known that if energy disappears in one form it reappears in another, and this principle applied to the sun will explain the famous difficulty.

As the sun loses heat it contracts, and every pair of particles in the sun are nearer to each other after the contraction than they were before. The energy due to their separation is thus less in the contracted state than in the original state, and as that energy cannot be lost it must reappear in heat. The sun is thus slowly contracting; but as it contracts it gains heat by the operation of the law just referred to, and thus the further cooling and further contraction of the sun is protracted until the additional heat obtained is radiated away. In this way we can reconcile the fact that the sun is certainly losing heat with the fact that the change in temperature has not been large enough to be perceived within historic times.

It can be shown that the sun is at present contracting, so that its diameter diminishes four miles every century. This is of course an inappreciable distance when compared with the diameter of the sun, which is nearly a million of miles, but the significance for our present purpose depends upon the fact that this contraction is always taking place. A thousand years ago the sun must have had a diameter 40 miles greater than at present, ten thousand years ago that diameter must have been 400 miles more than it is now, and so on. We cannot perhaps assert that the same rate is to be continued for very many centuries, but it is plain that the further we look back into past time the greater must the sun have been.

Dealing then simply with the laws of nature as we know them, we can see no boundary to the growth of the sun as we look back. We must conceive a time when the sun was swollen to such an extent that it filled up the entire space girdled by the orbit of Mercury. Earlier still the sun must have reached to the Earth. Earlier still the sun must have reached to where Neptune now revolves on the confines of our system, but the mass of the sun could not undergo an expansion so prodigious without being made vastly more rarefied than at present, and hence we are led by this mode of reasoning to the conception of the primæval nebula from which our system has originated.

Considering that our sun is but a star, or but one of the millions of stars, it becomes a question of great interest to see whether any other systems present indication of a nebulous origin analogous to that which Laplace proposed for the solar system. In one of his most memorable papers, Sir W. Herschel marshals the evidence which can be collected on this point. He arranges in this paper a selection from his observations on the nebulæ in such a way as to give great plausibility to his view of the gradual transmutation of nebulæ into stars. Herschel begins by showing us that there are regions in the heavens where a faint diffused nebulosity is all that can be detected by the telescope. There are other nebulæ in which a nucleus can be just discerned, others again in which the nucleus is easily seen, and still others where the nucleus is a brilliant star-like point. The transition from an object of this kind to a nebulous star is very natural, while the nebulous stars pass into the ordinary stars by a few graduated stages. It is thus possible to enumerate a series of objects beginning at one end with the most diffused nebulosity and ending at the other with an ordinary fixed star or group of stars. Each object in the series differs but slightly from the object just before it and the object just after it. It seemed to Herschel that he was thus able to view the actual changes by which masses of phosphorescent or glowing vapour became actually condensed down into stars. The condensation of a nebula could be followed in the same manner as we can study the growth of the trees in the forest, by comparing the trees of various ages which the forest contains at the same time. In attempting to pronounce on the evidence with regard to Herschel's theory, we must at once admit that the transmutation of a nebula into a star has never been seen. It is indeed very doubtful whether any changes of a nebula have ever been seen which are of the same character as the changes Herschel's theory would require. It seems, however, most likely that the periods of time required for such changes are so stupendous that the changes accomplished in a century or two are absolutely inappreciable.

The nebular theory is a noble speculation supported by plausible argument, and the verdict of science on the whole subject cannot be better expressed than in the words of Newcomb:—"At the present time we can only say that the nebular hypothesis is indicated by the general tendencies of the laws of nature, that it has not been proved to be inconsistent with any fact, that it is almost a necessary consequence of the only theory by which we can account for the origin and conservation of the sun's heat, but that it rests on the assumption that this conservation is to be explained by the laws of nature as we now see them in operation. Should any one be sceptical as to the sufficiency of these laws to account for the present state of things, science can furnish no evidence strong enough to overthrow his doubts until the sun shall be found growing smaller by actual measurement, or the nebulæ be actually seen to condense into stars and systems." (R. S. B.)

NECHO, the Biblical form (2 Kings xxiii. 29; Jerem. xlvi. 2) of the name Neku; see EGYPT, vol. vii. p. 743, and ISRAEL, vol. xiii. p. 416.

NECKER, JACQUES (1732–1804), finance minister of Louis XVI., and convener of the states-general of 1789, was born at Geneva in 1732. His father was a native of Cüstrin in Pomerania, and had, after the publication of some works on international law, been elected professor of public law at Geneva. Jacques Necker had been sent to Paris in 1747 to become a clerk in the bank of a friend of his father, M. Vernet. He soon afterwards established, with another Genevese, the famous bank of Thelusson & Necker. Thelusson superintended the bank in London (his grandson was made a peer as Lord Rendlesham), while Necker was managing partner in Paris. Between them the bank prospered, and both partners became very rich. He chiefly occupied himself in his bank, but in 1763 fell in love with Madame de Verméneux, the widow of a French officer. She could not make up her mind to marry any one who was not noble, and, while considering his offer, she went on a visit to Geneva, where she met Suzanne Curchod, the daughter of a pastor near Lausanne, to whom Gibbon had been engaged, and took such a fancy to her that she brought her back as her companion to Paris in 1764. There Necker, transferring his love from the widow to the poor Swiss girl, married Suzanne before the end of the year. She was extremely ambitious, and encouraged her husband to try and make himself a public position. He accordingly became a syndic or director of the French East India Company, and, after showing his financial ability in its management, defended it in an able memoir against the attacks of Morellet in 1769. He had also made interest with the French Government by lending it money, and was appointed resident at Paris by the republic of Geneva. Madame Necker assisted his ambitious views by entertaining largely the chief leaders of the political, financial, and literary worlds of Paris, and her Fridays became as greatly frequented as the Mondays of Madame Geoffrin, or the Tuesdays of Madame Helvetius. In 1773 Necker won the prize of the Académie Francaise for an *éloge* on Colbert, and in 1775 published his *Essai sur la législation et le commerce des grains*, in which he attacked the free-trade policy of Turgot. His wife now believed he could get into office as a great financier, and made him give up his share in the bank, which he transferred to his brother Louis. She was right, and in October 1776 Necker was made finance minister of France, though with the title only of director of the treasury, which, however, he changed in 1777 for that of director-general of the finances. He did great good in regulating the finances by attempting to divide the taille or poll tax more equally, by abolishing the "vingtième d'industrie," and establishing "monts du piété." But his greatest financial measures were his attempt to fund the French debt and his establishment of annuities under the guarantee of the state. The operation of funding was too difficult in regard to the complicated French debt to be suddenly accomplished, and Necker rather pointed out the right line to be followed than completed the operation. In all this he treated French finance rather as a banker than as a profound political economist, and thus fell far short of Turgot, who was the very greatest economist of his day. Politically he did not do much to stave off the coming Revolution, and his establishment of provincial assemblies in the "pays d'élection" only tended to keep France disunited. In 1781 he published his famous *Compte Rendu*, in which he drew the balance sheet of France, and was dismissed from his office. Yet his dismissal was not really due to his book, but to the influence of Marie Antoinette, whose schemes for benefiting the Duc de Guines he had thwarted. In retirement he occupied himself with literature, and with his daughter, Mdlle Necker, who was his only child, and would be a wealthy heiress. He first attempted to procure the young English statesman Mr Pitt for her husband, but eventually chose the Swedish Baron Erik Magnus von Staël-Holstein, on condition that his master made him Swedish ambassador at Paris. Gustavus III. was quite willing, and in 1786 Mdlle Necker became Madame de Staël. But neither M. nor Madame Necker cared to remain out of office, and in 1787 Necker was banished by "lettre de cachet" 40 leagues from Paris for attacking Calonne. In 1788 the country, which had at the bidding of the literary guests of Madame Necker come to believe that Necker was the only minister who could "stop the deficit," as they said, demanded Necker's recall, and in September 1788 he became once more director-general of the finances. He entered office at a critical moment: Dauphiné was in actual rebellion, and France was crying out for the summons of the states-general. Necker put a stop to the rebellion in Dauphiné by legalizing its assembly, and then set to work to arrange for the summons of the states-general. Throughout the early months of 1789 Necker was regarded as the saviour of France, but his conduct at the meeting of the states-general sufficiently proved that he was not a great statesman, and showed that he regarded the states-general merely as an assembly which should grant money, not organize reforms. The same want of statesmanship appeared in his vacillating conduct with regard to the reunion of the three orders, when he allowed the king to be forced by the assembly instead of taking the lead in ordering the reunion. He was nevertheless regarded as the cause of the Revolution by the court, and on July 11, while at dinner, received the abrupt order to leave France at once. But Necker's dismissal brought about the taking of the Bastille, which induced the king to recall his old minister. His return was an absolute ovation, and he was received with joy in every city he traversed. But at Paris he again proved to be no statesman. In his conceit he believed he could save France alone, and refused to act with Mirabeau or La Fayette. He caused the king's acceptance of the suspensive veto, by which he sacrificed his chief prerogative in September, and destroyed all chance of a strong executive by contriving the decree of November 7, by which the ministry might not be chosen from the assembly. Financially he proved equally incapable for a time of crisis, and could not understand the need of such extreme measures as the establishment of assignats in order to keep the country quiet. His popularity vanished when his only idea was to ask the assembly for new loans, and in September 1790 he resigned his office, unregretted by a single Frenchman. Not without difficulty he reached Coppet, near Geneva, an estate he had bought in 1784. Here he occupied himself with literature, but Madame Necker pined for her Paris salon, and died in 1794. He continued to live on at Coppet, under the care of his daughter, Madame de Staël, and his niece, Madame Necker de Saussure, but his time was past, and his books had no political influence. A momentary excitement was caused by the advance of the French armies in 1798, when he burnt most of his political papers. He died at Coppet in April 1804.

The chief authorities for Necker's life are *La Vie privée de M. Necker*, by Madame de Staël-Holstein, and the *Notice sur la vie de M. Necker*, by Auguste de Staël-Holstein, his grandson, published in the collection of his works edited by the latter in 1833. The bibliography of his works is as follows:—*Réponse au Mémoire de M. l'Abbé Morellet*, 1769; *Éloge de J. B. Colbert*, 1773; *Essai sur la législation et le commerce des grains*, 1775; *Compte rendu au Roi*, 1781; *De l'administration des finances de la France*, 3 vols., 1784; *Mémoire en réponse au discours prononcé par M. de Calonne*, 1787; *De l'importance des opinions religieuses*, 1788; *Sur l'administration de M. Necker, par lui-même*, 1791; *Du pouvoir exécutif dans les grands états*, 2 vols., 1792; *Réflexions sur le procès de Louis XVI.*, 1792; *De la Révolution Française*, several editions, the last in 4 vols., 1797; *Cours de la morale religieuse*, 1800; *Dernières vues de politique et de finance*, 1802; *Manuscrits de M. Necker*, published by his daughter, 1804; *Suites funestes d'une seule faute*, published after his death. *Le Salon de Madame Necker*, by the Vicomte d'Haussonville, 2 vols., 1882, compiled from the papers at Coppet, should also be consulted (H. M. S.)

NECROSIS. This word, which has the same meaning as mortification, is now restricted in surgical works to death of bone. It is sometimes used to signify the part which dies; it may, however, with more propriety signify the process, ending in the death of the bone. A severe inflammation, caused by a severe blow, by cold, or by the absorption of various poisons, as mercury and phosphorus, is the general precursor of necrosis. The dead part, analogous to the slough in the soft tissues, is called a sequestrum or exfoliation. At first it is firmly attached to the living bone around; gradually, however, the dead portion is separated from the living tissue. The process of separation is a slow one. New bone is formed around the sequestrum, which often renders its removal difficult. As a rule the surgeon waits until the dead part is loose, and then cuts down through the new case and removes the sequestrum. The cavity in which it lay gradually closes, and a useful limb is the result.

NECTAR AND AMBROSIA are the nourishment of the gods in Homer and in Greek literature generally. The gods resemble men in all respects except that they have different food and drink. Usage varies much as to the exact meaning of the two terms. Probably they were not originally distinguished; but usually both in Homer and in later writers nectar is the drink and ambrosia the food. On the other hand in Alcman nectar is the food, and in Sappho and Anaxandrides ambrosia the drink. Each is used in Homer as an unguent (nectar, *Il.* xix. 30; ambrosia, *Il.* xiv. 170). Both are fragrant, and may be used as perfume. The derivation of the word *nectar* is uncertain; probably νηγάτεος is a kindred word. *Ambrosia* is derived from ἄμβροτος, immortal.

NECTARINE, a fruit differing from the peach in having a smooth or glabrous skin instead of a downy one. The varieties of nectarine, too, have often a distinct flavour from that of the peaches. The common origin of the peach and nectarine is shown, however, by the facts that seeds of the one will often reproduce the other, and that fruits of both kinds have not unfrequently been met with on the same branch. For cultivation see HORTICULTURE vol. xii. p. 272.

NEEDLE. The sewing needle is an implement which has been in use from prehistoric times in all places where mankind used the skins of animals or woven fabrics for clothing. Originally the needle was made of fish-bone, bone, or ivory, and its first form was probably a rude eyeless bodkin. Needles of bone continue to this day to be used by uncivilized tribes; but since the time of the discovery of bronze metal needles have been in use in civilized communities. It is on record that needles of steel were made at Nuremberg towards the end of the 14th century, and at a later period Spanish needles acquired wide celebrity. For upwards of two centuries the manufacture has been established in England,—Redditch in Worcestershire, with several other small towns in Warwickshire, being the centre of the industry, first planted there by Germans. Originally the trade was domestic in its character, but now it is carried on in large manufactories where mechanical appliances have to a certain extent supplanted handiwork, with much advantage to the health and the wellbeing of the operatives.

The raw material of the manufacture consists of steel wire of fine quality and suitable gauge. The wire is supplied in coils of definite weight and diameter, and the first operation consists in cutting the coil with powerful shears. With the aid of a gauge the coil is cut with precision into lengths, each sufficient for two needles. These lengths, having the curvature of the coil and other inequalities, are next straightened. For this purpose a bundle containing several thousand lengths is packed within two strong iron rings; the bundle is heated to red heat, and then pressed on an iron plate having two parallel grooves in which the iron rings run. Over this plate the bundle is worked backward and forward by the pressure of an oblong slightly curved iron tool having two longitudinal slits through which the edges of the rings project. Thus by combined pressure and rolling the whole of the lengths quickly become perfectly straight and even. The next operation consists in pointing both ends of the wires, which, being done on a dry grindstone revolving at high speed, is, from the sparks and dust created, very injurious to the operatives. A grinder, holding at one time several dozen wires against the stone with his left hand, and revolving them slightly with his right, will point about 100,000 needles in a day. He is but imperfectly protected against the deadly dust he produces by a cowl which, partly covering the grindstone, is connected with a pipe through which a strong current of air is drawn, sucking away a large proportion of the dust. For the operation of pointing various machines have been devised and have come into extensive use, especially in Germany. In general principle these machines consist of a wheel, to the periphery of which the wires to be pointed are held by an india-rubber band. It revolves at right angles to the revolving hollow grindstone, and, bringing each wire in rapid succession at the proper angle for grinding against the stone, it points three times as many as a skilful grinder. The succeeding series of operations have for their object the eyeing of the needles. As a preliminary to this the oxidized scale at the centre of the wire is ground off, and on the surface so prepared each wire is separately stamped, by means of dies, with the grooved and rounded impression of two needle heads set end to end. Through these stamped heads the eye-holes are next perforated by means of a screw-press working a pair of fine steel punches or prongs. Each wire now forms two needles attached head to head by a broad thin scarf of steel at the point of junction where the metal has been stamped for the head. These double needles, taken to the number of about one hundred, are threaded together with a fine wire passed through the eyes, giving the whole the appearance of a fine close-set comb. Each side is clamped up tightly, and the expansion of the scarf in the centre is removed by a file. The spitted row is now ready to break over into separate needles, and as the point of junction of the two sets of heads is weakened by the stamping process, the rows readily break at that point by bending. These heads are then smoothed and rounded with the file before the clamp is removed, the wire withdrawn, and the separate needles set free. At this stage the needles are hardened and tempered in the usual manner; that is, they are placed in an iron tray, heated to redness in a muffle furnace, plunged into an oil bath, then re-heated in the muffle till they assume a straw colour, and gradually cooled. Following the tempering comes the process of scouring and fining or polishing, for which purpose the needles are put up in bundles of several thousands mixed with soft soap, oil, and emery powder, and tied tightly round with a canvas cover. A number of such bundles are laid in the bed of a machine in which by rollers or other devices they are kept rolling backward and forward, so that each individual needle rubs against its neighbours. After sufficient time the bundles are withdrawn, the needles cleaned by washing, dried, and again bundled up as before, but with a mixture containing putty powder in place of emery. The rolling process is continued till the needles acquire a sufficiently polished surface. The needles are now unpacked, washed in an alkaline solution, and dried in sawdust. From that they are conveyed to trays, where they are brought parallel to each other by a sharp jerking motion. It is next necessary to bring all the heads in one direction, which is dexterously done by a "header," who with a cloth finger-stool on the fourth finger presses a lot of needles against that cloth. Points presented adhere, and thus at each operation a number of needles remain sticking in the finger-stool. While this arrangement is going on, faulty and imperfect needles are picked out. The heads being all now laid in one direction, attention is given to the smoothing and rounding of the eye-holes, a work essential for the prevention of the fraying and breaking of the thread in sewing. The heads are blued by heating, an operation most neatly and perfectly performed by bringing each head in succession in contact with a gas flame by means of a revolving wheel, against the periphery of which the needles are retained by an elastic band. The needles so blued are strung on a roughened steel wire, over which is spread a fine paste of oil and emery. These wires are suspended between uprights on a frame platform, to which a jerking motion is communicated; thereby an oscillating motion is communicated to the suspended needles, and the gentle friction thus set up between the needle eye and the roughened wire and emery slowly but effectually secures the desired effect. Now it only remains to free the head from the blue colour on a small grindstone, and give a final polish to the needle on a rapidly revolving buff wheel aided by putty powder. It has of late become a common practice to gild the heads of needles. The variety of needles manufactured for sewing by hand and machine, for packing, for upholstery and leather work, as well as for surgical purposes, is very great, and demands many modifications of processes and appliances. (J. PA.)

NEER, VAN DER. Aernout and Eglon van der Neer, father and son, were painters whose lives almost filled the whole of the 17th century.

I. **AERNOUT VAN DER NEER**, commonly called Aart or Artus, was the contemporary of Albert Cuyp and Hobbema, and so far like the latter that he lived and died in comparative obscurity. Houbraken, who knew something of Eglon, was without information as regards his father. He merely noted that Aernout had been steward to a Dutch nobleman, and an amateur painter, before he settled at Amsterdam and acquired skill with his brush. According to common chronology Aernout was born in 1619 and died in 1691; but neither of these statements is supported by any proofs. The earliest pictures in which Aernout coupled his monogram of A. V. and D. N. interlaced with a date are a winter landscape in the collection of Lord Overstone and a sunset in the museum of Gotha. Both pieces were finished, if we grant the genuineness of the inscriptions, in 1643, the year of Eglon's birth at Amsterdam. In 1652 Aernout, still faithful to his old haunts, witnessed the fire which consumed the old town-hall of Amsterdam. He made this accident a subject for two or three pictures in the galleries of Berlin and Copenhagen, probably on commission from merchants of the city of his choice. But, though Amsterdam appears to have been constantly Van der Neer's domicile, he was not so sedentary in his habits as to neglect the rest of Holland. His pictures tell that he was well acquainted with the canals and woods about Haarlem and Leyden, and proofs are at hand to show that he was familiar with the reaches of the Maes and Rhine. Dort, the home of Albert Cuyp, is sometimes found in his pictures, and substantial evidence exists that there were relations of friendship and neighbourhood between the two men. At some period of their lives they laid their hands to the same canvases, on each of which they left their joint mark. On some it was the signature of the name, on others the more indelible signature of style. The partnership may not have been of long duration. It was unequal, and illustrated in a few landscapes only, but these, as well as contemporary works of Cuyp alone, reflect sufficient light on Van der Neer's career. There are landscapes in the collections of the dukes of Bedford and Westminster, as well as in that of Colonel Neeld, in which Cuyp has represented either the frozen Maes with fishermen packing herrings, or the moon reflecting its light on the river's placid waters. These are models after which Van der Neer appears to have worked. His specialties were moonlights and sunsets on canals and estuaries, or winter landscapes with skaters and ball players. The same feeling and similar subjects are found in Cuyp and Van der Neer, before and after their partnership. But Cuyp was the leading genius. Van der Neer got assistance from him; Cuyp expected none from Van der Neer. He carefully enlivened his friend's pictures, when asked to do so, with figures and cattle. It is in pictures jointly produced by both that we discover Van der Neer's presence at Dort. We are near Dort in that landscape sunset of the Louvre, in which Cuyp evidently painted the foreground and cows. In the National Gallery Cuyp signs his name on the pail of a milkmaid, whose figure and red skirt he has painted with light effectiveness near the edge of Van der Neer's landscape. We recognize the partners in a sunset which was exhibited at Manchester when owned by Mr Francis Edwards. Again, a couple of fishermen with a dog, and a sportsman creeping up to surprise some ducks, are Cuyp's in a capital Van der Neer at the Staedel in Frankfort.

Van der Neer has been known to paint a smithy, with figures alternately lighted by the sun and the blacksmith's fire (Oppenheim collection at Cologne), but habitually his subjects were the rivers and water-courses of his native country either at sunset or after dark. Sometimes the moon sheds its light on tall trees and gables and windmills. His peculiar skill is shown in realizing transparence which allows objects—even distant—to appear in the darkness with varieties of warm brown and steel greys. He cleverly manages reflexions in water, and balances the light on one side of a canal with dark masses of shadow on the other. His greatest subtlety is displayed in combining the lurid glare of fires with the cooler serenity of moonlight. Bürger says he inspired Van der Poel with such a love of midnight-fires that this unfortunate artist was induced to burn incalculable numbers of cities and hamlets. Another of his fancies is to paint frozen water, and his daylight icescapes with golfers, sleighers, and fishermen are as numerous as his moonlights. But he always avoids the impression of frostiness, which is one of his great gifts. His pictures are not scarce. They are less valuable in the market than those of Cuyp or Hobbema; but, possessing a charm peculiarly their own, they are much sought after by collectors. According to the latest documentary evidence discovered in Holland, Aernout van der Neer was living at Amsterdam when he purchased the freedom of the city of Gouda in 1685. He is said to have resided at Rotterdam in 1691. But in 1692 he married a second wife at Gouda; and so the date usually assigned to his death receives correction. Out of about one hundred and fifty pictures accessible to the public, the choicest selection is in the Hermitage at St Petersburg. In England the largest collector is Sir Richard Wallace. But there are good specimens in numerous English galleries besides.

II. **Eglon van der Neer**, born at Amsterdam in 1643, died at Düsseldorf on the 3d of May 1703. He was first taught by his father, and then took lessons from Jacob Vanloo, whose chief business then consisted in painting figures in the landscapes of Wynants and Hobbema. When Vanloo went to Paris in 1663 to join the school from which Boucher afterwards came, he was accompanied or followed by Eglon. But, leaving the French capital about 1666, he settled at Rotterdam, where he dwelt for many years. Later on he took up his residence at Brussels, and finally came to Düsseldorf, where he entered the service of the elector-palatine Johann Wilhelm von der Pfalz. In each of the places where he stopped Eglon married, and having had three wives became the father of twenty-five children. A modern French critic has observed that the burden of so large a family was as nothing to Eglon's misfortune in having taught the arts to Van der Werff.

Eglon van der Neer has painted landscapes imitating those of his father, of Berchem and Adam Elsheimer. He frequently put the figures into the town views of Jan van der Heyden in competition with Berchem and Adrian van de Velde. His best works are portraits, in which he occasionally came near Terburg or Metsu in delicacy of touch, De Hooch in effectiveness of lighting, or Mieris in polish of surface. One of his earliest pieces in which the influence of Terburg is apparent is the Lady with the Book, of 1665, which was sold with the Bredel collection in 1875. A young woman in white and red satin at Rotterdam, of 1669, recalls Mieris, whose style also reappears in Eglon's Cleopatra at Buckingham Palace. Two landscapes with Tobit and the Angel, dated 1685 and 1694, in the museums of Berlin and Amsterdam, illustrate his fashion of setting Scripture scenes in Dutch backgrounds. The most important of his sacred compositions is the Esther and Ahasuerus, of 1696, in the Uffizi at Florence. But he varied his practice also with arrangements of hunting and hawking parties, pastures and fords, and cavalry skirmishes. The latest of his panels is a mountain landscape of 1702 in the gallery of Augsburg. (J. A. C.)

NEES VON ESENBECK, Christian Gottfried (1776–1858), botanist and entomologist, was born at Erbach on February 14, 1776, and was educated at Darmstadt and at Jena, where he took the degree of M.D. He spent some time in medical practice in Frankfort-on-the-Main, but in 1818 was appointed professor of botany in Erlangen. Next year he became professor of natural history in Bonn, and in 1831 he was appointed to the chair of botany in the university of Breslau. He enjoyed a high reputation as a lecturer, but had a strong leaning to the transcendental philosophy of nature so much in vogue in Germany in the earlier part of this century. In 1848 he was elected a member of the German parliament, and became a leader of the party opposed to the Government, to which he made himself so obnoxious that in 1851 he was deprived of his professorship, and in consequence the latter years of his life were spent in great poverty. He died in 1858.

For about forty years he edited the *Nova Acta* of the "Acad. Leopold.-Carolina," and in this important series of scientific memoirs several of his own papers were published. His earliest memoirs deal with the ichneumons, and for some years he continued to write on these insects. He published a *Monographia der Ichneumons* in 2 vols., in 1828; and *Hymenopterorum Ichneumonibus affinium Monographia*, in 2 vols., in 1834. Nees von Esenbeck was a prolific writer in various departments of botany, and published the following separate works:—*Die Algen des süssen Wassers nach ihren Entwickelungsstufen dargestellt*, 1814; *Das System der Pilze und Schwämme*, 1816; *Naturgeschichte der europäischen Lebermoose*, in 4 vols., 1833–38; "Agrostologia Brasiliensis," in the *Flora Brasiliensis*; and a *Systema Laurinearum*, 1836. Besides these he wrote numerous monographs in the series above mentioned, also in *Flora*, in *Linnæa*, and in other scientific German magazines, either alone or along with other well-known botanists. His best known works are those that deal with the *Fungi*, the *Hepaticæ*, and the *Glumiferæ*, in all which groups he made valuable additions to knowledge, which have exerted much influence on later investigations.

His brother Theodore (1787–1837), inspector of the botanic gardens at Leyden, and afterwards professor of pharmacy at Bonn, also wrote numerous papers on botanical subjects, dealing more particularly with medicinal plants and their products.

NEGAPATAM, a town and the chief port of Tanjore district, Madras, India, situated in 10° 45′ 37″ N. lat. and 79° 53′ 28″ E. long. It forms a single municipality with the adjoining town of Nagúr, the joint population in 1881 being 53,855. The port carries on an active trade with Ceylon, Burmah, and the Straits, the imports consisting chiefly of cotton goods and betel-nuts, and the exports of rice and paddy. Negapatam was one of the earliest settlements of the Portuguese on the Coromandel coast. It was taken by the Dutch in 1660, and by the English in 1781.

NEGLIGENCE is in one aspect the correlative of diligence (see Diligence), in another of intention. It is the absence of diligence or the absence of intention. All definitions imply this. Negligence is a term difficult to define for more than one reason. It is used not only to denote a mental state, but the consequences resulting from a mental state. Again, the term bears a somewhat different meaning as applied to civil or criminal liability. "The meaning of negligence, in the common use of language," says Mr Justice Stephen (*History of the Criminal Law*, vol. ii. p. 123), "is very general and indefinite. It is practically synonymous with heedlessness or carelessness, not taking notice of matters relevant to the business in hand, of which notice might and ought to have been taken. This meaning is no doubt included in the legal sense of the word, but in reference to criminal law the word has also the wider meaning of omitting, for whatever reason, to discharge a legal duty, *e.g.*, the omission by a medical man to exercise that skill which it is his duty to exercise." The vagueness of the standard by which negligence is tested is another and more serious practical difficulty. The standard is the average prudent action of the average citizen, and the defendant fails to reach this standard at his peril. This is the standard implied by such definitions as that of the New York Penal Code, "the terms 'neglect,' 'negligence,' 'negligent,' and 'negligently' . . . . import a want of such attention to the nature or probable consequences of the act or omission as a prudent man ordinarily bestows in acting in his own concerns," and that of Sirey (*Code Pénal*, § 319), "the omission or forgetfulness of a precaution dictated by prudence." The connexion between negligence and intention is illustrated by a passage in the judgment of Baron Alderson in Blyth *v.* The Birmingham Water Works Company (1856). "The definition of negligence," says that learned judge, "is the omitting to do something that a reasonable man would do, or the doing something that a reasonable man would not do; and an action may be brought if thereby mischief is caused to a third party not intentionally." The intention is of great importance in criminal law. Thus as a general rule it may be said that what is manslaughter where there is negligence becomes murder where there is intention. But the negligence may in some cases be of such a nature as to lead to the presumption of legal malice. In the same way in cases where the liability is civil it is important to notice that the phenomena of negligence often accord closely with those of intention. Thus in one case Lord Justice James speaks of "wilful negligence which leads the court to conclude that the person is an accomplice in the fraud." The phenomena of negligence and of dishonest intention may be similar to such an extent that the court may regard them as the same, since the legal consequences resulting from them are the same.

It is the general view that there are three degrees of negligence, corresponding to three degrees of diligence. This is illustrated by the case of bailment. Where the bailment is for the benefit of the bailor, the bailee is bound to use only slight diligence, and is liable only for gross negligence; where the bailment is for the benefit of bailor and bailee alike, each is bound to use ordinary diligence, and is liable for ordinary negligence; where the bailment is for the benefit of the bailee, he is bound to use great diligence, and is liable for slight negligence. The soundness of this position, alleged to be founded on the Roman law, is open to question. Roman law probably only recognized two degrees of *culpa*, the term which most nearly approaches negligence. And the term "gross negligence" has been objected to as misleading (see DILIGENCE). The truth is that it is impossible to make any useful legal distinction of degrees of negligence, when the question of negligence is mainly a question of fact. In English law it is for the jury to say, subject to certain rules of evidence, whether a particular defendant has in a particular case fallen below the standard of the average citizen. Each case must depend to a large extent upon its own merits, aided by the consideration of a series of previous cases in which certain facts have been held by the court to be or not to be *prima facie* evidence of negligence to go to the jury.

Contributory Negligence.—As a general rule it is a defence to an action that the injury was caused by conduct of the injured person, without which the injury would not have happened. But, though a plaintiff may have been guilty of negligence which may have actually contributed to the injury, yet if the defendant could by the exercise of ordinary care and diligence have avoided the mischief the plaintiff's negligence will not excuse him. Contributory negligence of a person other than the plaintiff is no excuse for the negligence of the defendant except in the case of the legal identification of the plaintiff with the negligent third party; *e.g.*, a passenger in a train of A company is so far identified by the law with his driver that he cannot recover against B company for an injury caused by an accident to which the negligence of A company's driver contributed. So a child cannot recover for an injury to which the negligence of the adult in charge of the child contributed.

Nature of the Remedy.—The person injured may have either a civil or a criminal remedy, or both. In most cases where the act of negligence is criminally punishable, the plaintiff may recover damages in addition. The question as to what amount or kind of negligence will bring a person within the criminal law is one by no means easy to answer. In certain cases criminal proceedings are authorized by statute, *e.g.*, against parish authorities for refusing to call vestries (1 & 2 Will. IV. c. 60), and against persons neglecting to transmit election writs (53 Geo. III. c. 89). The question of criminal negligence arises most commonly in cases of homicide. The rule as to the functions of the jury cannot be better put than in the words of Mr Justice Stephen, *ubi supra*:—"in order that negligence may be culpable, it must be of such a nature that the jury think that a person who caused death by it ought to be punished." The same high authority proceeds to point out that cases of manslaughter by negligence may be imagined in which there is no carelessness. In one matter the prisoner or defendant in criminal proceedings is under a disadvantage as compared with the defendant in an action. He cannot, as the latter can, set up contributory negligence as a defence. To this extent only is the criminal remedy wider than the civil. Where the question of contributory negligence does not arise, it may generally be said that, if an indictment will lie for negligence, *a fortiori* an action will lie upon the same facts. (J. W.†)

NEGRO (Spanish and Italian *Negro*, from Latin *Niger*, black) in anthropology designates the distinctly dark as opposed to the fair, yellow, and brown varieties of mankind. In this its widest sense it embraces all the dark races, whose original home are the inter-tropical and subtropical regions of the eastern hemisphere, stretching roughly from Senegambia, West Africa, to the Fiji Archipelago, Pacific Ocean, west and east, and lying north and south between the extreme parallels of the Philippines and Tasmania. The Negro domain thus originally comprised all Africa south of the Sahara, India south of the Indo-Gangetic plains, Malaysia, and the greater part of Australasia. But this domain has since prehistoric times been intruded upon in the east mainly by peoples of the yellow Mongoloid, in the west mainly by peoples of the fair Caucasic stock. During the early and middle Tertiary epochs it appears also to have been gradually broken into two great divisions—by the subsidence of lands, some suppose, which are now flooded by the waters of the Indian Ocean, and to which Sclater has given the name of Lemuria. To these two great eastern and western geographical divisions now correspond the two great ethnical divisions of the Negro stock—the Papuan or Melanesian of Malaysia and Australasia, and the Negro proper of the African mainland. During the long ages that have elapsed since this separation, the two branches, if originally one, have had time under diverse outward conditions to become differentiated into two sufficiently marked physical types, so that on strictly anthropological as well as geographical grounds it becomes convenient to deal separately with the Papuan and African divisions of the Negro family. The present article is confined to the latter. For the Papuans see NEW GUINEA.

Soudan (Sûdán), the fertile zone stretching from the Sahara towards the equator nearly across the continent, is usually regarded as the true home of the African Negro. But, according to the views recently advanced by Lepsius, Soudan is rather an intermediate or mixed domain lying between the two Hamitic and Negro ethnical groups, which have respectively occupied northern and southern Africa from the remotest times. Certainly none of the chief native races in Soudan—Mandingo, Joloff, Toucouleur in the west; Kanembu, Haussa, Kanuri in the centre; Maba in Wadai, Nuba in the Nile valley, least of all the Fulahs of the Chad and Niger basins—can be considered as of pure Negro descent. But the same phenomenon of intermixture is presented in the strictly equatorial and south equatorial regions, where the Fans of the Ogoway basin, the Zandey (Niam-Niam), Bongo, Bari, and other Upper-Nilotic tribes, the Waganda of the Victoria Nyanza of the extreme east, the Zulu-Kaffres of the extreme south, are all of Negroid and even sub-Negroid rather than of strictly Negro lineage. Hence the same argument that would exclude Soudan would also exclude the greater part of southern Africa, and we should have to look to the hypothetical Lemuria or other now submerged lands for the cradle of the Negro stock. Practically, however, the whole of Africa south of the Sahara must be taken as the original habitat of the race, which is there almost everywhere still found in compact masses, although rarely perhaps absolutely free from foreign intermixture.

But wherever found in a comparatively pure state, as on the coast of Guinea,[1] in the Gaboon, along the lower Zambesi, and in the Benua and Shari basins, the African aborigines present almost a greater uniformity of physical and moral type than any of the other great divisions of mankind. By the nearly unanimous consent of anthropologists this type occupies at the same time the lowest position in the evolutionary scale, thus affording the best material for the comparative study of the highest anthropoids and the human species. The chief points in which the Negro either approaches the *Quadrumana* or differs most from his own congeners are:—(1) the abnormal length of the arm, which in the erect position sometimes reaches the knee-pan, and which on an average exceeds that of the

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[1] Here apparently is to be met the most pronounced Negro type proper yet discovered. See the missionary Wilson's *Ethnographic View of Western Africa*, New York, 1856, published anonymously.

Caucasian by about 2 inches; (2) prognathism, or projection of the jaws (index number of facial angle about 70, as compared with the Caucasian 82); (3) weight of brain, as indicating cranial capacity, 35 ounces (highest gorilla 20, average European 45); (4) full black eye, with black iris and yellowish sclerotic coat, a very marked feature; (5) short flat snub nose, deeply depressed at the base or frontal suture, broad at extremity, with dilated nostrils and concave ridge; (6) thick protruding lips, plainly showing the inner red surface; (7) very large zygomatic arches—high and prominent cheek bones; (8) exceedingly thick cranium, enabling the Negro to butt with the head and resist blows which would inevitably break any ordinary European's skull; (9) correspondingly weak lower limbs, terminating in a broad flat foot with low instep, divergent and somewhat prehensile great toe, and heel projecting backwards ("lark heel"); (10) complexion deep brown or blackish, and in some cases even distinctly black, due not to any special pigment, as is often supposed, but merely to the greater abundance of the colouring matter in the Malpighian mucous membrane between the inner or true skin and the epidermis or scarf skin;[1] (11) short, black hair, eccentrically elliptical or almost flat in section, and distinctly woolly, not merely frizzly, as Prichard supposed on insufficient evidence;[2] (12) thick epidermis, cool, soft, and velvety to the touch, mostly hairless, and emitting a peculiar rancid odour, compared by Pruner Bey to that of the buck goat; (13) frame of medium height, thrown somewhat out of the perpendicular by the shape of the pelvis, the spine, the backward projection of the head, and the whole anatomical structure; (14) the cranial sutures, which close much earlier in the Negro than in other races. To this premature ossification of the skull, preventing all further development of the brain, many pathologists have attributed the inherent mental inferiority of the blacks, an inferiority which is even more marked than their physical differences. Nearly all observers admit that the Negro child is on the whole quite as intelligent as those of other human varieties, but that on arriving at puberty all further progress seems to be arrested. No one has more carefully studied this point than Filippo Manetta, who during a long residence on the plantations of the Southern States of America noted that "the Negro children were sharp, intelligent, and full of vivacity, but on approaching the adult period a gradual change set in. The intellect seemed to become clouded, animation giving place to a sort of lethargy, briskness yielding to indolence. We must necessarily suppose that the development of the Negro and White proceeds on different lines. While with the latter the volume of the brain grows with the expansion of the brainpan, in the former the growth of the brain is on the contrary arrested by the premature closing of the cranial sutures and lateral pressure of the frontal bone."[3]

It must at the same time be confessed that the question of the mental temperament of the Negro has been greatly complicated by the partisanship of interested advocates on either side. But for this disturbing element it would perhaps be readily admitted that the mental are at least as marked as the physical differences between the dark and other races. And as both are the gradual outcome of external conditions, fixed by heredity, it follows that the attempt to suddenly transform the Negro mind by foreign culture must be, as it has proved to be, as futile as the attempt would be to suddenly transform his physical type. On his moral status, even when removed from the old associations and brought directly under more favourable influences, a lurid light is cast by the report of the Rev. Dr Tucker at the American Church Congress for 1883 on the present condition of the black communities in the Southern States.[4]

It is more correct to say of the Negro that he is nonmoral than immoral. All the social institutions are at the same low level, and throughout the historic period seem to have made no perceptible advance except under the stimulus of foreign (in recent time notably of Mohammedan) influences. Religion is a system of pure fetichism and worship of ancestry associated with such sanguinary rites as the "customs" of Dahomey and Ashantee, and a universal belief in sorcery. Slavery continues everywhere to prevail, both as a local institution and a branch of the export trade, where not checked by European Governments. Much of the surplus population not thus carried off probably finds its way to the shambles of the native states in the middle Congo basin and other parts where cannibalism is practised, and where human flesh appears to be sold in the open market-place. During its voyage down the Congo the Stanley expedition was attacked at many points for the avowed purpose of procuring a fresh supply of human food, and from other incidents of modern exploration cannibalism would seem to prevail very generally in the little known equatorial regions of the interior.[1] Political institutions are in a rudimentary state, and where a higher system has been imposed or adopted from the whites, as in Liberia, it does not appear to have materially contributed to the improvement of the race. The great bulk of the natives are still in the tribal condition, while in the kingdoms that have been founded in Guinea and elsewhere the authority of the sovereign is everywhere absolute, and its exercise often marked by the most wanton and atrocious cruelty. The largest and most powerful native state is that of Ulunda, whose present "muata yanvo," or ruler, is the fourteenth in descent from the founder of the dynasty. When visited in 1879 by Dr Buchner, this potentate, to impress his guest with his power, caused one of his subjects to assume the part of a chief just arrived from a remote province of the empire. The sham cortége of soldiers and women advanced to the throne all thickly plastered with mud from head to foot, and the "chief" approaching on all fours deliberately rolled himself in the sand at his majesty's feet. The administration of justice is regulated, not by any sense of right or wrong, but by the caprice of the king, who is himself often in the power of the navumbula, or witch-detector. Beyond what has been acquired from without, of letters there is absolutely no knowledge, unless an exception be made in favour of the invention or adaptation of a rude syllabic system some years ago by a native of the Vei tribe. Hence literature is purely oral, and limited to a few tribal legends, some folklore, proverbs, and songs of the simplest kind. The arts also are exclusively of an industrial character, and restricted mainly to coarse weaving, pottery, the smelting and working of metals (chiefly copper and iron), agriculture, and grazing. Architecture has no existence, nor are there any monumental ruins or stone structures of any sort in the whole of Negroland except those erected in Soudan under Hamitic and Semitic influences. No full-blood Negro has ever been distinguished as a man of science, a poet, or an artist, and the fundamental equality claimed for him by ignorant philanthropists is belied by the whole history of the race throughout the historic period.

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[1] It is also noteworthy that the dark colour seems to depend neither on geographical position, the isothermals of greatest heat, nor even altogether on racial purity. The extremes of the chromatic scale are found in juxtaposition throughout the whole Negro domain, in Senegambia, the Gaboon, upper Nile basin, lower Congo, Shari valley, Mozambique. In the last region Froberville determined the presence of thirty-one different shades from dusky or yellow-brown to sooty black. Some of the sub-Negroid and mixed races, such as many Abyssinians, Gallas, Joloffs, and Mandingoes, are quite as black as the darkest full-blood Negro. A general similarity in the outward conditions of soil, atmosphere, climate, food charged with an excess of carbon, such as the fruit of the butter-tree, and other undetermined causes have tended to develop a tendency towards dark shades everywhere in the Negro domain apart from the bias mainly due to an original strain of black blood. Even the African Arabs are described by Burckhardt, De Pagès, and other observers as often decidedly black. Waddington mentions more particularly the Shegya Arabs south of Dongola on the White Nile as distinguished by their "clear, glossy, jet black" (p. 149). The same expression "jet black" is applied by Schweinfurth to the Upper-Nilotic Shilluks, Nuers, and Dinkas, while the neighbouring Bongos and Mittus are described as of a "red-brown" colour "like the soil upon which they reside" (*Heart of Africa*, i. p. 261).

[2] This point has been fully determined by P. A. Brown (*Classification of Mankind by the Hair*, &c.), who shows conclusively that, unlike true hair and like true wool, the Negro hair is flat, issues from the epidermis at a right angle, is spirally twisted or crisped, has no central duct, the colouring matter being disseminated through the cortex and intermediate fibres, while the cortex itself is covered with numerous rough, pointed filaments adhering loosely to the shaft; lastly, the Negro pile will felt, like wool, whereas true hair cannot be felted. Observing that the Negro domain is also the habitat of the most anthropoid apes—gorilla and chimpanzee,—and that these bimanous and quadrumanous species are both of a pronounced dolichocephalic type (index nos. 72–75), some anthropologists have suggested the direct descent of the former from the latter. But against this view may be urged the different texture of the pile, which, although black in both, is woolly in the Negro but true hair in the ape. It may further be noted that in the eastern section of the dark domain, while the Papuan is still black and dolichocephalic, often excessively so, his presumed progenitor the orang-outang is, on the contrary, brachycephalic, with decidedly red hair. Dr Bernard Davis also recognizes brachycephaly in equatorial Africa itself, four out of the eighteen skulls from this region in his collection being distinctly of the round-headed type, and Schweinfurth describes the Bongos as "hardly removed from the lowest grade of brachycephaly" (i. 268).

[3] *La Razza Negra nel suo stato selvaggio*, &c., Turin, 1864, p. 20.

[4] "I know of whole neighbourhoods," he tells us, "where there is not one single Negro couple, whether legally married or not, who are faithful to each other beyond a few weeks. In the midst of a prayer-meeting I have known Negroes steal from each other, and on the way home they will rob any hen-roost that lies conveniently at hand. The most pious Negro that I know is confined in a penitentiary for an atrocious murder, and he persists in saying he can see no offence against God in his crime, though he acknowledges an offence against man." Mention is further made of Negro missionaries guilty of the grossest immorality, living in open concubinage, addicted to thieving, lying, and every imaginary crime, yet all "earnest and successful preachers, and wholly unconscious of hypocrisy. Their sins, universally known, did not diminish their influence with their race. It was impossible to doubt their absolute sincerity." A much darker picture is presented by the independent Negro commonwealths of Hayti, for eighty years the scene of almost uninterrupted fratricidal strife.

On the other hand the native languages, all of which belong to the agglutinating order, are often very highly developed, and the Bantu group especially is characterized by an intricacy of structure and an alliterative phonetic system of an exceedingly delicate type.[2] From the wide range of this Bantu speech, which occupies all the southern half of the continent except the Hottentot and Bushman territory in the extreme south-west, Lepsius concludes that it is the original language of the Negro race, and that the numerous linguistic groups of Soudan are merely scattered fragments of that speech or of the Hamitic intruding from the north. Thus has been developed his theory of the two ethnical and linguistic stocks originally in exclusive possession of North and South Africa, and gradually amalgamating in the now diversified intermediate zone of Soudan. But this theory cannot be accepted as at all adequate to explain the present conditions in those regions. It is not by any means certain that the Bantu itself was originally a Negro language at all. There seems, moreover, to be good reason for believing that its present diffusion over South Africa dates from comparatively recent times, and that it is due to the intrusion of foreign conquerors penetrating from the north-east up the Nile valley and through the region of the great lakes into the Congo and Zambesi basins. Nor is it possible to regard the Mandingo, Vei, Haussa, Fulah, and many other Soudanese tongues as fragments or offshoots of Bantu, from which they differ as fundamentally as they do from each other.

To Dr Gustav Nachtigal[3] is due the recent discovery or determination of another independent and widespread linguistic family, which had its original home amongst the Hamitic Teda or northern Tubus of the eastern Sahara, and which, gradually spreading southwards, has been imposed through the Dasa or southern Tubus on the Kanembu and Kanuri of Lake Chad, the Baele of Wanyanga, the Zoghawa of Dar-Fur, and other Negro or Negroid peoples of central and eastern Soudan. The whole of Soudan, or, more correctly, the whole of Central Africa between the equator and the Sahara, is in fact a region of linguistic confusion, such as is elsewhere found only in Caucasia, Melanesia, the Anamese highlands, and some parts of America. Several radically distinct stock languages have already been determined, especially in Guinea, Senegambia, and the Chad basin. But many more are known to be current in Adamawa, Bornu, Baghirmi, Wadai, Dar-Fur, the White Nile Valley, while others will doubtless be revealed by the future exploration of the lands watered by the Welle, Aruwimi, Mangala, and other streams flowing either to the Nile, the Congo, or the Shari. Most of them may be properly designated as strictly Negro tongues. But in the north, that is, along the skirt of the Sahara, and in the east, that is in the Blue Nile and Atbara basins, in Kaffa, Galla, and Somaliland, the current speech is mainly Caucasic, and here also the populations are mainly Negroid and sub-Negroid rather than of pure Negro descent. The Caucasic speech again is represented by Hamitic, Tubu, and Semitic groups, all intruders in this Negro domain from prehistoric times except the Semitic Arabic, which dates only from the introduction of Islam. In attempting a complete, however brief, survey of this vast ethnical and linguistic area, account must also be taken of other disturbing elements within the area itself, which are of unknown origin, and whose actual relations to the surrounding Negro masses are still involved in much obscurity. Conspicuous amongst them are the Nubas of the Middle Nile, apparently intermediate between the true Negro and the Egyptian Hamite; the Fulahs of central and west Soudan, who, although now much mixed, seem to have been originally distinct both from the Negro and the Hamite; the Fans, who have in recent times reached the west coast just above the equator, and who are also a clearly non-Negro race; lastly, the dwarfish Akkas, Obongos, and others, who appear to be scattered over the whole of the continent south of 10° N. lat. Many, perhaps the majority, of the Bantu-speaking southern races—Waswahili of the Zanzibar coast, Waganda and others of the great lacustrine region, Zulu-Kaffres of the south-east, Marutse of the Zambesi, Ovambos of the south-west coast—are also variously affected by foreign elements, some no doubt either Arab or Hamitic Galla penetrating from the north-east, but others drawn from now long-forgotten sources. Thus the popular idea that Negroland presents a homogeneous ethnical field must be dismissed as absolutely erroneous. It will be safer to say that, while the Negro strain is here everywhere conspicuously present, it has been repeatedly crossed and re-crossed by diverse interminglings, which began with the first appearance of the Hamite on African soil, and which have been continued from that vastly remote epoch down to the present time.[4]

From the subjoined rough scheme of classification of the chief Negro and Negroid races and languages are excluded the above-mentioned Caucasic-speaking Hamites and Semites, who hem in the Negro zone proper by a mighty ethnical barrier stretching almost continuously from the Senegal river through the Sahara, Abyssinia, and Gallaland to the east coast at the equator. From it are also omitted the Hovas, Sakalavas, Betsimisarakas, and other peoples of Madagascar, all of Malagasy (Malayo-Polynesian) speech, as well as the Bosjesman and Hottentot groups of the extreme south-west, as lying beyond the scope of the present survey.

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[1] Amongst the Niam-Niam "human fat is universally sold," while "the Fan barter their dead among themselves," and even disinter them to be devoured (*Heart of Africa*, ii. pp. 18, 19). Still more pronounced is the cannibalism of the Monbuttu, who dry the bodies of the slain in battle for future consumption, and "drive their prisoners before them, as butchers drive sheep to the shambles, and these are only reserved to fall victims on a later day to their horrible and sickly greediness" (*Ib.*, ii. p. 93).

[2] For this remarkable linguistic phenomenon see vol. xiii. p. 820.

[3] *Sahara und Sudan*, Berlin, 1881, vol. ii. p. 283 *sq.* See also "North African Ethnology," by A. H. Keane, in *Nature* for March 1, 1883.

[4] In support of this conclusion, which to some may seem overdrawn, appeal might be made to the language of many modern African explorers, one of the most careful of whom thus expresses himself:—"If we could at once grasp and set before our minds facts that are known (whether as regards language, race, culture, history, or development) of that vast region comprehended in the name of Africa, we should have before us the witness of an intermingling of races which is beyond all precedent. And yet, bewildering as the prospect would appear, it remains a fact not to be gainsaid, that it is impossible for any one to survey the country as a whole without perceiving that high above the multitude of individual differences there is throned a principle of unity, which embraces well nigh all the population" (Schweinfurth, *op. cit.*, i. p. 313). The principle of unity here spoken of is the autochthonous black element, mostly predominant, and everywhere forming the substratum, nearly as far north as the tropic of Cancer.

West Soudan and Guinea.

Mandingan Group: Manda, Kabunga, Landoro, Tene, Gbandi, Susu, Mano, Toma, Gbese, Vei (?). Mainly in South Senegambia and Upper Guinea.

Wolof Group: Joloff, Kayor, Dakar, Baol, Sine, Walo, Bambara (?). Mainly between the Senegal and Gambia rivers.

Felup Group: Felup, Bola, Serere, Filham, Pepel, Diola, Kallum, Biafada, Pajade, Temné, Kissi, Sherbro. Between the Gambia and Sierra Leone.

Liberian Group: Deh, Queah, Gurrah, Kru, Kondo, Pessa, Golla, Bassa, Kabo, Yedabo, Grebo, Babo, Webo, Tebo, Nyambo. Grain and Ivory coasts.

Ewe Group: Acra (Ga), Fantee, Ashantee, Ffon, Mina, Jeji, Dahoman, Nago, Otyi, Yoruba. Gold and Slave coasts.

Ibo Group: Ibo, Nupe, Michi, Oru, Wari, Igara, Juku, Kororofa, Ado, Akoto. Binue and lower Niger.

Sonhray: Large, historical nation. Middle Niger, from Timbuktu to Gando. Distinct speech.

Fulah: Futa-Jallo, Futa-Toro, Jel, Baa, So, Mabube, Laube, Beri. Senegambia and in scattered groups eastwards to Baghirmi. Distinct speech.

Central Soudan and Chad Basin.

Adamawa Group: Batta, Dama, Fala, Buma, Marga, Holma, Ba, Bula, Kilba, Bura, Mbafu, Kotafa, Woka, Fani, Doga, Longoda. Upper Binue; thence east to Logon.

Tubu Group: Teda, Dasa, Kanembu, Dalatoa, Kanuri, Danawa, Haussa (?), Baele, Bodela, Bulala (?), Kuka (?), Zoghawa. Tibesti, Kanem, Bornu, Borku, and north Dar-Fur.

Logon Group: Logon, Mandara, Margi, Makari, Mosgu, Gamergu, So (extinct), Keribina, Yedina (Buduma), Kuri (Kalea), Bede, Ngisem, Kerrikerri, Babir, Fika. Bornu, lower Shari (between Adamawa and Baghirmi), Chad archipelagoes.

Baghirmi Group: Baghirmi, Somrai, Tummok, Kuang, Busso, Gaberi, Nyillem, Ndamm, Sâra, Dekakire, Sokoro, Bua Kullanga, Bua Kuli, Yussiye, Sarûa. Lower and middle Shari, east to Runga and Dar-Banda.

Wadai Group: Maba (Kelingen, Kajanga, Malanga, Kuno, Bili, and many other subdivisions), Masalit, Mimi, Marfa, Korunga, Moëwo, Abyi, Kondongo, Kabbaga, Mubi, Marta, Bakka, Birkit, Tala. Wadai and east Dar-Fur.

East Soudan and Upper Nile.

Dar-Banda Group: Runga, Kredy, Ago, Silla, Bandala, Daggel, Gulla, Fana, Birrimbirri, Seli, Kutingara. Upper Shari, east to Dar-Fertit.

Fur Group: Fur (Forang-bele), Dudunga, Kunjara, Kera, Massabât, Tunjur, Dajo, Berti, Bego, Birguid, Berdûna, Jellaba, Sungor, Mararit, Jebal, Guimir, Kabga. Dar-Fur and Kordofan, between Wadai and White Nile.

Nilotic Group: Shilluk, Nuer, Dinka, Bongo, Jur, Bari, Mittu, Rôl, Millow, Agar, Sofi, Lehssi, Ayell, Ayarr, Monbuttu, Janghey, Fallaugh, Miauk, Bonjak, Jibbe, Kunkung, Nikuar, Madi, Loboré, Shuli, Berta, Amam. White Nile and its tributaries, east to Kaffa and Gallaland, south to Uganda.

Zandey (Niam-Niam): Large, compact nation, about the Welle, and reaching southwards probably to the Lualaba.

South Africa—Bantu Family.

Zulu-Kaffre Group: Ama-Zulu, Ama-Khosa, Ama-Fingu, Ma-Tonga, Ama-Zuazi, Ba-Tembu, Matebele, Mazitu, Masai (?). Zululand, Natal, Kaffraria, and in scattered fragments from the Limpopo north to the great lakes.

Central Group: Be-Chuana, Ba-Suto, Ba-Rolong, Ma-Kololo, Ma-Rotse, Ma-Kalaka (Ma-Nansa), Ma-Laya, Ma-Totola, Ma-Shukulombwe, Ma-Shubia, Ma-Nchoia, Ma-Mbunda, Ba-Libale, Ma-Pingula, Ma-Hes, Ba-Yeiye. Upper Orange river, Transvaal, Lake Ngami, upper and middle Zambesi, and Chobe river.[1]

Eastern Group: Wa-Swahili, Wa-Pokomo, Wa-Nika, Wa-Kamba, Wa-Sambara, Wa-Zaramo, Achikunda, Ma-Gololo, A-Nyasa, Wa-Yao, Ma-Chinga, A-Ngulu (Walolo), Ma-Kua, Ma-Tumboka, Wa-Jagga, Wa-Segua. East coast from the equator south to Delagoa Bay, and inland to Lake Nyassa.

Equatorial Group: Wa-Ganda, Wa-Nyoro, Wa-Nyamwesi, Wa-Sukuma, Wa-Legga, Wa-Rundi, Wa-Lha, Wa-Fipa, Wa-Bemba, Wa-Bisa, Wa-Rua, Wa-Lunda, Kioko, Wa-Shinsh, Tu-Shinsh, Tu-Shilange, Tu-Ruba, Tu-Kette, Ba-Songe (Ba-Luba), A-Kawanda (Ma-Wanda), Ba-Tetela, Ba-Kuba, Lovalé, Wa-Mangala, Ibonga, Ba-Rumbe, Ba-Bwende. Region of the great lakes, upper and middle Lualaba, south to the Lokinga (Mushinga) range.

Western Group: Ova-Herero, Ova-Mbo, Ova-Quanyama, Kibokwe, Bailunda, Kibanda, Kisanji, Nano, Sindonga, Ba-Songo, Ma-Tamba, Ma-Yakka, Ba-Kongo, Kimbunda, Ma-Hungo, Shissilongi, Ma-Yombe, Ba-Teke, Obamba, Odumbo, Aduma, Bakota, Mbamba, Ashongo, Apinji, Okanda, Bangwé, Mpongwé, Ba-Kalai, Isubu, Bimbia, Ba-Kwilleh, Dualla, Abo, Wuri, Qua Qua (Ba-Koko), Lungasi, Edea, Bubi (Fernandian). West coast from Damaraland north to Cameroon mountains; inland to about 20° E. long.[2]

The total population is vaguely estimated at 130,000,000, to which must be added probably about 20,000,000 full-blood and half-caste Negroes settled either as slaves or the descendants of slaves in various parts of the world, but chiefly in tropical and sub-tropical America. Owing to their peculiar qualities, great muscular development, and power of endurance in hot and moist lands, combined with a remarkable absence of personal self-respect, the African populations have from the remotest times supplied a chief material to the slave markets of the Old and the New World. For thousands of years an incessant stream of black blood has been directed from the interior to the east coast and thence to Madagascar, Arabia, Persia, and even India, or down the Nile to Egypt and Asia Minor, or across the Sahara to the Barbary States. Since the discovery of America hundreds of thousands have in the same way been shipped from the west coast for the West Indies, New Spain, the British and French plantations, and Brazil. Speaking generally, this black element has not amalgamated with the populations of the eastern hemisphere, and has consequently left few traces of its presence anywhere except in Madagascar, where there may possibly have been an indigenous Negro people before the arrival of the intruding Hovas and other Malay tribes. Nevertheless a strain of Negro blood is apparent, not only amongst the Tuaregs and especially the Tibus of the Sahara, but also in Morocco, South Algeria, Egypt, the low-lying Tehama of the West Arabian seaboard, Makran, and even here and there along the coast of Malabar and Ceylon. But no statistics are anywhere here available which might throw some light on the proportion of blacks to the surrounding populations. We read that there may be as many as 100,000 in Morocco, a large number amongst the Berbers of Wargla (South Algeria) and Tripoli, and so on. It is also evident that a decided majority of the inhabitants of Madagascar must be regarded as of Negroid stock, although no Negro language has held its ground either there or anywhere beyond the Negro domain proper.

This is the more surprising that in some parts of America, notably the West Indian islands, the coloured has actually replaced the indigenous and largely absorbed the white element. Here we are altogether on firmer ground, and fairly accurate returns enable us to form an approximate estimate of the proportion of full-blood and half-caste Negroes in almost every part of the New World. On the other hand, the nomenclature of these mongrels has become so perplexing, and is often applied so irregularly, that it has led to many misconceptions on this point. Thus the term "Creole," applicable in Mexico only to persons of pure Spanish descent, denotes in Brazil, Peru, and elsewhere the presence of black blood in varying proportions. Of this bewildering nomenclature the chief terms are as under:—

Negro, African, Black: Full-blood Negro, whether born in Africa or of African descent.

Mulatto: Issue of black and white parents either way—a constant term in America.

Mestizo: Any half-breed, whether of white and Negro parents, or (more commonly in Spanish America) of white and Indian parents.

Creole: Mostly white of pure descent, but also blacks of pure descent (Brazil), the issue of whites and Mestizoes (Peru), and Mestizoes generally (Alaska).

Zambo: Any half-breed, but mostly the issue of Negro and Indian parents; in the United States, Peru, and West Indies of Negro and Mulatto; in St Vincent the half-caste Caribs.

Zambo Preto: Issue of Negro father and Zamba mother (Mexico and elsewhere).

Cholo: Issue of Zamboes (South America).

Pardo: Synonymous with Mulatto (Brazil); any Mestizo (Argentine States).

Mamaluco: Any Mestizo, but especially the issue of whites and Indians (Brazil).

Chino: Negro and Indian half-caste (Mexico, and generally in Spanish America).

Casco: Direct issue of Mulattoes on both sides (South America).

Tente en el Ayre: Mongrels in whom the white element predominates (South America).

Cafuso: Issue of Negro and Indian, dark shade and woolly hair predominating (Brazil).

Caburet: Issue of Negress and Indian (Brazil).

Cariboco, Tapanhuna, Xibaro: Local Brazilian terms of Tupi origin applied to various crosses between the Negroes and Indians

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[1] The Ma-Kololo, as a distinct people, have been destroyed by the Ma-Rotse; but their language (a mixed Se-Chuana and Se-Suto dialect) survives as the *lingua franca* in the Ba-Rotse state, and generally between the Limpopo and Zambesi (Dr Holub and Père Depelchin).

[2] Intruders in the northern section of this group are the non-Negro Fans, the Oshyeba of the other natives. There are two main divisions,—Maké-Fan on the left, Mbelé-Fan on the right bank of the Ogoway.

Quarteroon, Quinteroon, Octoroon: Negro and white half-breeds, with fresh infusion of white blood each successive generation. Thus: Quarteroon has one-fourth, Quinteroon one-eighth, Octoroon one-sixteenth black blood only, the last being scarcely distinguishable from a white.

Before the suppression of the slave trade, during the first half of the present century, from 60,000 to 70,000 Negroes were annually shipped to America, where their descendants of all shades now number altogether upwards of twelve millions as under:—

	Coloured Element.	Proportion to the Whole Population.
United States	6,580,000	13 per cent.
Mexico	60,000	½ „
Central America	50,000	1 „
West Indies	3,700,000	83 „
Brazil	2,000,000	20 „

In Hayti the Africans have established their political autonomy, here forming two independent states, with total population 820,000. Elsewhere slavery has been everywhere abolished, except in Brazil, where it is rapidly becoming extinct. Hence the whole of the coloured population now practically constitutes a class of freedmen, in some places apparently dying out (Central America, Argentine States), in some remaining stationary (Mexico, Peru), but in others increasing rapidly. This is especially the case in the United States, as shown by the subjoined returns for the whole of the present century:—

	Coloured Element.	Proportion to the Whole Population.
1800	1,002,000	19 per cent.
1820	1,772,000	19 „
1840	2,874,000	17 „
1860	4,442,000	14 „
1870	4,880,000	13 „
1880	6,581,000	13 „

It is obvious from this table that the Negroes, without any further importations from Africa, are increasing far more rapidly than the native whites, and that they would ultimately become the predominant element in the Southern States but for the constant stream of migration flowing from Europe to North America. Owing to this migration they decreased relatively to the rest of the population from 1820 to 1860. But since then they have maintained their relative proportion in spite of this migration. Recently they have themselves begun to move westwards at the rate of about 50,000 annually. Should the movement continue, an equilibrium may be established, because the rate of mortality gains on the birth-rate according as they move farther from the hot Southern States, where alone the race can expect to establish itself in the republic.

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NEGROPONT. See EUBŒA.

NEHEMIAH (נְחֶמְיָה), governor of Judæa under Artaxerxes Longimanus; see ISRAEL, vol. xiii. p. 418. The book of Nehemiah is really part of the same work with the book of EZRA (*q.v.*), though it embodies certain memoirs of Nehemiah in which he writes in the first person. Apart from what is related in this book, we possess no trustworthy information about Nehemiah. Even the legend in 2 Mac. ii. 13 that he founded a library containing ancient documents, which is often taken as authentic and as marking an important step in the history of the Old Testament canon (see vol. v. p. 2), is discredited by standing in an epistle of which the manifest aim was to give currency to certain spurious books.

NEISSE, a well-built town and fortress of the first rank in the district of Oppeln, Prussian Silesia, lies at the junction of the Neisse and the Biela, and consists of the town proper on the right bank of the former river and the Friedrichstadt on the left. Of its nine churches the most interesting is the parish church of St James (Jakobikirche), dating mainly from the 12th century, but finished in 1430. The chief secular buildings are the old episcopal residence, the new town-house, the old rathsthurm, 205 feet in height (1499), and the theatre. There are also several schools, convents, and hospitals. The manufactures are unimportant, but a considerable trade is carried on in agricultural products. In 1880 the town contained 20,507 inhabitants, of whom 15,825 were Roman Catholics. The garrison forms about a fourth of the population.

Neisse, one of the oldest towns in Silesia, is said to have been founded in the 10th century, and afterwards became the capital of a principality of its own name, which was incorporated with the bishopric of Breslau about the year 1200. Its first walls were erected in 1350, and enabled it to repel an attack of the Hussites in 1428. It was thrice besieged during the Thirty Years' War. The end of the first Silesian war left Neisse in the hands of Frederick the Great, who laid the foundations of its modern fortifications. The town was taken by the French in 1807. In addition to its forts, ramparts, and bastions, Neisse can, at the will of the garrison, be protected by a system of inundation.

NELEUS, a hero of Greek mythology, was son of Poseidon by Tyro, daughter of Salmoneus, to whom the god appeared under the form of the Thessalian river-god Enipeus. The legends connected with him are exceedingly difficult to classify, the events are so unconnected and the scene shifts so rapidly from country to country. Born in Thessaly, where his brother Pelias is king of Iolcus, Neleus becomes king of Pylus in Messenia and the ancestor of a royal family called the Neleidæ, who are historically traceable as the old ruling family in some of the Ionic states in Asia Minor. Tradition uniformly derives the Ionic colonies from the Attic coast, and the presence of the Neleidæ is explained by the legend that when the Dorians conquered the Peloponnesus the Neleidæ were driven out and took refuge in Attica, where they at once became kings of the land, and led colonies to the eastern shores of the Ægean. This tangle of legends seems to have as its historical basis the fortunes of an energetic yet wandering race which has left its mark indelibly on the history of every country which it touched. This race was obviously a maritime one, for there is no path except the sea between the widely separate shores where it can be traced, and its divine ancestor is Poseidon. Neleus was father by Chloris of Nestor, Pero, and other children. Through the contest for the hand of Pero he is connected with the legends of the prophetic race of the Melampodidæ, who founded the mysteries and expiatory rites and the orgies of Bacchus in Argolis.

NELLORE, a district in Madras presidency, India, lying between 13° 25′ and 15° 55′ N. lat., and between 79° 9′ and 80° 14′ E. long., bounded on the N. by Kistna district, E. by the Bay of Bengal, S. by North Arcot and Chingleput, and W. by the Eastern Ghâts, separating it from Karnúl and Cuddapah. The area is 8739 square miles. The district comprises a tract of low-lying land extending from the base of the Eastern Ghâts to the sea. Its general aspect is forbidding: the coast-line is a fringe of blown sand through which the waves occasionally break, spreading a salt sterility over the fields. Farther inland the country begins to rise, but the soil is not naturally fertile, nor are means of irrigation readily at hand. Less than one-third of the total area is cultivated; the rest is either rocky waste or is covered with low scrub jungle. The chief rivers are the Pennair, Suvarnamukhi, and Gundlakamma. They are not navigable, but are utilized for irrigation purposes, the chief irrigation work being the anicut across the Pennair. Nellore is, however, very subject both to droughts and to floods. Copper was discovered in the western hills in 1801, but several attempts by European capitalists to work the ore proved unremunerative, and the enterprise has been abandoned since 1840. Iron ore is smelted by natives in many places. Nellore, with the other districts of the Carnatic, passed under direct British administration in 1801.

The population of Nellore in 1881 was 1,220,236, including 1,138,031 Hindus and 61,344 Mohammedans. Four Christian missions are established in the district,—Roman Catholic, Baptist, Presbyterian, and Lutheran. Among the aboriginal tribes, the Yanadis are the most numerous. On the island of Sríharikota, from which Madras derives its firewood, they still live in the jungle, and refuse to cultivate the soil or rear cattle. They have adopted some form of Hinduism, but still worship their own demons and bury their dead. Five towns had in 1881 a population of over 5000—Nellore (27,505), Ongole (9200), Venkatagiri (7989), Kandukur (6601), and Addanki (6481). The climate is dry, the monthly temperature varying from about 74° F. in December to 90° in May; and the average annual rainfall is 36·58 inches.

In former days Nellore was celebrated for its textile fabrics, but the export has now ceased, though spinning and weaving for local consumption is carried on in many villages. Prior to the opening of the Madras Railway, Nellore formed the high road between the interior and the coast. The two principal ports are Kottapatam and Ittamukula, both in the north of the district. Indigo is exported by land to Madras at the rate of about 800,000 maunds a year. The chief means of communication is the Great Northern Trunk Road, which runs along the coast to the Bengal frontier. Water communication with Madras city is also afforded by the East Coast or Buckingham Canal.

NELSON, a seaport of New Zealand, capital of a provincial district of the same name, prettily situated in 41° 18′ S. lat. and 173° 19′ E. long., on the shores of a small harbour at the bottom of Blind Bay on the northern coast of the South Island. It is a diocesan city, and contains several churches and a college. The climate is healthy, and the surrounding scenery very picturesque. The woods and fields in the neigbourhood abound with English song-birds, and the streams are stocked with trout; while the orchards in the town and suburbs are famous for English kinds of fruit, and hops are extensively cultivated. The industries include brewing, the manufacture of cloth (chiefly a superior kind of tweed), tanning, soap-boiling, candle-making, and the preparation of paint produced from hæmatite. A railway 23 miles long connects Nelson with Bellgrove, and is in course of extension towards Roundell up the Wai-iti valley. The borough returns one member to the house of representatives, and its local affairs are administered by a mayor and council elected by the ratepayers. The entrance to Nelson harbour is 10 miles south-west of Pepin Island. Six miles from the entrance commences the long and remarkable Boulder Bank, whose southern portion forms the natural breakwater to that anchorage. The population of Nelson in 1881 was 6764 (3261 males and 3503 females).

NELSON, HORATIO NELSON, VISCOUNT (1758–1805), was a younger son of the Rev. Edmund Nelson, and was born at Barnham, Thorpe, Norfolk, September 29, 1758. A love of adventure and a daring spirit, which developed itself from his earliest years, inclined the future admiral to the life of the sea, and, through the interest of a maternal uncle, the lad entered the navy in 1770. It is unnecessary to dwell on the career of Nelson as he passed through the first grades of his calling; as a midshipman or a lieutenant he saw service in almost every division of the globe, and on several occasions he gave signal proof of extraordinary energy and fertility of resource, and, above all, of a courage in danger which, if somewhat rash, was truly heroic. Already, too, he had shown an expertness in seamanship and in the art of the pilot often noticed by his superior officers, and he had displayed a singular aptitude for command in a variety of enterprises entrusted to him. He was made a post-captain at the age of twenty-one, a promotion due to merit alone, and remarkable in that aristocratic age; and during the next few years he was actively engaged in the vicissitudes of the American War. It was a period of chequered fortunes as regards the English navy; its supremacy on the ocean was not yet assured; and, though Rodney's great victory in 1782 attested the excellence of British seamen, the flag of France was for a time dominant in the West Indies and Indian seas; the fleets of the French and Spanish monarchies insulted the English coasts for several weeks, and assailed Gibraltar in formidable strength; and the armed neutrality of the Northern powers threatened England with no ordinary peril. Nelson, however, though his correspondence proves that he followed them with the eye of genius, took no part in these great operations; he was in command only of small vessels, and was chiefly employed in protecting convoys and in chasing cruisers of the same class as his own; and his most notable exploit was a bold descent on the shores of the South American isthmus, in which he gave fresh proofs of his habitual bravery. Yet his reputation as a promising officer was steadily growing during these years; he attracted the attention of every admiral on the different stations on which he served; and King William IV., at this time a midshipman, probably only echoed a general opinion in describing Nelson as a "boy captain with an enthusiasm that showed he was no common being." After the peace of Versailles in 1783, Nelson was in the West Indies for several years; and he gained credit for almost Quixotic zeal, and drew down on himself no little odium, by the efforts he made to prevent smuggling between the new United States and British colonies, and to expose the frauds of the greedy contractors who, especially on the Jamaica station, had been long permitted to plunder the navy. The time was now at hand when the commanding powers of this great seaman were to become manifest. War between England and revolutionary France was declared in the first months of 1793; and Nelson, on the recommendation of Lord Hood—a veteran who held him in high esteem—was made captain of the "Agamemnon," the first ship of the line commanded by him. He was despatched under Hood to the Mediterranean; and, though his vessel was one of the worst in the fleet, he performed feats of daring and perfect seamanship which at once marked him out for applause and distinction. With a detachment of sailors who, when led by him, "minded shot," he declared, "as little as peas," he took a prominent part in the siege of Bastia; and the capitulation of the place was due, for the most part, to their determined valour. At the siege of Cadiz also, where he lost an eye, he contributed largely to the result, his "seamen," as he reported, having "fought the guns" with the assistance only of "a single artilleryman." Nelson, however, was greatest on his own element; and soon after this he for the first time displayed conspicuously, and in a decisive manner, the transcendent gifts which made him pre-eminent. In March 1795 the British fleet, under Admiral Hotham—Lord Hood had by this time been replaced—was partially engaged off the coasts of Italy with a French fleet of superior force; and a French eighty-four, having been dismasted, sheered off, towed by a powerful frigate, and supported by two large ships of the line. The "Agamemnon," though only a sixty-four, stood out boldly after the retiring enemy; and Nelson's manœuvres were so skilful that he all but destroyed the crippled Frenchman, and kept the whole hostile squadron at bay, without incurring any serious loss. The injured ship, with one of her consorts, was easily captured a few hours afterwards; and, had the admiral followed Nelson's advice, the whole French fleet would have been brought to action, and have probably met a complete defeat.

In the winter of 1795–96 Nelson was employed in cutting off the supplies of the French army on the Italian seaboard; and, had he been well seconded by the Austrian generals, Napoleon would not have possessed the means of beginning his career of Italian conquest. Soon after this he became a commodore; and before long he had again performed one of those great feats of daring and skill which ordinary commanders would have deemed impossible. Spain, drawn into her old alliance with France, had declared war in 1796; and on 13th February 1797 a Spanish fleet met one of the English, a few miles off Cape St Vincent. Though the enemy had twenty-seven ships of the line, and the British force was only fifteen, its admiral, Jervis, did not hesitate; and, skilfully employing a well-known manœuvre, he broke the hostile line, cutting off nine ships. The Spanish admiral, however, endeavoured to rejoin this detachment by wheeling round his van; and the evolution might have been successful had not Nelson, placed at the British rear, immediately abandoned his own line, and, disregarding his superior's orders, assailed with his single ship the advancing squadron. This audacious movement threw him in the way of three first and three second-rates; and, though the "Captain" was ably seconded by the three nearest ships of the British line, Nelson was engaged for more than half an hour with a force immeasurably superior to his own. Yet British discipline and valour triumphed; the Spanish commander drew off beaten, and the "Captain" boarded and took two ships, each larger and more powerful than herself, Nelson leading his exulting crew in person to the cry of "Westminster Abbey or Victory." For this extraordinary passage of arms Nelson received the order of the Bath and was made an admiral,—his splendid success and skilful promptitude having effaced, even in professional minds, his disregard of the rules of the service. During the following months he was engaged in operations against Spain and her colonies; and he lost an arm in an attack on Santa Cruz, a place famous for one of Blake's victories. The time had now arrived when his genius and skill were to appear in full force in an independent command. In May 1798 he was despatched by Jervis—now Lord St Vincent—to intercept a great French armament, which, under the guidance of Bonaparte, was intended to reach Egypt and to threaten India. His squadron, however, having been crippled in a gale, the hostile fleet escaped from Toulon and reached Alexandria on 1st July, the British admiral, who had made Aboukir on the 28th June, having just missed it. This misadventure deceived Nelson, who believed that the enemy was still at sea; and it was not until he had made a circuit by Crete to the coasts of Sicily, and back again to the shores of Greece, that he heard how the French had made good their landing. He set off from the Gulf of Coron, though his intelligence was a rumour only; and on the 1st August the enemy was descried. His plan of attack was quickly formed, and it was marked by his wonted insight and skill. The French fleet lay in front of the roads of Aboukir, the rear supported by coast batteries, the centre and van more out at sea, but composed of new and formidable ships; and, as shoals stretched between it and the neighbouring shore, its admiral, Brueys, believed that no foe would thread the way between and attack from that side. Nelson, however, a dexterous pilot from boyhood, saw that with fine steering the feat was possible; and he directed part of his fleet to assail the enemy to the landward through this intricate passage, while the remaining part assailed from the seaward. As evening fell his preparations were complete; the shoal stopped only one of the British ships, and before an hour had passed his divided line had encompassed more than half the French fleet. The issue of the battle was never doubtful; the French, indeed, fought with heroic courage, but their rear and centre, placed between two fires, were gradually overpowered and destroyed; and their van, at anchor, like all their line, was either unable or perhaps unwilling to make sail and assist their consorts. The flagship of Brueys, the huge "Orient," blew up towards midnight in a volcano of flame, and by daybreak on the 2d the victory was complete. Of thirteen French ships two only escaped, and it should be added that the British fleet, though equal in numbers to that of the enemy, was wholly inferior in real force. The British seventy-fours were no match for the new and magnificent French eighties; and Nelson's flagship, the "Vanguard," had scarcely more than half the strength of the "Orient."

This great victory—perhaps Nelson's masterpiece—marks a new epoch in British naval history. The superiority, indeed, of the English fleets had been proved from the beginning of the war, especially on June 1, 1794, and the Revolution had injured the marine of France. But it was not until the Battle of the Nile—the name given to Nelson's triumph—that the navy of England attained its complete ascendency, and that it became the terror of even its bravest enemies. This change was due in the main to Nelson, and unquestionably the dread his name inspired was the principal cause that, years afterwards, Napoleon's plan of invading England failed. From this period, too, the whole naval service, so to speak, was animated by a new spirit, and deeds of daring were done by men of the rising school which the Hawkes and Ansons would have never dreamt of. It is painful to turn from this blaze of glory to notice a dark passage in Nelson's career. The Battle of the Nile having again combined the Continent against revolutionary France,—for Bonaparte and his army seemed lost,—the court of Naples was drawn into the war; and, in the struggle that ensued, the king and queen were compelled to take refuge in Palermo. They soon, however, had returned to the capital, Suwaroff having driven the French from Italy; and they entered Naples on the faith of a treaty, which amnestied their revolted subjects. Nelson, who still held his Mediterranean command, and had taken the royal family under his protection, nevertheless declared the capitulation null, allowed the vindictive creatures of the court to work their will on disarmed enemies, and, hurrying on himself the trial and sentence, gave his sanction to what can be only called the judicial murder of Caraccioli, the admiral of the Neapolitan fleet, who had served in the "rebel" cause only under compulsion. History must severely condemn these acts, but there is reason to believe that they were not caused, as is commonly supposed, by female prompting; and we must not forget that, in that age, political passion ran furiously high, and often broke down all moral barriers,—that it was the age of the assassinations at Rastadt, of the crime of Vincennes, of the execution of Ney. Nelson remained on his station after this tragedy; he shared in some of the short-lived triumphs of the allies in 1799–1800, had the satisfaction of hearing of the capture of the two ships which had escaped from Aboukir, and gave effectual aid in the siege of Malta, taken by Bonaparte on his way to Egypt. By the winter of 1800 he was again in England, having received a peerage for the Battle of the Nile, and the well-merited rank of vice-admiral, and greeted by his country with general acclaim. He was called before long to perform another service, in which his great qualities became again manifest. The victory of Marengo, won by Bonaparte after his extraordinary return from Egypt, having broken up the coalition against France, and inclined the czar to a French alliance, the Northern courts, with Denmark at their head, renewed the armed neutrality of 1780; and, in the first months of 1801, a British fleet was fitted out for the Baltic to put an end to this menacing league. Sir Peter Parker, a cautious veteran, was made chief of this expedition, Nelson being only the second in command, for negotiation was to be tried at first, and for this Nelson had no aptitude; but, though this arrangement promised well, it did not prove, on the whole, fortunate. The fleet, an extremely powerful armament, had passed the Sound by the 31st March,—Nelson chafing at the delays of his colleague, and at diplomatic efforts which, he rightly thought, would give to the Danes what they wanted, time; and by the 7th April it cast anchor in the waters around the Danish capital. The enemy, however, had already prepared the means of making a stern resistance: Copenhagen was covered by strong batteries; and an imposing array of heavily armed craft, protected by a shoal, as was the case at Aboukir, presented a most formidable line of defence. Nelson, however, declared for an immediate attack; and on the 2d May the attempt was made, Parker having judiciously left him to act for himself. Nelson's tactics resembled those of the Nile; he closed on his foe by getting within the shoal; but, from the nature of the case, he had not the means of placing the Danes between two fires; he had to deal with forts, not with vessels only; and his operations were in part unfortunate, for three of his ships at the outset grounded. The result was that, although his squadron destroyed the first line of the Danish defences, and threatened the capital with ruinous injury, the hostile batteries were not silenced, and Nelson's ships had suffered so much that he readily welcomed the terms of a truce which extricated him from no little danger. Parker, indeed, had been so alarmed at the prospect that he had actually signalled the fleet to retreat; but Nelson characteristically refused to obey until something like victory had been attained,—on the whole, certainly, a wise resolve.

Nelson was made a viscount for Copenhagen, and the league of the North was soon dissolved, for, though his success had not been perfect, it had taught the enemy a severe lesson. During the summer of 1801 he was engaged in watching the first preparations for a descent on the English coast, already contemplated by Napoleon; and he directed a boat attack on what was ere long to grow into the formidable and threatening flotilla of Boulogne. The peace of Amiens brought the war to a close; and Nelson stood on a pinnacle of fame, the acknowledged chief of the navy of England. His life, however, had become unhappy, for his private as well as his public character was not, it must be confessed, spotless. He was singularly susceptible to female influences; and he had formed for some years an erring attachment for Emma, the wife of Sir William Hamilton, ambassador at Naples in 1798. She was an adventuress of great beauty and parts; and, though his conduct at Naples does not seem to have been due to her evil counsels, he became almost her slave in his wild passion; and this had not only led to a separation from his wife, but had given him many wretched moments, and had caused much pain to his aged sovereign. Discredit, however, of this kind could not detract from his splendid services; and on the renewal of the war in 1803 Nelson was appointed to the Mediterranean command. He took up his station off Toulon; and for nearly two years he kept the French in port, in spite of repeated efforts of escape, and of the vicissitudes of all kinds of weather—an example of endurance never equalled. Meanwhile Napoleon had been maturing his deep-laid plan for invading England; the army which afterwards subdued the Continent had been marshalled along the cliffs of Boulogne; a vast and armed flotilla had been assembled; and the descent was to be covered by an immense fleet, collected from many points of the compass, and concentrated in suitable force in the Channel. A variety of circumstances, however, the principal being the timidity of the French admirals, alarmed at the recollections of the Nile, and fearing attempts to break the blockade, delayed the execution of the enemy's design, though certainly it was formidable in the extreme, and was unsuspected until the last moment. At last, at the end of March 1805, the French admiral, Villeneuve, escaped from Toulon,—his mission being to rally a Spanish squadron, to cross the Atlantic and reach the West Indies, and then, returning to the seas of Europe, to liberate the French and Spanish squadrons blockaded at Ferrol, Rochefort, and Brest, and to attain the Channel with a great armada of from fifty to sixty ships of the line. Villeneuve's operations were at first successful: he was at Martinique by the middle of May, having been joined by a fleet from Cadiz; and, though haunted, as it were, by the thought of Nelson, he was in full sail for Europe by the 1st June, having as yet completely eluded the enemy. Meantime Nelson had sought for Villeneuve on the Mediterranean for several days; he had been long delayed by contrary winds; and, though he had crossed the Atlantic with extreme rapidity when apprised of the destination of his foe, he had been lured away by a false report to the shores of the South American continent, and he only reached the latitude of Martinique to find that Villeneuve and his fleet were gone. He sailed from Antigua on the 13th June, pursuing with eleven sail a fleet of nineteen or twenty; and, as he feared that he might not come up with Villeneuve, he despatched several light craft to warn the Admiralty—though not suspecting Napoleon's design—that a hostile fleet was on the way to Europe. This precaution proved of the highest moment. Nelson missed Villeneuve in the Atlantic wastes, but one of these vessels conveyed his message. Sir Robert Calder, sent off for the purpose, intercepted Villeneuve off the coasts of Spain, and though the action was not decisive the Frenchman was compelled to put into Ferrol, and was thus prevented from making northwards. Before long Nelson, still chasing Villeneuve, but ignorant where his enemy was, had approached Europe and made for England; and at this intelligence the French admiral sailed from Ferrol southward, and put into Cadiz, completely frustrating his master's projects. The position of affairs had now become clearer,—though Collingwood alone of British seamen had even an inkling of Napoleon's purpose; and the Admiralty made preparations at once to attack the fleet that had fled into Cadiz. Nelson was placed in supreme command, and he was off Cadiz in the last days of September. His fleet numbered thirty-three or thirty-four sail of the line; that of Villeneuve was of the same force, the Ferrol squadron having joined his own; but, as Nelson knew that the French chief would not venture to fight on equal terms, he actually sent away seven or eight ships, in order to bring about an engagement which, he had resolved, should prove decisive.

By 20th October Villeneuve had put to sea with the combined fleets of France and Spain. He obeyed a peremptory command of Napoleon, who had stigmatized him as a feeble coward; he left Cadiz trusting to a false report that Nelson had only twenty ships; and yet, with thirty-three, he dreaded a battle. Nelson, eager to decoy the Frenchman out, had kept a considerable distance from land, but the enemy's movements were watched by his frigates, and he was informed of them throughout the night. His plan of attack had been made some time: the ships of the allies being very numerous, he had resolved to break their line at two points; and in this way the results, he believed, of the manœuvre would be more quick and effective. By daybreak on the 21st the fleet of Villeneuve was descried off the Cape of Trafalgar; and the English fleet was formed into two columns, the northern led by Nelson in the "Victory," the southern under Collingwood in the "Royal Sovereign." The wind was light, and there was an ocean swell; Nelson's ships slowly advanced on the waters; and, as they approached it, the hostile fleet, the sun shining on the masses of sails, presented a grand and imposing appearance. Villeneuve, a skilful seaman though a timid leader, had arranged his squadrons ably to meet the attack: he had formed them into two parallel lines, the vessels of the second commanding the spaces between the vessels of the first line; and they were thus marshalled in a compact array, each division giving support to the other, and offering a continuous front of fire to the enemy. Deafening cheers broke from the British armament as the celebrated signal flew from the flagship, "England expects every man to do his duty"; and it is said that Villeneuve, as he heard the shouting, exclaimed to his officers that "all was lost." The southern column came into action towards noon; and Collingwood first broke the hostile line, pouring a destructive broadside into the "Santa Anna," and then ranging alongside the "Fougeux." The "Royal Sovereign," however, had out-sailed her consorts, and he was surrounded by enemies for many minutes before a friendly ship could come to her aid; and this circumstance not only proves how absolute had become the confidence of the British chiefs, but how the manœuvre of piercing the line requires a better fleet to have a chance of success. By this time the northern column was engaged; the "Victory," assailed by a tremendous fire, broke through the enemy soon after twelve, making immense havoc in Villeneuve's flagship, and exchanging broadsides with the "Redoubtable" and with the huge "Santissima Trinidad," by far the largest man-of-war afloat; and here again some moments elapsed before the "Temeraire" gave her partial relief. The action had now become general; and the British ships in the rear came up, reducing the great inferiority in the first attack. Six or seven ships of the enemy's first line made a stern and noble resistance; but the second line gradually fell to leeward; the van, as at the Nile, scarcely fired a shot; and, divided, scattered, and overpowered at every point where the defence was maintained, the allied fleet ere long was a mass of fragments, disabled, helpless, and pursued by their conquerors. Nevertheless the victory, splendid as it was, was dearly bought by the loss of the life of the illustrious warrior who had prepared it. A musket ball from the "Redoubtable's" tops inflicted a mortal wound on Nelson about an hour after the battle began, and he died towards evening to the unspeakable grief of all who witnessed the sorrowful scene in the "Victory." He retained, however, his great faculties to the last; he lived to hear that almost two-thirds of the enemy's fleet had been destroyed or captured; and, though he passed away in the prime of manhood, it can hardly be said that his death was premature, for the foes of England had been swept from the ocean. We have indicated Nelson's undoubted errors; and he was inferior to several of England's naval chiefs in political sagacity and calm forethought. But he was the greatest of her commanders at sea; he was unrivalled, in an eventful age of war, for resource, daring, professional skill, and the art of winning the hearts of men; and, on the whole, he was beyond comparison the first of the naval worthies of his country. His remains were conveyed to England and interred in St Paul's Cathedral on January 9, 1806.

See *The Dispatches and Letters of Nelson*, 7 vols., London, 1844–46; the *Life* by Clarke and M'Arthur (1806), and that by Southey (1828); Alison, *History of Europe*; Thiers, *French Revolution* and *History of the Consulate and the Empire*. (W. O. M.)

NEMATOIDEA. The name *Nematoidea* (νῆμα, thread, εἶδος, form) was first introduced by Rudolphi, but the group had been previously recognized as distinct by Zeder under the name of *Ascarides*. They are now by many systematists united with the *Acanthocephali* to form the order *Nemathelminthes*.

The *Nematoidea* possess an elongated and thread-like form (see fig. 1), varying in length from a few lines up to several feet. The body is covered externally by a chitinous cuticle which is a product of the subjacent epidermic layer; this cuticle is frequently prolonged into spines and papillæ, which are especially developed at the anterior end of the body. The mouth opens at one extremity of the body and the anus at or near the other. Beneath the epidermis is a longitudinal layer of muscle-fibres which are separated into four distinct groups by the dorsal, ventral, and lateral areas; these are occupied by a continuation of the epidermic layer; in the lateral areas run two thin-walled tubes with clear contents, which unite in the anterior part of the body and open by a pore situated on the ventral area. These vessels are considered to represent the segmental organs of other worms. The lateral areas are entirely absent in *Gordius*. The body cavity is largely occupied by connective tissue, and neither here nor elsewhere are cilia found at any period of development. The alimentary tract consists of a straight tube running from the mouth to the anus without any convolutions; it is separable into three divisions:—(1) a muscular œsophagus which is often provided with cuticular teeth; (2) a cellular intestine; and (3) a short terminal rectum surrounded by muscular fibres.

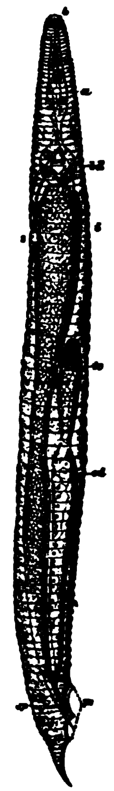

Fig. 1.—*Oxyuris* (after Galeb, *Arch. de Zool. Exp.*, 1878). *a*, mouth; *œ*, œsophagus; *bd*, enlargement of the œsophagus, armed with chitinous teeth; *i*, intestine; *s*, opening of segmental tubes (placed by mistake on the dorsal instead of the ventral surface); *te*, testes; *vd*, vas deferens; *sp*, cloaca; *pa*, papillæ.

A nervous system has been shown to exist in many species, and consists of a periœsophageal ring giving off several nerves which run forwards and backwards along the lateral and median lines. Some of the free-living forms possess eye specks. The sexes are distinct (with the exception of a few forms that are hermaphrodite), and the male is always smaller than the female. The generative organs consist of one or two tubes, in the upper portion of which the ova or spermatozoa are developed, the lower portion serving as an oviduct or vas deferens; the female generative organs open at the middle of the body, the male close to the posterior extremity into the terminal portion of the alimentary canal; from this cloaca a diverticulum is given off in which are developed one to three chitinous spicules that subserve the function of copulation. The spermatozoa differ from those of other animals in having the form of cells which sometimes perform amœboid movements. The development is similar to that of the ova, with which they appear to be homologous.

Mode of Life and Metamorphoses.—While the majority of the Nematodes are parasites, there are many that are never at any period of their life parasitic. These free-living forms are found everywhere—in salt and fresh water, in damp earth and moss, and among decaying substances; they are always minute in size, and like many other lower forms of life, are capable of retaining their vitality for a long period even when dried, which accounts for their wide distribution; this faculty is also possessed by certain of the parasitic Nematodes, especially by those which lead a free existence during a part of their life-cycle. The free-living differ from the majority of the parasitic forms in undergoing no metamorphosis; they also possess certain structural peculiarities which led Bastian (*Trans. Linn. Soc.*, 1865) to separate them into a distinct family, the *Anguillulidæ*. It is impossible, however, to draw a strict line of demarcation between the free and parasitic species, since—(1) many of the so-called free *Nematoidea* live in the slime of molluscs (Villot), and are therefore really parasitic; (2) while certain species belonging to the free-living genus *Anguillula* are normally parasitic (*e.g.*, *A. tritici*, which lives encysted in ears of wheat), other species occasionally adopt the parasitic mode of existence, and become encysted in slugs, snails, &c.; (3) it has been experimentally proved that many normally parasitic genera are capable of leading a free existence;[1] (4) transitional forms exist which are free at one period of their life and parasitic at another. The parasitic Nematodes include by far the greatest number of the known genera; they are found in nearly all the orders of the animal kingdom, but more especially among the *Vertebrata*, and of these the *Mammalia* are infested by a greater variety than any of the other groups. No less than nineteen distinct species have been described as occurring in man. The Nematode parasites of the *Invertebrata* are usually immature forms which attain their full development in the body of some vertebrate; but there are a number of species which in the sexually adult condition are peculiar to the *Invertebrata*.[2]

The *Nematoidea* contain about as many parasitic species as all the other groups of internal parasites taken together; they are found in almost all the organs of the body, and by their presence, especially when encysted in the tissues and during their migration from one part of the body to another, give rise to various pathological conditions. Although some attain their full development in the body of a single host—in this respect differing from all other *Entozoa*—the majority do not become sexually mature until after their transference from an "intermediate" to a "definitive" host. This migration is usually accompanied by a more or less complete metamorphosis, which is, however, not so conspicuous as in most other parasites, *e.g.*, the *Trematoda*. In some cases (many species of *Ascaris*) the metamorphosis is reduced to a simple process of growth.

The parasitic and free-living Nematodes are connected by transitional forms which are free at one stage of their existence and parasitic at another; they may be divided into two classes—those that are parasitic in the larval state but free when adult, and those that are free in the larval state but parasitic when adult.

(1) To the first class belong the "hairworms" *Gordius* and *Mermis*. The adult *Gordius aquaticus* inhabits clear running water; it is a long slender worm often about a foot in length but only $\frac{1}{15}$ inch in diameter. Several individuals are frequently found together twisted into a knot, whence the name *Gordius*. The larva when first hatched is provided with a number of cephalic hooks by the aid of which it bores its way into the larvæ of the gnat and other *Diptera*; there it becomes encysted, but continues to move about within the cyst. The gnat larvæ are devoured by fish, and the young *Gordius* is set free and penetrates the mucous membrane of the intestine, where it encysts itself and becomes quiescent; in this second larval period the cyst differs in character from that formed during the first larval period. In the spring, about six months after the second encystment, the larva becomes free and finds its way through the alimentary canal to the exterior; the cephalic armature disappears, the alimentary canal becomes rudimentary, and after acquiring sexual organs the larva assumes the character of the adult (Villot). (2) To the second class belong *Dochmius*, *Strongylus*, and many species of *Ascaris*; the embryo on leaving the egg lives free in water or damp earth, and resembles very closely the free-living genus *Rhabditis*. After a longer or shorter period it enters the alimentary canal of its proper host and becomes sexually mature. *Ascaris nigrovenosa* has a developmental history which is entirely anomalous, passing through two sexual generations which regularly alternate. The worm inhabits the lung of the frog and toad, and is hermaphrodite (Schneider) or parthenogenetic (Leuckart); the embryos hatched from the eggs find their way through the lungs into the alimentary canal and thence to the exterior; in a few days they develop into a sexual *Rhabditis*, in which the sexes are distinct; the eggs remain within the uterus, and the young when hatched break through its walls and live free in the perivisceral cavity of the mother, devouring the organs of the body until only the outer cuticle is left; this eventually breaks and sets free the young, which are without teeth, and have therefore lost the typical *Rhabditis* form. They live for some time in water or mud, occasionally entering the bodies of water snails, but undergo no change until they reach the lung of a frog, when the cycle begins anew. Although several species belonging to the second class occasionally enter the bodies of water snails and other animals before reaching their definitive host, they undergo no alteration of form in this intermediate host; the case is different, however, in *Filaria medinensis*, *F. bancrofti*, and other forms, in which a free larval is followed by a parasitic existence in two distinct hosts, all the changes being accompanied by a metamorphosis. *Filaria medinensis*—the Guinea worm—is parasitic in the subcutaneous connective tissue of man (occasionally also in the horse). It is chiefly found in the tropical parts of Asia and Africa, but has also been met with in South Carolina and several of the West Indian islands. The adult worm, which sometimes reaches a length of 6 feet, has the characters of a female, but is probably hermaphrodite, seeing that no males have ever been discovered. It is viviparous, and the young, which, unlike the parent, are provided with a long tail, live free in water; it was formerly believed from the frequency with which the legs and feet were attacked by this parasite that the embryo entered the skin directly from the water, but it has been proved by Fedschenko that the larva bores its way into the body of a *Cyclops* and there undergoes further development. It is probable that the parasite is then transferred to the alimentary canal of man by means of drinking water, and thence makes its way to the subcutaneous connective tissue.

The *Nematoidea* which are parasitic during their whole life may similarly be divided into two classes—those which undergo their development in a single host, and those which undergo their development in the bodies of two distinct hosts.

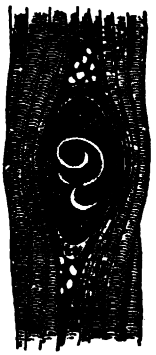

Fig. 2.—*Trichina* encysted among muscular fibres. After Leuckart.

(1) In the former class the eggs are extruded with the fæces, and the young become fully formed within the egg, and when accidentally swallowed by their host are liberated by the solvent action of the gastric juice and complete their development. This simple type of life history has been experimentally proved by Leuckart to be characteristic of *Trichocephalus affinis*, *Oxyuris ambigua*, and other species. (2) The life history of *Ollulanus tricuspis* is an example of the second class. *Ollulanus tricuspis* is found in the adult state in the alimentary canal of the cat; the young worms are hatched in the alimentary canal, and often wander into the body of their host and become encysted in the lungs, liver, and other organs; during the encystment the worm degenerates and loses all trace of structure. This wandering appears to be accidental, and to have nothing to do with the further evolution of the animal which takes place in those embryos which are voided with the excrement. Leuckart proved experimentally that these young forms become encysted in the muscles of mice, and the cycle is completed after the mouse is devoured by a cat. The well-known *Trichina spiralis* (fig. 2) has a life history closely resembling that

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[1] Ercolani successfully cultivated *Oxyuris curvula*, *Strongylus armatus*, and other species in damp earth; the free generation was found to differ from the parasitic by its small size, and by the females being ovoviviparous instead of oviparous. To this phenomenon he gave the name of dimorphobiosis.

[2] The genera *Ascaris*, *Filaria*, *Trichosoma* are found throughout the *Vertebrata*; *Cucullanus* (in the adult condition) only in fishes and *Amphibia*; *Dochmius*, *Trichocephalus*, *Trichina*, and *Pseudalius* live only in the *Mammalia*, the last-mentioned genus being confined to the order *Cetacea*; *Strongylus* and *Physaloptera* are peculiar to mammals, birds, and reptiles, while *Dispharagus*, *Syngamus*, and *Hystrichis* are confined to birds. *Gordius* and *Mermis* (in the larval state) are with one or two exceptions confined to the *Invertebrata* and *Sphærularia* to bees. *Oxyuris*, though chiefly parasitic in the *Mammalia*, occurs also in reptiles, *Amphibia*, and one or two insects. *Dacnitis* and *Ichthyonema* are only found in fishes.

of *Ollulanus.* The adult worm, which is of extremely minute size, the male being only $\frac{1}{18}$th and the female $\frac{1}{8}$ of an inch in length, inhabits the alimentary canal of man and many other carnivorous mammalia; the young bore their way into the tissues and become encysted in the muscles—within the muscle-bundles according to Leuckart, but in the connective tissue between them according to Chatin and others. The co-existence of the asexual encysted form and the sexually mature adult in the same host, exceptionally found in *Ollulanus* and other Nematodes, is the rule in *Trichina*; many of the embryos, however, are extruded with the fæces, and complete the life cycle by reaching the alimentary canal of rats and swine which frequently devour human ordure. Swine become infested with *Trichina* in this way and also by eating the dead bodies of rats, and the parasite is conveyed to the body of man along with the flesh of "trichinized" swine.

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(F. E. B.)

NEMEAN GAMES. See GAMES, vol. x. p. 65.

NEMERTINES, or NEMERTEANS (*Nemertea*), is the name of a subdivision of worms,[1] characterized by the ciliation of the skin, by the presence of a retractile proboscis, by the simple arrangement of the generative apparatus, and in certain cases by a peculiar pelagic larval stage to which the name "pilidium" has been given. Many of them are long thread-shaped or ribbon-shaped animals, more or less cylindrical in transverse section. Even the comparatively shortest species and genera can always be termed elongate, the broadest and shortest of all being the parasitic *Malacobdella* and the pelagic *Pelagonemertes.* There are no exterior appendages of any kind. The colours are often very bright and varied. They live in the sea, some being common amongst the corals and algæ, others hiding in the muddy or sandy bottom, and secreting gelatinous tubes which ensheath the body along its whole length. Formerly, they were generally arranged amongst the Platyelminthes as a suborder in the order of the Turbellarians, to which the name of *Rhynchocœla* was applied, the other suborders being the *Dendrocœla* and the *Rhabdocœla.* With the advance of our knowledge of these lower worms it has been found desirable to separate them from the Turbellarians and to look upon the *Nemertea* as a separate phylum of Platyelminthes. Lately the interest in their morphology has increased, since it has been advanced (6, 8)[2] that certain points in their organization appear to indicate a remote degree of relationship to the ancestral forms which must have preceded the *Chordata* (to which the vertebrate animals also belong), and that this relationship is closer than that which exists between those *Protochordata* and any other group of invertebrate animals.

CLASSIFICATION.—The Nemertines are subdivided into three suborders:—*Hoplonemertea*, *Schizonemertea*, and *Palæonemertea* (5). The (1) *Hoplonemertea* embrace all the species with a stylet in the proboscis, and also *Malacobdella*, which has an unarmed proboscis, but which, by the details of its organization and its development, must certainly be placed here (parasitism may be the cause of its incipient degeneration). The special characters of this suborder may be gathered from the anatomical descriptions hereafter to be given. In those species of which the embryology has been investigated the development was direct. The more common or more important genera are *Amphiporus* (*A. pulcher*, British coasts, Mediterranean; *A. splendidus*, Atlantic), which is comparatively short, *Nemertes* (*N. gracilis*, Atlantic and Mediterranean; *N. antonina*, Mediterranean; *N. echinoderma*, Mediterranean), which is long and thread-like, *Tetrastemma*, *Drepanophorus* (with more complicate armature in the proboscis), *Akrostomum*, *Malacobdella.* (2) In the *Schizonemertea* all those genera and species are united which have deep, longitudinal, lateral, cephalic fissures. The development of some (*Lineus*) is characterized by the so-called larva of Desor, of others (*Cerebratulus*) by the curious and characteristic pilidium-larva. The principal genera are *Lineus* (*L. longissimus*, Atlantic; *L. obscurus*), *Cerebratulus* (*C. marginatus*, *C. bilineatus*, both Atlantic and Mediterranean; *C. urticans*, Mediterranean; *C. fasciolatus* and *aurantiacus*, *C. hepaticus* and *dohrnii*, Mediterranean; *C. macintoshii*, Madeira), *Langia* (*L. formosa*), *Borlasia* (*B. elisabethæ*). (3) Of the *Palæonemertea* the most typical and most characteristic genera are *Carinella* and *Cephalothrix.* They differ considerably both from Hoplo- and from Schizonemertines, and evidently belong to a lower stage of differentiation. The genera *Polia* (*P. delineata* and *P. curta*, Mediterranean) and *Valencinia* are provisionally arranged in this order because, though less primitive, they are not typical representatives of the other two suborders. The development of these species is not at all, or only very superficially, known. For the further characters of the last two suborders see the anatomical description below.

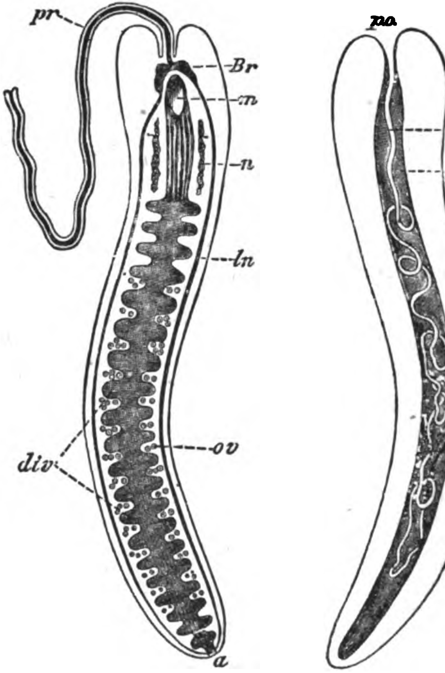

Fig. 1. Fig. 2.

FIGS. 1, 2.—Diagrams of the organs of a Nemertine, fig. 1 from below, fig. 2 from above. *m*, mouth; *div*, intestinal diverticula; *a*, anus; *ov*, ovaries; *n*, nephridia; *Br*, brain-lobes; *ln*, longitudinal nerve stems; *pr*, proboscis; *ps*, proboscidian sheath; *p.o.*, opening for proboscis.

Another subdivision generally current is that into the *Enopla* and the *Anopla* (14). This does not, however, take into sufficient account the primitive and diverging characters disclosed by the very important less highly organized genera.

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[1] Nemertes was a sea nymph, daughter of Nereus and Doris. One of the genera was named *Nemertes* by Cuvier.

[2] These figures refer to the bibliography at the end of the article.

Anatomy.—(*a*) *Proboscis and Proboscidian Sheath.*—The organ most characteristic of a Nemertine is without doubt the proboscis. With very few exceptions (*Malacobdella*, *Akrostomum*, where it has fused with the mouth to a single exterior opening), there is a terminal opening (subterminal in *Valencinia*) at the foremost tip of the body, out of which the proboscis is seen shooting backwards and forwards, sometimes with so much force that both its interior attachments are severed and it is entirely expelled from the body. It then often retains its vitality for a long time, apparently crawling about as if it were itself a worm, a phenomenon which is at least partially explained by the extraordinary development of nervous tissue, equally distributed all through the walls of the proboscis, and either united (10) into numerous longitudinal nerve-stems (*Drepanophorus*, *Amphiporus*) or spread out into a uniform and comparatively thick layer (*Cerebratulus*, sp.). This very effective and elaborate innervation, which has been directly traced (6) to the brain, whence strong nerves (generally two) enter the proboscis, renders it exceedingly probable that the most important functions of the proboscis are of a sensiferous, tactile nature, a supposition which is again strengthened by the fact that amongst the Rhabdocœl Turbellarians an organ which may be called the forerunner of the Nemertean proboscis has been proved (3) to be the morphological equivalent of the foremost tip of the body, which, as an organ of delicate touch, has acquired the property of folding inwards. In Nemertines the everted proboscis is retracted in the same way as the tip of a glove finger would be if it were pulled backwards by a thread situated in the axis and attached to the tip. The comparison may be carried still further. The central thread just alluded to is represented in the Nemertean proboscis by that portion which is never everted, and the tip of the glove by the boundary between the evertible and non-evertible portion of the proboscis—a boundary which in the *Hoplonemertini* is marked by the presence of a pointed or serrated stylet. This stylet is thus situated terminally when the proboscis has reached its maximum eversion. It adds a decisively aggressive character to an organ the original significance of which, as we have seen, was tactile. This aggressive character has a different aspect in several genera which are destitute of a central stylet, but in which the surface that is turned outwards upon eversion of the proboscis is largely provided with nematocysts, sending the urticating rods of different sizes in all directions. In others this surface is beset with thick, glandular, adhesive papillæ.

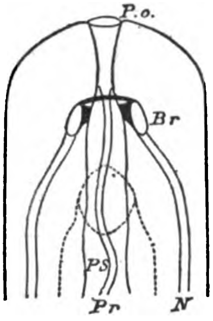

Fig. 3.—Anterior portion of the body of a Nemertine. *Br*, brain-lobes; *N*, lateral nerves; *PS*, proboscidian sheath; *Pr*, proboscis; *P.o.*, exterior opening through which the proboscis is everted. Œsophagus and mouth shown by dotted lines.

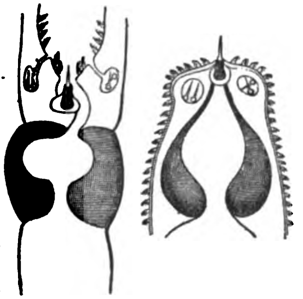

Fig. 4. Fig. 5.

Figs. 4, 5.—Proboscis with stylet, "reserve" sacs, and muscular bulb of a Hoplonemertine. Fig. 4 retracted; fig. 5 everted.

The comparison with the glove-finger is in so far insufficient as the greater portion of the non-evertible half of the proboscis is also hollow and clothed by glandular walls. Only at the very hindermost end does it pass into the so-called retractor-muscle (fig. 2), which is attached to the wall of the space (proboscidian sheath) in which the proboscis moves about. This retractor-muscle, indeed, serves to pull back with great rapidity the extruded proboscis, and is aided in its action by the musculature of the head. The extrusion itself depends entirely upon contraction of the muscular walls of the space just mentioned (proboscidian sheath). As it is (1) closed on all sides, and (2) filled with a corpuscular fluid, the contractions alluded to send this fluid to impinge against the anterior portion, where the proboscis, floating in its sheath, is attached with it to the muscular tissue of the head (fig. 3). Partial extrusion lessening the resistance in this region inevitably follows, and when further contractions of the walls of the sheath ensue total extrusion is the consequence. It is worthy of notice that in those Nemertines which make a very free use of their proboscis, and in which it is seen to be continually protruded and retracted, the walls of the proboscidian sheath are enormously muscular. On the other hand, they are much less considerably or even insignificantly so in the genera that are known to make a rather sparing use of their proboscis.

The proboscis, which is thus an eminently muscular organ, is composed of two or three, sometimes powerful, layers of muscles—one of longitudinal and one or two of circular fibres. In the posterior retractor the longitudinal fibres become united into one bundle, which, as noticed above, is inserted in the wall of the sheath. At the circular insertion of the proboscis in front of the brain the muscular fibres belonging to the anterior extremity of the body and those connected with the proboscis are very intimately interwoven, forming a strong attachment.

The proboscis broken off and expelled is generally reproduced, the posterior ribbon-like end of this reproduced portion again fusing with the walls of the sheath (11). There is reason to suppose that, when a wound is inflicted by the central stylet, it is envenomed by the fluid secreted in the posterior proboscidian region being at the same time expelled. A reservoir, a duct, and a muscular bulb in the region (fig. 4) where the stylet is attached serve for this purpose. The significance of two or more (in *Drepanophorus* very numerous) small sacs containing so-called "reserve" stylets resembling in shape that of the central dart is insufficiently known.

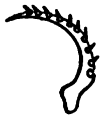

Fig. 6.—The armature from the proboscis of *Drepanophorus*.

The proboscidian sheath, which by its transverse contractions serves to bring about eversion of the proboscis in the way above traced, and the muscular walls of which were similarly noticed, is attached to the musculature of the head just in front of the ganglionic commissures (fig. 3). In nearly all Nemertines it extends backwards as far as the posterior extremity, just above the anus; in *Carinella* it is limited to the anterior body-region. The corpuscles floating in the fluid it contains are of definite shape, and in *Cerebratulus urticans* they are deep red from the presence of hæmoglobin. Internally the muscular layers are lined by an epithelium. In the posterior portion this epithelium in certain *Schizonemertea* has a more glandular appearance, and sometimes the interior cavity is obliterated by cell-proliferation in this region. Superiorly the sheath either closely adheres to the muscular body-wall, with which it may even be partly interwoven, or it hangs freely in the connective tissue which fills the space between the intestine and the muscular body-wall.

(*b*) *Cutaneous System.*—Externally in all species a layer of ciliated cells forms the outer investment. In it are, moreover, enclosed unicellular glands pouring their highly refracting contents, of a more or less rod-like shape, directly to the exterior. They appear to be the principal source of the mucus these animals secrete. In Schizonemertines these elements are separated by a thin homogeneous basement membrane (fig. 8) from the following,—that is, from a layer in which longitudinal muscular fibres are largely intermixed with tortuous glands, which by reason of their deeper situation communicate with the exterior by a much longer and generally very narrow duct. The pigment is also principally localized in this layer, although sometimes it is present even deeper down within the musculature. The passage from this tegumentary layer to the subjacent longitudinal muscular one is gradual, no membrane separating them. In *Carinella*, *Cephalothrix*, *Polia*, and the Hoplonemertines the two tegumentary layers with their different glandular elements are fused into one; a thick layer of connective tissue is situated beneath them (instead of between them) and keeps the entire cutaneous system more definitely separate from the muscular (figs. 7, 8).

(*c*) ***Musculature and Connective Tissue.***—The muscular layers by which the body-wall is constituted have been very differently and to some extent confusingly described by the successive authors on Nemertean anatomy. There is sufficient reason for this confusion. The fact is that not only have the larger subdivisions a different arrangement and even number of the muscular layers, but even within the same genus, nay, in the same species, well-marked differences occur. Increase in size appears sometimes to be accompanied by the development of a new layer of fibres, whereas a difference in the method of preparation may give to a layer which appeared homogeneous in one specimen a decidedly fibrous aspect in another. Nevertheless there are three principal types under which the different modifications can be arranged. One of them is found in the two most primitively organized genera, *Carinella* and *Cephalothrix*, *i.e.*, an outer circular, a longitudinal, and an inner circular layer of muscular fibres (fig. 7). The second is common to all the Schizonemertines as well as to *Polia* and *Valencinia*, and also comprehends three layers, of which, however, two are longitudinal, viz., the external and the internal one, there being a strong circular layer between them (fig. 9). To the third type all the *Hoplonemertea* correspond; their muscular layers are only two, an external circular and an internal longitudinal one (fig. 8).

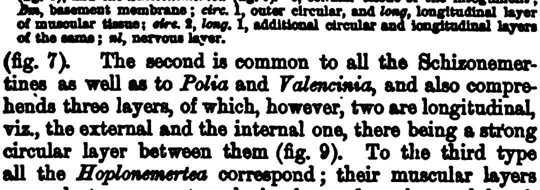

Fig. 7. Fig. 8. Fig. 9.

FIGS. 7-9.—The layers of the body-wall in *Carinella* (fig. 7), the *Hoplonemertea* (fig. 8), and the *Schizonemertea* (fig. 9). *c*, cellular tissue of the integument; *Bm*, basement membrane; *circ.* 1, outer circular, and *long*, longitudinal layer of muscular tissue; *circ.* 2, *long.* 1, additional circular and longitudinal layers of the same; *nl*, nervous layer.

The *Schizonemertea* thus appear to have developed an extra layer of longitudinal fibres internally to those which they inherited from more primitive ancestors, whereas the *Hoplonemertea* are no longer in possession of the internal circular layer, but have on the contrary largely developed the external circular one, which has dwindled away in the *Schizonemertea*. In only one instance has the present writer met with a thin exterior circular layer in a very large specimen of *Cerebratulus*; younger specimens of the same species did not show it. It is noticeable that Keferstein (9) also observed four layers similarly arranged in one of the specimens of *Cerebratulus* which he investigated. The situation of the lateral nerve-stems in the different genera with respect to the muscular layers lends definite support to the interpretation of their homologies here given.

In *Carinella*, *Cephalothrix*, and *Polia*, as well as in all Hoplonemertines, the basement membrane of the skin already above alluded to is particularly strong and immediately applied upon the muscular layers. In the Schizonemertines there is a layer in which the cutaneous elements are largely represented below the thin basement membrane (fig. 8), between it and the bulk of the outer longitudinal muscles. The difference in the appearance of the basement membrane—sometimes wholly homogeneous, sometimes eminently fibrillar—can more especially be observed in differently preserved specimens of the genus *Polia*.

The connective tissue of the integument and basement membrane imperceptibly merges into that which surrounds the muscular bundles as they are united into denser and definite layers, and this is especially marked in those forms (*Akrostomum*) where the density of the muscular body-wall has considerably diminished, and the connective tissue has thus become much more prominent. It can then at the same time be observed, too, that the compact mass of connective tissue ("reticulum," Barrois) which lies between the muscular body-wall and the intestine (1) is directly continuous with that in which the muscular layers are imbedded. Nuclei are everywhere present. The omnipresence of this connective tissue excludes the idea of any true body cavity in Nemertines.

In *Polia* the connective tissue enclosed in the external muscular layer is eminently vacuolar,—all the intermediate stages between such cells in which the vacuole predominates and the nucleus is peripheral and those in which the granular protoplasm still entirely fills them being moreover present.

In addition to the musculature of the proboscis and proboscidian sheath, longitudinal muscular fibres are found in the walls of the œsophagus, whilst transverse ones are numerous and united into vertical dissepiments between the successive intestinal cæca, thus bringing about a very regular internal metamerization (4). The genital products develop in intermediate spaces similarly limited by these dissepiments and alternating with the digestive cæca.

(*d*) ***Nervous System and Sense Organs.***—The nervous system of Nemertines presents several interesting peculiarities. As central organs we have to note the brain-lobes and the longitudinal lateral cords which form one continuous unsegmented mass of fibrous and cellular nerve-tissue. The fibrous nerve-tissue is more dense in the higher differentiated, more loose and spongy in the lower organized forms; the cellular nerve-tissue is similarly less compact in the forms that are at the base of the scale. No ganglionic swellings whatever occur in the course of the longitudinal cords. The brain must be looked upon as the anterior thickening of these cords, and at the same time as the spot where the two halves of the central nerve system intercommunicate. This is brought about by a double commissure, of which the ventral portion is considerably thicker than the dorsal, and which, together with the brain-lobes, constitutes a ring through which both proboscis and proboscidian sheath pass. The brain-lobes are generally four in number, a ventral and a dorsal pair, respectively united together by the above-mentioned commissures, and moreover anteriorly interfusing with each other, right and left. In *Carinella* this separation into lobes of the anterior thickenings of the cords has not yet commenced, the ventral commissure at the same time being extremely bulky. There is great probability that the central stems, together with the brain,

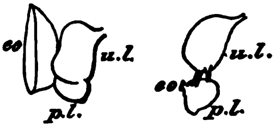

Fig. 10. Fig. 11.

FIGS. 10, 11.—Brain and lateral organ of a Schizonemertine (fig. 10) and a Hoplonemertine (fig. 11). *eo*, exterior opening; *u.l.*, superior brain-lobe; *p.l.*, posterior brain-lobe.

must be looked upon as local longitudinal accumulations of nervous tissue in what was in more primitive ancestors a less highly differentiated nervous plexus, situated in the body-wall in a similar way to that which still is found in the less highly organized Cœlenterates. Such a nervous plexus indeed occurs in the body-wall of all Schizonemertines (7), sometimes even as a comparatively thick layer, situated, as are the nerve stems, between the external longitudinal and the circular muscles (fig. 9). In *Carinella*, where the longitudinal nerve-stems are situated exteriorly to the muscular layers, this plexus, although present, is much less dense, and can more fitly be compared to a network with wide meshes. In both cases it can be shown to be in immediate continuity with the coating of nerve-cells forming part of the longitudinal cords. It stretches forward as far as the brain, and in *Carinella* is again continued in front of it, whereas in the Schizonemertines the innervation of the anterior extremity of the head, in front of the brain, takes the form of more definite and less numerous branching stems. The presence of this plexus in connexion with the central stems, sending out nervous filaments amongst the muscles, explains the absence, both in Palæo- and Schizonemertines, of separate and distinct peripheral nerve stems springing from the central stems innervating the different organs and body-regions, the only exceptions being the nerves for the proboscis, those for the sense organs in the head, and the strong nerve pair (*n. vagus*) for the œsophagus. At the same time it renders more intelligible the extreme sensitiveness of the body-wall of the Nemertines, a local and instantaneous irritation often resulting in spasmodic rupture of the animal at the point touched.

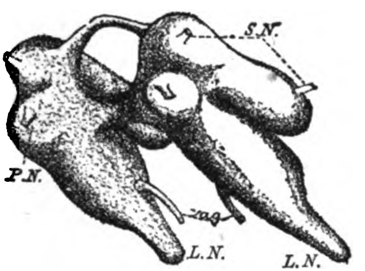

Fig. 12.—The brain of a Nemertine, with its lobes and commissures. *S.N.*, nerves to sensory apparatus; *P.N.*, nerves for proboscis; *sag.* nerves for œsophagus; *L.N.*, lateral nerve stems.

In the *Hoplonemertea*, where the longitudinal stems lie inside the muscular body-wall, definite and metamerically placed nerve branches spring from them and divide dichotomously in the different tissues they innervate. A definite plexus can here no longer be traced. In certain Hoplonemertines the lateral stems have been noticed to unite posteriorly by a terminal commissure, situated above the anus, the whole of the central nervous system being in this way virtually situated above the intestine. In others there is an approximation of the lateral stems towards the median ventral line (*Drepanophorus*); in a genus of Schizonemertines (*Langia*), on the other hand, an arrangement occurs by which the longitudinal stems are no longer lateral, but have more or less approached each other dorsally (6).

In addition to the nerves starting from the brain-lobes just now especially mentioned, there is a double apparatus which can hardly be treated of in conjunction with the sense organs, because its sensory functions have not been sufficiently made out, and which will therefore rather be considered along with the brain and central nervous system. This apparatus is usually known under the name of the lateral organs. To it belong (*a*) superficial grooves or deeper slits situated on the integument near the tip of the head, (*b*) nerve lobes in immediate connexion with the nervous tissue of the brain, and (*c*) ciliated ducts penetrating into the latter and communicating with the former. Embryology shows that originally these different parts are separately started, and only ultimately become united into one. Two lateral outgrowths of the foremost portion of the œsophagus, afterwards becoming constricted off, as well as two ingrowths from the epiblast, contribute towards its formation, at least as far as both Hoplo- and Schizonemertines are concerned. As to the *Palæonemertea*, their embryology has not yet been studied, and in the most primitive genus, *Carinella*, we do not find any lateral organs answering to the description above given. What we do find is a slight transverse furrow on each side of the head, close to the tip, but the most careful examination of sections made through the tissues of the head and brain shows the absence of any further apparatus comparable to that described above. Only in one species, *Carinella inexpectata*, a step in advance has been made, in so far as in connexion with the furrow just mentioned, which is here also somewhat more complicated in its arrangement, a ciliated tube leads into the brain, there to end blindly amidst the nerve-cells. No other intermediate stages have as yet been noticed between this arrangement and that of the *Schizonemertea*, in which a separate posterior brain-lobe receives a similar ciliated canal, and in which the œsophageal outgrowths have made their appearance and are coalesced with the nerve-tissue in the organ of the adult animal. The histological elements of this portion remain distinct both by transmitted light and in actual sections.

These posterior brain-lobes, which in all Schizonemertines are in direct continuity of tissue with the upper pair of principal lobes, cease to have this intimate connexion in the *Hoplonemertea*; and, although still constituted of (1) a ciliated duct, opening out externally, (2) nervous tissue surrounding it, and (3) histological elements distinctly different from the nervous, and most probably directly derived from the œsophageal outgrowths, they are nevertheless here no longer constantly situated behind the upper brain-lobes and directly connected with them, but are found sometimes behind, sometimes beside, and sometimes before the brain-lobes. Furthermore, they are here severed from the principal lobes and connected with them by one or more rather thick strings of nerve-fibres. In some cases, especially when the lobes lie before the brain, their distance from it, as well as the length of these nervous connexions, has considerably increased.

With the significance of these parts we are still insufficiently acquainted. There appear to be analogous organs amongst Platyelminthes, but a careful comparative study is wanted. A partial comparison has been hazarded (8) with the anterior œsophageal outgrowths in *Balanoglossus* and *Amphioxus*, and for the Schizonemertines arguments have been adduced (6) to prove that here they have the physiological significance of a special respiratory apparatus for the central nervous tissue, which in all these forms is strongly charged with hæmoglobin. The hæmoglobin would, by its pre-eminent properties of fixing oxygen, serve to furnish the nerve system, which more than any other requires a constant supply, with the necessary oxygen. Such could hardly be obtained in any other way by those worms that have no special respiratory apparatus or delicately ramifying blood-vessels, and that live in mud and under stones, where the natural supply of freshly oxygenated sea-water is practically limited. Whether in the Hoplonemertines, where the blood fluid is often provided with hæmoglobiniferous disks, the chief functions of the side organs may not rather be a sensory one must be further investigated.

The exterior opening of the duct has been several times alluded to. In the Hoplonemertines it is generally situated towards the middle of a lateral transverse groove on either side of the head, as was noticed for *Carinella*, and as is also present in *Polia*. Generally a row of shorter grooves perpendicular to the first, and similarly provided with strong cilia, enlarges the surface of these furrows (fig. 14). In *Valencinia* there is nothing but a circular opening without furrow. In all Schizonemertines there is on each side of the head a longitudinal slit of varying length but generally considerable depth, in the bottom of which the dark red brain is very plainly visible by transparency. These slits are continued into the ciliated duct, being at the same time themselves very strongly ciliated. In life they are commonly rhythmically opened and shut by a wavy movement. They are the head slits (cephalic fissures, "Kopfspalten") so characteristic of this subdivision (figs. 16 and 13).

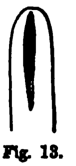

Fig. 13.

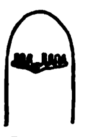

Fig. 14.

Figs. 13, 14.—Lateral views of head of a Schizonemertine (fig. 13) with longitudinal slit, and of a Hoplonemertine (fig. 14) with transverse groove and furrows.

With respect to the sense organs of the Nemertines, we find that eyes are of rather constant occurrence, although many Schizonemertines living in the mud appear to be blind. The more highly organized species have often very numerous eyes (*Amphiporus*, *Drepanophorus*), which are provided with a spherical refracting anterior portion, with a cellular "vitreous body," with a layer of delicate radially arranged rods, with an outer sheath of dark pigment, and with a separate nerve-twig each, springing from a common or double pair of branches which leave the brain as *n. optici*, for the innervation of the eyes. Besides these more highly differentiated organs of vision, more primitive eyes are present in others down to simple stellate pigment specks without any refracting apparatus.

Organs of hearing in the form of capsules containing otoliths have only been very rarely observed, apparently only in *Hoplonemertea*.

As to the organ of touch, the great sensitiveness of the body has already been noticed, as well as the probable primary significance of the proboscis. Small tufts of tactile hairs or papillæ are sometimes observed in small number at the tip of the head (11); sometimes longer hairs, apparently rather stiff, are seen on the surface, very sparingly distributed between the cilia, and hitherto only in a very limited number of small specimens. They may perhaps be considered as sensory.

(*e*) *Digestive System.*—The anterior opening, the mouth, is situated ventrally, close to the tip of the head and in front of the brain in the *Hoplonemertea*, somewhat more backward and behind the brain in the other Nemertines. In most Schizonemertines it is found to be an elongated slit with corrugated borders; in the

Hoplonemertines it is smaller and rounded; in *Malacobdella* and *Akrostomum* it, moreover, serves for the extrusion of the proboscis, which emerges by a separate dorsal opening just inside the mouth. The œsophagus is the anterior portion of the digestive canal; its walls are folded longitudinally, comparatively thick, and provided with longitudinal muscular fibres. Two layers are specially obvious in its walls,—the inner layer bordering the lumen being composed of smaller ciliated cells, the outer thicker one containing numerous granular cells and having a more glandular character. Outside the wall of the œsophagus a vascular space has been detected (11) which is in direct continuity with the longitudinal blood-vessels. In certain cases, however, the walls of the œsophagus appear to be very closely applied to the muscular body-wall, and this vascular space thereby considerably reduced.

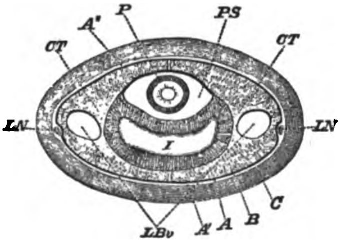

Fig. 15.

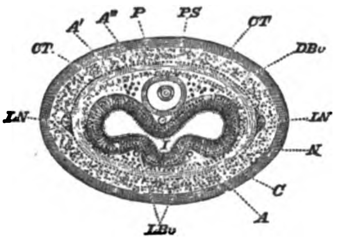

Fig. 16.

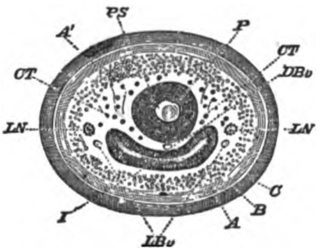

Fig. 17.

Figs. 15-17.—Diagrammatic sections to show disposition of internal organs in *Carinella* (*Palæonemertea*), fig. 15, *Schizonemertea*, fig. 16, and *Hoplonemertea*, fig. 17. *C*, cellular portion of integument; *B*, basement membrane; *A*, circular muscular layer; *A'*, longitudinal do.; *A''*, second circular (in *Carinella*); *A'''*, second longitudinal (in *Schizonemertea*); *N*, nervous layer; *LN*, lateral nerves; *PS*, cavity of proboscidian sheath (the sheath itself of varying thickness); *P*, proboscis; *I*, intestine; *LBv*, lateral blood-vessel; *DBv*, dorsal do.; *CT*, connective tissue.

The posterior portion of the intestine is specially characterized by the appearance of the intestinal diverticula horizontally and symmetrically placed right and left and opposite to each other. Sometimes this region, into which the œsophagus leads, stretches forwards under the œsophagus (Hoplonemertines) for a certain distance, anteriorly terminating by a cul-de-sac. Cases of asymmetry or irregularity in the arrangement of the cæca, though sometimes occurring, are not normal. At the tip of the tail, where the growth of the animal takes place, the cæca are always eminently regular. So they are throughout the whole body in most of the Hoplonemertines. In *Carinella* they are generally deficient and the intestine straight; in young specimens of this species, however, they occur, though less regular and more in the form of incipient foldings by which the digestive surface is increased. The inner surface of the intestinal cæca is ciliated, the cæca themselves are sometimes—especially in the hindermost portion of the body—of a considerably smaller lumen than the intermediate genital spaces; sometimes, however, the reverse is the case, and in both cases it is the smaller lumen that appears enclosed between and suspended by the transverse fibres constituting the muscular dissepiments above mentioned.

The anus is situated terminally, the muscular body-wall through which the intestine must find its way outwards probably acting in this region the part of a sphincter. The lateral nerve stems mostly terminate on both sides in closest proximity to the anus; in certain species, however, they interfuse by a transverse connexion *above* the anus. The longitudinal blood-vessels do the same. The question has been raised whether the regular intestinal cæca of Nemertines might not be compared with those intestinal diverticula of the embryo *Amphioxus* which ultimately become the mesoblastic somites of the adult (8). This view would be a further extension of the views concerning the cœlom first propounded by Huxley.

(*f*) *Circulatory Apparatus.*—This consists of three longitudinal trunks, a median and two lateral ones. They are in direct connexion with each other both at the posterior and at the anterior end of the body. At the posterior end they communicate together by a ⊤-shaped connexion in a simple and uniform way. Anteriorly there is a certain amount of difference in the arrangement. Whereas in the Hoplonemertines an arrangement prevails as represented in fig. 18, the lateral stems in the Schizonemertines, while entirely uniform all through the posterior portion of the body, no longer individually exist in the œsophageal region, but here dissolve themselves into a network of vascular spaces surrounding this portion of the digestive tract (11). The median dorsal vessel, however, remains distinct, but instead of continuing its course beneath the proboscidian sheath it is first enclosed by the ventral musculature of this organ, and still farther forwards it even bulges out longitudinally into the cavity of the sheath. Anteriorly it finally communicates with the lacunæ just mentioned, which surround the œsophagus, bathe the posterior lobes of the brain, pass through the nerve ring together with the proboscidian sheath, and are generally continued in front of the brain as a lacunar space in the muscular tissue, one on each side.

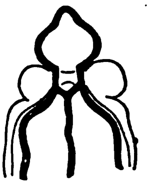

Fig. 18.—Diagram of the circulatory apparatus in the anterior body-region of a Hoplonemertine.

Special mention must be made of the delicate transverse vessels regularly connecting the longitudinal and the lateral ones. They are metamerically placed, and belong to the same metamer as the digestive cœca, thus alternating with the generative sacs. The blood fluid does not flow in any definite direction; its movements are largely influenced by those of the muscular body-wall. It is colourless, and contains definite corpuscles, which are round or elliptical, and in many Hoplonemertines are coloured red by hæmoglobin, being colourless in other species. The circulatory system of *Carinella* is considerably different, being more lacunar and less restricted to definite vascular channels. Two lateral longitudinal lacunæ form, so to say, the forerunners of the lateral vessels. A median longitudinal vessel and transverse connecting trunks have not as yet been detected. There are large lacunæ in the head in front of the ganglia.

(*g*) *Nephridia.*—Although these organs were already very well known to Max Schultze (14), their presence in Nemertines was repeatedly and seriously disputed until Von Kennel (10) definitely proved their existence and gave details concerning their histology. With the exception of a few genera where they have not as yet been discovered (*Carinella*), one pair of nephridia appears to be very generally present. They essentially consist of a complex coiled tube, one on each side of the œsophagus (fig. 1), communicating with the exterior by a duct piercing the body-wall. The two openings of the nephridia are situated sometimes more towards the ventral, at other times more towards the dorsal side. Even in the larger Schizonemertines these pores are only a few millimetres behind the mouth region. Internal funnel-shaped openings, although sought for, have as yet not been detected. The coiled tubes extend both forwards and backwards of the external opening, by far the greater portion being situated backwards. The anterior coils reach forwards till in the immediate vicinity of the posterior brain-lobes. The coils are tubiform, with an internal lumen, only one layer of rather large cells constituting the walls. These cells are ciliated; in some transparent species the internal ciliary movement can be observed during life. In transverse sections the nephridia can be shown to be generally situated in the region limited by (1) the proboscidian sheath, (2) the upper wall of the intestine, (3) the muscular body-wall. No trace of nephridia is found posterior to the œsophagus.

(*h*) *Generative System.*—In the Nemertines the sexes are separate, with only very few exceptions (12) (*Tetrastemma hermaphroditica*, Marion). The generative products are contained in separate pouches placed metamerically in the way noticed above in treating of the digestive system. They are conveyed outwards along narrow canals, one pair for each metamer piercing the muscular body-wall, and visible on the outside in mature individuals as minute light-coloured specks. The ova and spermatozoa, when mature, present no peculiarities. As the ova are in many species deposited in a gelatinous tube secreted by the body-walls, in which they are arranged (three or more together) in flask-shaped cavities, impregnation must probably take place either before or at the very moment of their being deposited. The exact mode has not yet been noticed. Another point not yet sufficiently settled is the oogenesis in Nemertines. In several cases the ova appear to originate directly as the lining of the generative pouches, but the exact part which the mesoblastic connective tissue plays, both with regard to these pouches and to the generative products themselves, remains yet to be settled.

Prosorhochmus claparedii is a viviparous form.

Development.—The embryology of the Nemertines offers some very remarkable peculiarities. Our knowledge of the development of the most primitive forms is very scanty. Of that of *Carinella* absolutely nothing is known. On *Cephalothrix* we have observations, in certain respects contradictory. Both *Schizo-* and *Hoplonemertea* have been more exhaustively studied, the first, as was noticed above, being characterized by peculiar larval forms, the second developing without metamorphosis.

The larva of *Cerebratulus* is called the pilidium. In exterior shape it resembles a helmet with spike and ear-lobes, the spike being a strong and long flagellum or a tuft of long cilia, the ear-lobes lateral ciliated appendages (fig. 19). It encloses the primitive alimentary tract. Two pairs of invaginations of the skin, which originally are called the prostomial and metastomial disks, grow round the intestine, finally fuse together, and form the skin and muscular body-wall of the future Nemertine, which afterwards becomes ciliated, frees itself from the pilidium investment, and develops into the adult worm without further metamorphosis (2, 13).

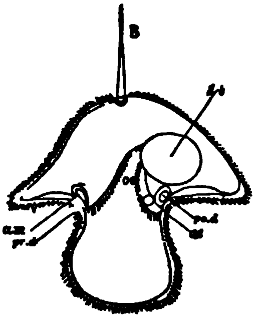

Fig. 19.—Pilidium-larva. *B*, bunch of cilia or flagellum; *œ*, œsophagus; *st*, stomach; *os*, œsophageal outgrowth for lateral organ; *am*, amnion; *pr.d.*, prostomial disk; *po.d.*, metastomial disk.

The eggs of these species are not enveloped by such massive gelatinous strings as are those of the genus *Lineus*. In the latter we find the young Nemertines crawling about after a period of from six to eight weeks, and probably feeding upon a portion of this gelatinous substance, which is found to diminish in bulk. In accordance with these more sedentary habits during the first phases of life, the characteristic pilidium larva, which is so eminently adapted for a pelagic existence, appears to have been reduced to a close-fitting exterior layer of cells, which is stripped off after the definite body-wall of the Nemertine has similarly originated out of four ingrowths from the primary epiblast. To this reduced and sedentary pilidium the name of "larva of Desor" has been given (1).

In the *Hoplonemertea*, as far as they have been investigated, a direct development without metamorphosis has been observed. It appears probable that this is only a further simplification of the more complicated metamorphosis described above.

As to the development of the different organs, there is still much that remains doubtful. The hypoblast in some forms originates by invagination, in others by delamination. The proboscis is an invagination from the epiblast; the proboscidian sheath appears in the mesoblast, but is perhaps originally derived from the hypoblast. The origin of the lateral organs has already been noticed; that of the nerve system is essentially epiblastic.

Literature.—(1) J. Barrois, "Recherches sur l'embryologie des Némertes," *Annales des Sc. Naturelles*, vi., 1877; (2) O. Bütschli, "Einige Bemerkungen zur Metamorphose des Pilidium," *Archiv für Naturgeschichte*, 1878; (3) L. von Graff, *Monographie der Turbellarien*, 1882; (4) A. A. W. Hubrecht, "Untersuchungen über Nemertinen a. d. Golf von Neapel," *Niederl. Archiv für Zoologie*, ii.; (5) Id., "The Genera of European Nemerteans critically revised," *Notes from the Leyden Museum*, 1879; (6) Id., "Zur Anatomie u. Physiologie d. Nervensystems d. Nemertinen," *Verh. Kon. Akad. v. Wetensch.*, Amsterdam, 1880, vol. xx.; (7) Id., "The Peripheral Nervous System of the Palæo- and Schizonemertini, one of the layers of the body-wall," *Quart. Journal of Micr. Science*, vol. xx.; (8) Id., "On the Ancestral Forms of the Chordata," *Ib.*, July 1883; (9) W. Keferstein, "Untersuchungen über niedere Seethiere," *Zeitschr. f. wissensch. Zool.*, vol. xii., 1863; (10) J. von Kennel, "Beiträge zur Kenntniss der Nemertinen," *Arbeiten a. d. zool.-zoot. Instit.*, ii., Würzburg, 1878; (11) W. C. MacIntosh, *A Monograph of British Annelida: I. Nemerteans*, Ray Society, 1873–74; (12) A. F. Marion, "Recherches sur les animaux inférieurs du Golfe de Marseille," *Ann. des Sc. Nat.*, 1873; (13) E. Metschnikoff, "Studien über die Entwickelung der Echinodermen und Nemertinen," *Mém. de l'Acad. Imp. de St. Petersb.*, xiv., 1869; (14) Max Schultze, *Beiträge zur Naturgeschichte der Turbellarien*, Greifswald, 1851, and *Zeitschr. für wissensch. Zool.*, iv., 1852. (A. A. W. H.)

NEMESIANUS, a Roman poet who flourished about 283 B.C. His full name was Marcus Aurelius Nemesianus Olympius, and he is called a Carthaginian. He was an admired and popular poet at the court of the Roman emperor Carus. He wrote poems on the arts of fishing and hunting, but only a fragment of the latter, 325 hexameter lines, has been preserved. It is neatly expressed in good Latin. Some other extant fragments are ascribed without good authority to this poet.

Editio princeps, Venice, 1534. The *Cynegetica* of Gratius Faliscus and Nemesianus are united in the edition of R. Stern (Halle, 1832), and are added to M. Haupt's edition of Ovid's *Halieutica* (Leipsic, 1838).

NEMESIS occasionally appears as a Greek goddess. At Rhamnus in Attica she had a famous temple, and there was an Attic legend that Helen was the daughter of Nemesis. The Attic goddess was perhaps a form of Aphrodite, who sometimes bears the epithet Nemesis. In Smyrna and the neighbouring Temnos we find a pair of goddesses of the name. They are represented on coins of these cities, and it is said that they appeared in a dream to Alexander the Great, bidding him rebuild Smyrna. They are certainly connected with the cultus of Meter Sipylene or Cybele, the tutelary goddess of Smyrna and all the country round Mount Sipylus. In general Nemesis appears as a personification of that righteous indignation which punishes the arrogant and tyrannical abuse of prosperity. Often the idea is carried much further than this; in Herodotus especially the divine Nemesis is offended by all great prosperity among men, quite irrespective of the moral guilt of the persons concerned.

NEMESIUS, a Christian philosopher, author of a treatise *On Human Nature*, was, according to the title of his book, bishop of Emesa (in Syria); of his life nothing further is known, and even his date is uncertain, but most probably he flourished towards the close of the 4th century. Theologically, and especially as regards his christology, he is usually claimed by the orthodox; but his views as to the pre-existence of the soul and a modified metempsychosis are more Platonic than catholic, and his leaning towards the doctrine of the world's eternity is difficult to reconcile with what, afterwards at least, came to be the teaching of the church. One or two of his physiological expositions have occasionally been quoted, very irrelevantly, to show that Harvey's discovery of the circulation of the blood had been anticipated at that early age. Nemesius is frequently quoted by later writers of the Eastern Church, such as Joh. Damascenus. His writings have sometimes been attributed to Gregory of Nyssa. The *editio princeps* of the περὶ φύσεως ἀνθρώπου appeared at Antwerp in 1565; the work has more than once been re-edited and translated.

NENAGH, a market and assize town of county Tipperary, province of Munster, Ireland, is finely situated in a rich though hilly country near the river Nenagh, 29 miles north of Tipperary and 95 south-west of Dublin. The principal buildings are the court-house, the barracks, and the market-house. Of the old castle, "Nenagh Round," dating from the time of King John, there still exists the circular donjon or keep. There are no remains of the hospital founded in 1200 for Austin canons, nor of the Franciscan friary, founded in the reign of Henry III. and one of the richest religious houses in Ireland. The town depends chiefly on agriculture, and there is an important butter and corn market. The population in 1871 was 5696, and in 1881 it was 5422.

Nenagh was one of the ancient manors of the Butlers, who received for it the grant of a fair from Henry VIII. In 1550 the town and friary were burned by O'Carroll. In 1641 the town was taken by Owen Roe O'Nial, but shortly afterwards it was recaptured by Lord Inchiquin. It surrendered to Ireton in 1651, and was burned by Sarsfield in 1688.

NENNIUS, the supposed author of a *Historia Britonum*, which, commencing with a description of Britain, gives the mythical origin of the Britons and Scots and an account of the Roman occupation and of the reign of Vortigern, describes the successive settlements of the Saxons, and concludes with a narrative of the twelve battles in which King Arthur, in the 6th century, is said to have defeated the Saxons. The work is evidently the production of a Cymric or ancient Welsh writer; but the claim of Nennius to be regarded as the author is derived solely from two prologues, where he is described as the disciple of one Elvodugus or Elbotus, whom we may perhaps identify with Elbodus, bishop of North Wales, who died in 809, and whose notable innovation of the introduction of the Roman cycle in keeping Easter "Nennius" appears to have followed. Of the above prologues (which differ considerably) one is preserved in the MS. in the cathedral library at Durham, and in this it is stated that the *History* was written in the year 858, which year is also spoken of as being the twenty-fourth of the reign of Mervin, king of the Britons. But in the work itself (chap. xvi.) it is stated that between the arrival of the Saxons (assigned in chap. xxxi. to the year 447) and the fourth year of the reign of Mervin, four hundred and twenty-nine years elapsed. Thus the twenty-fourth year of Mervin becomes coincident with the year 896, or thirty-eight years later than the date assigned by the prologue. This discrepancy, taken in conjunction with the following facts, viz., that both the above prologues are much superior in style and diction to the barbarous Latin of the *Historia* itself, that the MSS. prior to the 13th century are either altogether silent respecting the authorship or ascribe it to Gildas, and that Henry of Huntingdon, in his *Historia Anglorum* (chap. xviii.), after quoting verbatim the account above referred to of King Arthur's battles, expressly speaks of it as taken from Gildas,—has led the most competent critics to conclude that the real author of the *Historia Britonum* must be looked upon as unknown. The original text is likewise a matter of doubt, the work having evidently been subjected to several recensions, in which the earliest version can no longer be traced.

As an historical composition the *Historia Britonum* has but little value. M. de la Borderie lays it down as a canon that, when the work is found to contain an unsupported statement, which at the same time does not clash with the authority of Bede, Gildas, or any other received authority, such statement may, after due examination, be accepted; but if at variance with those authorities, it should be rejected. Much of the narrative, however, is evidently the offspring of invention and imagination; while the Cymric superstition respecting the mysterious importance attaching to the number three and its multiples induces the writer habitually to represent the more striking events and phenomena as occurring in a succession of triads. The peculiar value of the *Historia* consists in the illustration it affords of the Welsh mythology and those traditions of the race which took the place of history; it is in fact the earliest collection of those British legends which gave birth to the romances of Brut, Merlin, King Arthur, and the whole cycle of epics associated with the Knights of the Round Table. This element is discussed at some length by San Marte (A. Schulz) in the preface to his edition of Gildas and Nennius (Berlin, 1844). The best edition of the text is that edited by the Rev. Joseph Stevenson for the English Historical Society (1838). The most recent criticism on both the work and the manuscript sources will be found in *L Historia Britonum*, by M. de la Borderie (Paris, 1883).

NEOPHYTE (*νεόφυτος*, "newly planted") was the designation applied to newly baptized persons in the ancient church. These usually wore the white garments which they received at their admission to the church (see BAPTISM, vol. iii. p. 351) during the whole of the following week, but the application of the name did not necessarily cease at the close of that period. A special employment of the word was to denote one who, not having duly passed through the inferior grades, was in view of 1 Tim. iii. 6 considered canonically unfit to be consecrated a bishop.

NEOPLATONISM.—*Historical Position and Significance.*—The political history of the ancient world closes with the formation, under Diocletian and Constantine, of a universal state bearing the cast of Oriental as well as Græco-Roman civilization. The history of ancient philosophy ends in like manner with a universal philosophy which appropriated elements of almost all the earlier systems, and worked up the results of Eastern and Western culture. And, just as the Byzantine Roman empire was at once the supreme effort of the old world and the outcome of its exhaustion, so Neoplatonism is in one aspect the consummation, in another the collapse, of ancient philosophy. Never before in Greek or Roman speculation had the consciousness of man's dignity and superiority to nature found such adequate expression; and never before had real science and pure knowledge been so undervalued and despised by the leaders of culture as they were by the Neoplatonists. Judged from the standpoint of pure science, or the empirical investigation of the universe, philosophy passed its meridian in Plato and Aristotle, declined in the post-Aristotelian systems, and set in the darkness of Neoplatonism. But, from the religious and moral point of view, it must be affirmed that the ethical "mood" which Neoplatonism endeavoured to create and maintain is the highest and purest ever reached by antiquity. That this attainment should have been made at the expense of science was inevitable. On the level of the polytheistic nature-religions physical science must either subjugate and destroy religion, or be subjugated and destroyed by it. Religion and morality, however, are found to be the stronger forces; and philosophy, standing midway between these and physical science, may waver for a little, but ultimately it yields to the greater power. The conflict with empirical knowledge is rendered inevitable by the fact that within the sphere of nature-religion the ethical is itself, without any misgiving, conceived as a higher order of the natural. The higher "physics"—for as such we must here regard religious ethics—must dislodge the lower, in order to maintain its own ground. Philosophy must cease to exist as science, in order that man's assertion of the supernatural value of his person and his life may receive full recognition.

It is a proof of the strength of the moral instincts of mankind that the only phase of culture which we can survey in all its stages from beginning to end culminated, not in materialism, but in the boldest idealism. This idealism, however, is also in its way a mark of intellectual bankruptcy. Contempt for reason and science leads in the end to barbarism,—its necessary consequence being the rudest superstition, and sheer helplessness in the presence of all sorts of delusion. As a matter of fact, barbarism did break out after the flower had fallen from Neoplatonism. The philosophers themselves, no doubt, still lived on the knowledge they repudiated; but the masses were trained to a superstition with which the Christian church, as the executor of Neoplatonism, had to reckon and contend. By a fortunate coincidence, at the very moment when this bankruptcy of the old culture—its reversion to barbarism—must have become apparent, the stage of history was occupied by barbaric peoples, with whom the work of the past thousand years went for nothing. This has obscured the fact, which is nevertheless obvious enough to a keener scrutiny, that the inner history of antiquity, ending as it did in despair of this world, must in any event have seen a recurrence of barbarism. The present world was a thing that men would neither enjoy nor master nor study. A new world was discovered, for the sake of which everything else was abandoned; to make sure of that world insight and intelligence were freely sacrificed; and, in the light that streamed from beyond, the absurdities of the present became wisdom, and its wisdom became foolishness.

Such is Neoplatonism. The pre-Socratic philosophy took its stand on natural science, to the exclusion of ethics and religion. The systems of Plato and Aristotle sought to adjust the rival claims of physics and ethics (although the supremacy of the latter was already acknowledged); but the popular religions were thrown overboard. The post-Aristotelian philosophy in all its branches makes withdrawal from the objective world its starting point. It might seem, indeed, that Stoicism indicates a falling off from Plato and Aristotle towards materialism, but the ethical dualism, which was the ruling tendency of the Stoa, could not long endure its materialistic physics, and took refuge in the metaphysical dualism of the Platonists. But this originated no permanent philosophical creation. From one-sided Platonism issued the various forms of scepticism, the attempt to undermine the trustworthiness of empirical knowledge. Neoplatonism, coming last, has borrowed something from all the schools. First, it stands in the line of post-Aristotelian systems; it is, in fact, as a subjective philosophy, their logical completion. Secondly, it is founded on scepticism; for it has neither interest in, nor reliance upon, empirical knowledge. Thirdly, it can justly claim the honour of Plato's name, since it expressly goes back to him for its metaphysics, directly combating those of the Stoa. Yet even on this point it has learned something from the Stoics; the Neoplatonic conception of the action of the Deity on the world and of the essence and origin of matter can only be explained by reference to the dynamic pantheism of the Stoa. Fourthly, the study of Aristotle also exercised an influence on Neoplatonism. This appears, not only in its philosophical method, but also—though less prominently—in its metaphysic. And, fifthly, Neoplatonism adopted the ethics of Stoicism; although it was found necessary to supplement them by a still higher conception of the functions of the spirit.

Thus, with the exception of Epicureanism—which was always treated as the mortal enemy of Neoplatonism—there is no outstanding earlier system which did not contribute something to the new philosophy. And yet Neoplatonism cannot be described as an eclectic system, in the ordinary sense of the word. For, in the first place, it is dominated by one all-pervading interest—the religious; and in the second place, it has introduced a new first principle into philosophy, viz., the supra-rational, that which lies beyond reason and beyond reality. This principle is not to be identified with the "idea" of Plato or the "form" of Aristotle. For, as Zeller rightly says, "in Plato and Aristotle the distinction of the sensible from the intelligible is the strongest affirmation of the validity of the thinking process. It is only sense perception, and the existence perceived by the senses, whose relative unreality is presupposed; of a higher region of spiritual life, lying beyond the notion and beyond thought, there is no hint. In Neoplatonism, on the contrary, it is precisely this 'supra-rational' which is held to be the final goal of all effort and the ultimate ground of all being. Rational cognition is only an intermediate stage between sense perception and supra-rational intuition; the forms of the intellect are not the highest and ultimate reality, but only the channels through which the activity of the formless primeval being flows into the world. This theory, therefore, proceeds, not merely on the denial of the reality of sensible existence and sensible presentations, but upon absolute doubt—a straining after something behind the sum total of reality. The highest intelligible is not that which constitutes the actual contents of reason, but simply what man postulates and reaches after as the unknowable ground of his thought." Neoplatonism perceived that neither sense perception nor rational cognition is a sufficient basis or justification for religious ethics; consequently it broke away from rationalistic ethics as decidedly as from utilitarian morality. But, just because it renounced perception and reason, it had to find out a new world and a new spiritual function, in order first to establish the existence of what it desiderated, and then to realize and describe what it had proved to exist. Man, however, cannot add to his psychological endowment. He is hemmed in by walls of iron; and, if he will not allow his thought to be determined by experience, he falls a victim to his imagination. In other words, thought, which will not stop, takes to mythology; and in the place of reason we have superstition. A dumb astonishment in the presence of the incomprehensible passes for the highest aim of mental activity; artificially excited ecstasies are prized above all the conscious acts of the spirit. Still, as we cannot allow every fancy of the subjective reason to assert itself, we require some new and potent principle to keep the imagination within bounds. This is found in the authority of a sound tradition. Such authority must be superhuman, otherwise it can have no claim on our respect; it must, therefore, be divine. The highest sphere of knowledge—the supra-rational—as well as the very possibility of knowledge, must depend on divine communications,—that is, on revelations. In one word, philosophy as represented by Neoplatonism, its sole interest being a religious interest, and its highest object the supra-rational, must be a philosophy of revelation. This is not a prominent feature in Plotinus or his immediate disciples, who still exhibit full confidence in the subjective presuppositions of their philosophy. But the later adherents of the school did not possess this confidence;[1] they based their philosophy on revelations of the Deity, and they found these in the religious traditions and rites of all nations. The Stoics had taught them to overstep the political boundaries of states and nationalities, and rise from the Hellenic to a universal human consciousness. Through all history the spirit of God has breathed; everywhere we discover the traces of His revelation. The older any religious tradition or mode of worship is the more venerable is it, the richer in divine ideas. Hence the ancient religions of the East had a peculiar interest for the Neoplatonist. In the interpretation of myths Neoplatonism followed the allegorical method, as practised especially by the Stoa; but the importance it attached to the spiritualized myths was unknown to the Stoic philosophers. The latter interpreted the myths and were done with them; the later Neoplatonists treated them as the proper material and the secure foundation of philosophy. Neoplatonism claimed to be not merely the absolute philosophy, the keystone of all previous systems, but also the absolute religion, reinvigorating and transforming all previous religions. It contemplated a restoration of all the religions of antiquity, by allowing each to retain its traditional forms, and at the same time making each a vehicle for the religious attitude and the religious truth embraced in Neoplatonism; while every form of ritual was to become a stepping-stone to a high morality worthy of mankind. In short, Neoplatonism seizes on the aspiration of the human soul after a higher life, and treats this psychological fact as the key to the interpretation of the universe. Hence the existing religions, after being refined and spiritualized, were made the basis of philosophy.

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[1] Porphyry wrote a book, *περὶ τῆς ἐκ λογίων φιλοσοφίας*, but this was before he became a pupil of Plotinus; as a philosopher he was independent of the *λόγια*.

Neoplatonism thus represents a stage in the history of religion; indeed this is precisely where its historical importance lies. In the progress of science and enlightenment it has no positive significance, except as a necessary transition which the race had to make in order to get rid of nature-religion, and that undervaluing of the spiritual life which formed an insuperable obstacle to the advance of human knowledge. Neoplatonism, however, failed as signally in its religious enterprise as it did in its philosophical. While seeking to perfect ancient philosophy, it really extinguished it; and in like manner its attempted reconstruction of ancient religions only resulted in their destruction. For in requiring these religions to impart certain prescribed religious truths, and to inculcate the highest moral tone, it burdened them with problems to which they were unequal, and under whose weight they were crushed. And further, by inviting them to loosen, though not exactly to dissolve, their political allegiance—the very thing that gave them stability—it removed the foundation on which they rested. But might it not then have placed them on a broader and firmer foundation? Was not the universal empire of Rome ready at hand, and might not the new religion have stood to it in the same relation of dependence which the earlier religions had held to the smaller nations and states? So one might imagine, but in truth it was no longer possible. It is true that the political and spiritual histories of the peoples on the Mediterranean run in parallel lines, the one leading up to the universal monarchy of Rome, the other leading up to monotheism and universal human morality. But the spiritual development had shot far ahead of the political; even the Stoa occupied a height far beyond the reach of anything in the political sphere. It is also true that Neoplatonism sought to come to an understanding with the Byzantine Roman empire; the noble Julian perished in the pursuit of this project. But even before his day the shrewder Neoplatonists had seen that their lofty religious philosophy could not stoop to an alliance with the despotic world-empire, because it could not come in contact with the world at all. To Neoplatonism political affairs are at bottom as indifferent as all other earthly things. The idealism of the new philosophy was too heavenly to be naturalised in a degenerate, tyrannical, and effete institution like the Byzantine empire, which stood more in need of despotic and unscrupulous police officials than of high-minded philosophers. Important and instructive, therefore, as are the attempts made from time to time by the state and by individual philosophers to unite Neoplatonism and the universal monarchy, their failure was a foregone conclusion.

There is one other question which we are called upon to raise here. Why did not Neoplatonism set up an independent religious community? It had entirely remodelled the ancient religions, with a view to their restoration; it had tried to fill the old unsophisticated worships with profound philosophical ideas, and to make them the exponents of pure morality; why did it not address itself, in the last resort, to the creation of a religious society of its own? Why did it not provide for its mixed multitude of divinities by founding a church, destined to embrace all mankind, in which all the gods of all nations might be worshipped along with the one ineffable Deity? Why not? The answer to this question involves the answer to another—Why was Neoplatonism defeated by Christianity? Three essentials of a permanent religious foundation were wanting in Neoplatonism; they are admirably indicated in Augustine's *Confessions* (vii. 18–21). First, and chiefly, it wanted a religious founder; second, it could not tell how the state of inward peace and blessedness could become permanent; third, it had no means to win those who were not endowed with the speculative faculty. The philosophical discipline which it recommended for the attainment of the highest good was beyond the reach of the masses; and the way by which the masses could attain the highest good was a secret unknown to Neoplatonism. Thus it remained a school for the "wise and prudent"; and when Julian tried to enlist the sympathies of the common rude man for the doctrines and worship of this school, he was met with scorn and ridicule.

It is not as a philosophy, then, nor as a new religion, that Neoplatonism became a decisive factor in history, but, if one may use the expression, as a "mood." The instinctive certainty that there is a supreme good, lying beyond empirical experience, and yet not an intellectual good,—this feeling, and the accompanying conviction of the utter vanity of all earthly things, were produced and sustained by Neoplatonism. Only, it could not describe the nature of this highest good; and therefore it had to abandon itself to imagination and æsthetic impressions. It was driven to explore "mysterious inward paths," which after all led nowhere. It changed thought into an emotional dream; it plunged into the ocean of sentiment; it treated the old world of fable as the reflexion of a higher reality, and transformed reality into poetry; and after all these expedients, to borrow a phrase of Augustine's, it only saw afar off the land of its desire. It dashed this world in pieces, and then had nothing left but an indescribable "something,"—a faint glimmer from some world beyond.

And yet the influence of Neoplatonism on the history of our ethical culture has been, and still is, immeasurable,—not merely because it has refined and strengthened our emotions and susceptibilities, nor merely because it wove the fine veil with which all of us, whether religious or irreligious, cover the Gorgon face of brute reality, but above all because it begot the consciousness that the only blessedness which can satisfy the heart must be sought higher even than the sphere of reason. That man shall not live by bread alone, the world had learned before Neoplatonism; but Neoplatonism has enforced the deeper truth—a truth which the older philosophy had missed—that man shall not live by knowledge alone. And, besides the propædeutic importance which thus belongs to it, another fact has to be taken into account in estimating the influence of Neoplatonism. It is to this day the nursery of that whole type of devotion which affects renunciation of the world, which strives after an ideal, without the strength to rise above æsthetic impressions, and is never able to form a clear conception of the object of its own aspiration.

Origin.—As forerunners of Neoplatonism we may regard, on the one hand, those Stoics who accepted the Platonic distinction between the sensible world and the intelligible, and, on the other hand, the so-called Neo-pythagoreans and religious philosophers like Plutarch of Chæronea and especially Numenius of Apamea. But these cannot be considered the actual progenitors of Neoplatonism; their philosophic method is quite elementary as compared with the Neoplatonic, their fundamental principles are uncertain, and unbounded deference is still paid to the authority of Plato. The Jewish and Christian thinkers of the first two centuries approach considerably nearer than Numenius to the later Neoplatonism.[1] Here we have Philo, to begin with. Philo, who translated the Old Testament religion into the terms of Hellenic thought, holds as an inference from his theory of revelation that the divine Supreme Being is "supra-rational," that He can be reached only through "ecstasy," and that the oracles of God supply the material of moral and religious knowledge. The religious ethics of Philo—a compound of Stoic, Platonic, and Neopythagorean elements—already bear the peculiar stamp which we recognize in Neoplatonism. While his system assigns the supremacy to Greek philosophy over the national religion of Israel, it exacts from the former, as a sort of tribute to the latter, the recognition of the elevation of God above the province of reason. The claim of positive religion to be something more than the intellectual apprehension of the reason in the universe is thus acknowledged. Religious syncretism is also a feature of Philo's system, but it differs essentially from what we find in later Neoplatonism. For Philo pays no respect to any cultus except the Jewish; and he believed that all the fragments of truth to be found amongst Greeks and Romans had been borrowed from the books of Moses. The earliest Christian philosophers, particularly Justin and Athenagoras, likewise prepared the way for the speculations of the Neoplatonists,—partly by their attempts to connect Christianity with Stoicism and Platonism, partly by their ambition to exhibit Christianity as "hyperplatonic." In the introduction to his *Dialogue with Trypho*, Justin follows a method which bears a striking resemblance to the later method of Neoplatonism: he seeks to base the Christian knowledge of God—that is, the knowledge of the truth—on Platonism, Scepticism, and "Revelation." A still more remarkable parallel to the later Neoplatonism is afforded by the Christian Gnostics of Alexandria, especially Valentinus and the followers of Basilides.[1] Like the Neoplatonists, the Basilidians believed, not in an emanation from the Godhead, but in a dynamic manifestation of its activity. The same is true of Valentinus, who also placed an unnameable being at the apex of his system, and regarded matter, not as a second principle, but as a product of the one divine principle. It must be added that the dependence of Basilides and Valentinus on Zeno and Plato is beyond dispute. But the method observed by these Gnostics in thinking out the plan and the history of the universe is by no means thoroughgoing. Ancient myths are admitted without undergoing analysis; the most naive realism alternates with daring efforts at spiritualizing. Philosophically considered, therefore, the Gnostic systems are very unlike the rigorous self-consistency of Neoplatonism; although they certainly contain almost all the elements which enter into the Neoplatonic theory of the universe.

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[1] The resemblance would probably be still more apparent if we thoroughly understood the development of Christianity at Alexandria in the 2d century; but unfortunately we have only very meagre fragments to guide us here.

But were the oldest Neoplatonists really acquainted with the speculations of Philo, or Justin, or Valentinus, or Basilides? Did they know the Oriental religions, Judaism and Christianity in particular? And, if so, did they really derive anything from these sources?

To these questions we cannot, unfortunately, give decided, still less definite and precise, answers. Since Neoplatonism originated in Alexandria, where Oriental modes of worship were accessible to every one, and since the Jewish philosophy had also taken its place in the literary circles of Alexandria, we may safely assume that even the earliest of the Neoplatonists possessed an acquaintance with Judaism and Christianity. But if we search Plotinus for evidence of any actual influence of Jewish and Christian philosophy, we search in vain; and the existence of any such influence is all the more unlikely because it is only the later Neoplatonism that offers striking and deep-rooted parallels to Philo and the Gnostics. The Philonic and Gnostic philosophies thus appear to be merely an historical anticipation of the Neoplatonic, without any real connexion. Nor is there anything mysterious in such an anticipation. It simply means that a certain religious and philosophical tendency, which grew up slowly on Greek soil, was already implanted in those who occupied the vantage-ground of a revealed religion of redemption. We have to come down to Iamblichus and his school before we find complete correspondence with the Christian Gnosticism of the 2d century; that is to say, it is only in the 4th century that Greek philosophy in its proper development reaches the stage at which certain Greek philosophers who had embraced Christianity had arrived in the 2d century. The influence of Christianity—whether Gnostic or Catholic—on Neoplatonism was at no time very considerable, although individual Neoplatonists, after Amelius, used Christian texts as oracles, and put on record their admiration for Christ.

History and Doctrines.—The founder of the Neoplatonic school in Alexandria is supposed to have been Ammonius Saccas (*ob. c.* 245 A.D.), who is said to have been a Christian by birth, and to have relapsed to heathenism. As he has left no written works behind him, it is impossible to criticize his teaching. He communicated to his pupils an admiration for Plato, and set them to work at the reconciliation of Plato and Aristotle. The most distinguished of his disciples were Origen the Christian, another Origen—a heathen, Longinus, Herennius, and, the greatest of all, Plotinus.[2]

The *Enneads* of Plotinus are the primary and classical document of Neoplatonism. The doctrine of Plotinus is mysticism, and like all mysticism it consists of two main divisions. The first or theoretical part deals with the high origin of the human soul, and shows how it has departed from its first estate. In the second or practical part the way is pointed out by which the soul may again return to the Eternal and Supreme. Since the soul in its longings reaches forth beyond all sensible things, beyond the world of ideas even, it follows that the highest being must be something supra-rational. The system thus embraces three heads—(1) the primeval Being, (2) the ideal world and the soul, (3) the phenomenal world. We may also, however, in accordance with the views of Plotinus, divide thus:—(A) the invisible world—(1) the primeval Being, (2) the ideal world, (3) the soul; (B) the phenomenal world.

The primeval Being is, as opposed to the many, the One; as opposed to the finite, the Infinite, the unlimited. It is the source of all life, and therefore absolute causality and the only real existence. It is, moreover, the Good, in so far as all finite things have their purpose in it, and ought to flow back to it. But one cannot attach moral attributes to the original Being itself, because these would imply limitation. It has no attributes of any kind; it is being without magnitude, without life, without thought; in strict propriety, indeed, we ought not to speak of it as existing; it is "above existence," "above goodness." It is also active force without a substratum; as active force the primeval Being is perpetually producing something else, without alteration, or motion, or diminution of itself. This production is not a physical process, but an emission of force; and, since the product has real existence only in virtue of the original existence working in it, Neoplatonism may be described as a species of dynamic pantheism. Directly or indirectly, everything is brought forth by the "One." In it all things, so far as they have being, are divine, and God is all in all. Derived existence, however, is not like the original Being itself, but is subject to a law of diminishing completeness. It is indeed an image and reflexion of the first Being; but the further the line of successive projections is prolonged the smaller is its share in the true existence. The totality of being may thus be conceived as a series of concentric circles, fading away towards the verge of non-existence, the force of the original Being in the outermost circle being a vanishing quantity. Each lower stage of being is united with the "One" by all the higher stages, and receives its share of reality only by transmission through them. All derived existence, however, has a drift towards, a longing for, the higher, and bends towards it so far as its nature will permit.

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[1] The dogmas of the Basilidians, as given by Hippolytus, read almost like passages from Neoplatonic works: *ἐπεὶ οὐδὲν ἦν, οὐχ ὕλη, οὐκ οὐσία, οὐκ ἀνούσιον, οὐχ ἁπλοῦν, οὐ σύνθετον, οὐκ ἀνόητον, οὐκ ἀναίσθητον, οὐκ ἄνθρωπος. . . . οὐκ ὢν θεὸς ἀνοήτως, ἀναισθήτως, ἀβούλως, ἀπροαιρέτως, ἀπαθῶς, ἀνεπιθυμήτως κόσμον ἠθέλησε ποιῆσαι . . . οὕτως οὐκ ὢν θεὸς ἐποίησε κόσμον οὐκ ὄντα ἐξ οὐκ ὄντων, καταβαλόμενος καὶ ὑποστήσας σπέρμα τι ἓν ἔχον πᾶσαν ἐν ἑαυτῷ τὴν τοῦ κόσμου πανσπερμίαν* (*Philos.*, vii. 20 *sq.*).

[2] Born at Lycopolis, in Egypt, in 205, Plotinus laboured from 244 onwards in Rome, where he gained many followers and admirers, amongst others the emperor Gallienus and his consort, and died in Lower Italy in 270. The writings of Plotinus were arranged by his pupil Porphyry, and published in six *Enneads*.

The original Being first of all throws out the nous, which is a perfect image of the One, and the archetype of all existing things. It is at once being and thought, ideal world and idea. As image, the nous corresponds perfectly to the One, but as derived it is entirely different. What Plotinus understands by the nous is the highest sphere accessible to the human mind (*κόσμος νοητός*), and, along with that, pure thought itself.

The image and product of the motionless nous is the soul, which, according to Plotinus is, like the nous, immaterial. Its relation to the nous is the same as that of the nous to the One. It stands between the nous and the phenomenal world, is permeated and illuminated by the former, but is also in contact with the latter. The nous is indivisible; the soul *may* preserve its unity and remain in the nous, but at the same time it has the power of uniting with the corporeal world, and thus being disintegrated. It therefore occupies an intermediate position. As a single soul (world-soul) it belongs in essence and destination to the intelligible world; but it also embraces innumerable individual souls; and these can either submit to be ruled by the nous, or turn aside to the sensual, and lose themselves in the finite.

Then the soul, a moving essence, generates the corporeal or phenomenal world. This world ought to be so pervaded by the soul that its various parts should remain in perfect harmony. Plotinus is no dualist, like the Christian Gnostics; he admires the beauty and splendour of the world. So long as idea governs matter, or the soul governs the body, the world is fair and good. It is an image—though a shadowy image—of the upper world, and the degrees of better and worse in it are essential to the harmony of the whole. But in the actual phenomenal world unity and harmony are replaced by strife and discord; the result is a conflict, a becoming and vanishing, an illusive existence. And the reason for this state of things is that bodies rest on a substratum of matter. Matter is the basework of each (*τὸ βάθος ἑκάστου ἡ ὕλη*); it is the dark principle, the indeterminate, that which has no qualities, the *μὴ ὄν*. Destitute of form and idea, it is evil; as capable of form it is neutral.

The human souls which have descended into corporeality are those which have allowed themselves to be ensnared by sensuality and overpowered by lust. They now seek to cut themselves loose from their true being; and, striving after independence, they assume a false existence. They must turn back from this; and, since they have not lost their freedom, a conversion is still possible.

Here, then, we enter upon the practical philosophy. Along the same road by which it descended the soul must retrace its steps back to the supreme Good. It must first of all return to itself. This is accomplished by the practice of virtue, which aims at likeness to God, and leads up to God. In the ethics of Plotinus all the older schemes of virtue are taken over, and arranged in a graduated series. The lowest stage is that of the civil virtues, then follow the purifying, and last of all the divine virtues. The civil virtues merely adorn the life, without elevating the soul. That is the office of the purifying virtues, by which the soul is freed from sensuality, and led back to itself, and thence to the nous. By means of ascetic observances the man becomes once more a spiritual and enduring being, free from all sin. But there is still a higher attainment; it is not enough to be sinless, one must become "God." This is reached through contemplation of the primeval Being, the One; or, in other words, through an ecstatic approach to it. Thought cannot attain to this, for thought reaches only to the nous, and is itself a kind of motion. Thought is a mere preliminary to communion with God. It is only in a state of perfect passivity and repose that the soul can recognize and touch the primeval Being. Hence in order to this highest attainment the soul must pass through a spiritual curriculum. Beginning with the contemplation of corporeal things in their multiplicity and harmony, it then retires upon itself and withdraws into the depths of its own being, rising thence to the nous, the world of ideas. But even there it does not find the Highest, the One; it still hears a voice saying, "not we have made ourselves." The last stage is reached when, in the highest tension and concentration, beholding in silence and utter forgetfulness of all things, it is able as it were to lose itself. Then it may see God, the fountain of life, the source of being, the origin of all good, the root of the soul. In that moment it enjoys the highest indescribable bliss; it is as it were swallowed up of divinity, bathed in the light of eternity.[1]

Such is the religious philosophy of Plotinus, and for himself personally it sufficed, without the aid of the popular religion or worship. Nevertheless he sought for points of support in these. God is certainly in the truest sense nothing but the primeval Being; but He reveals Himself in a variety of emanations and manifestations. The nous is a sort of second god, the *λόγοι* which are wrapped up in it are gods, the stars are gods, and so on. A rigid monotheism appeared to Plotinus a miserable conception. He gave a meaning to the myths of the popular religions, and he had something to say even for magic, soothsaying, and prayer. In support of image-worship he advanced arguments which were afterwards adopted by the Christian image-worshippers. Still, as compared with the later Neoplatonists, he is comparatively free from crass superstition and wild fanaticism. He is not to be classed amongst the "deceived deceivers," and the restoration of the worship of the old gods was by no means his chief object.

Amongst his pupils, Amelius and Porphyry are the most eminent. Amelius modified the teaching of Plotinus on certain points; and he also put some value on the prologue to the Gospel of John. To Porphyry[2] belongs the credit of having recast and popularized the system of his master

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[1] Porphyry tells us that on four occasions during the six years of their intercourse Plotinus attained to this ecstatic union with God.

[2] Born at Tyre in the year 233. Whether he was for a time a Christian is not certain. From 263 to 268 he was a pupil of Plotinus at Rome. He had previously written the work *περὶ τῆς ἐκ λογίων φιλοσοφίας*, which shows that he was inclined to base philosophy on revelations. For a couple of years (about 270) he lived in Sicily, where he wrote his fifteen books against the Christians. He then returned to Rome, where he worked as a teacher, edited the works of Plotinus, and wrote a series of treatises of his own. He married in his old age Marcella, a native of Rome, and died about the year 303.

Plotinus. He was no original or productive thinker, but he was a solid and diligent student, distinguished by great learning, by a turn for keen historical and philological criticism, and by an earnest purpose to disseminate the true philosophy of life, to uproot false teaching—especially Christianity, to ennoble men and train them to goodness. That a spirit so free and noble yielded itself up wholly to the philosophy of Plotinus and polytheistic mysticism shows how irresistible was the tendency of the age, and means also that the age had no better thing to offer than religious mysticism. The system of Porphyry is distinguished from that of Plotinus by being still more emphatically practical and religious. The object of philosophy, according to Porphyry, is the salvation of the soul. The origin and the blame of evil are not in the body, but in the desires of the soul. Hence the strictest asceticism (abstinence from flesh, and wine, and sexual intercourse) is demanded, as well as the knowledge of God. As he advanced in life, Porphyry protested more and more earnestly against the rude faith of the common people and their immoral worships. "The ordinary conceptions of God are such that it is more impious to share them than it is to slight the images of the gods." But, outspoken as he was in his criticism of the popular religions, he had no wish to give them up. He stood up for a pure worship of the many gods, and maintained the cause of every old national religion and the ceremonial duties of its adherents. His work *Against the Christians* was directed, not against Christ, nor even against what he believed to be Christ's teaching, but against the Christians of his own day and their sacred books, which, according to Porphyry, were the work of deceivers and ignorant people. In his trenchant criticism of the origin of what passed for Christianity in his time, he spoke bitter and severe truths, which have gained for him the reputation of the most rabid and wicked of all the enemies of Christianity. His work was destroyed,[1] and even the answers to it (by Methodius, Eusebius, Apollinaris, Philostorgius, &c.) have been lost. But the copious extracts which we find in Lactantius, Augustine, Jerome, Macarius Magnus, and others are sufficient to show how profoundly Porphyry had studied the Christian writings, and how great was his talent for real historical research.

Porphyry marks the transition to a new phase of Neoplatonism, in which it becomes completely subservient to polytheism, and seeks before everything else to protect the Greek and Oriental religions from the formidable assault of Christianity. In the hands of IAMBLICHUS (*q.v.*), the pupil of Porphyry (*ob.* 330), Neoplatonism is changed "from a philosophical theory to a theological doctrine." The distinctive tenets of Iamblichus cannot be accounted for from scientific but only from practical considerations. In order to justify superstition and the ancient forms of worship, philosophy becomes in his hands a theurgy, a knowledge of mysteries, a sort of spiritualism. To this period also belongs a set of "philosophers," with regard to whom it is impossible to say whether they are dupes or impostors—the "decepti deceptores" of whom Augustine speaks. In this philosophy the mystical properties of numbers are a leading feature; absurd and mechanical notions are glossed over with the sheen of sacramental mystery; myths are explained by pious fancies and fine-sounding pietistic reflexions; miracles, even the most ridiculous, are believed in, and miracles are wrought. The "philosopher" has become a priest of magic, and philosophy a method of incantation. Moreover, in the unbridled exercise of speculation, the number of divine beings was increased indefinitely; and these fantastic accessions to Olympus in the system of Iamblichus show that Greek philosophy is returning to mythology, and that nature-religion is still a power in the world. And yet it is undeniable that the very noblest and choicest minds of the 4th century are to be found in the ranks of the Neoplatonists. So great was the general decline that this Neoplatonic philosophy offered a welcome shelter to many earnest and influential men, in spite of the charlatans and hypocrites who were gathered under the same roof. On certain points of doctrine, too, the dogmatic of Iamblichus indicates a real advance. Thus his emphatic assertion of the truth that the seat of evil is in the will is noteworthy; and so also is his repudiation of Plotinus's theory of the divinity of the soul.

The numerous followers of Iamblichus (Ædesius, Chrysanthius, Eusebius, Priscus, Sopater, Sallust, and, most famous of all, Maximus) rendered little service to speculation. Some of them (Themistius in particular) are known as commentators on the older philosophers, and others as the missionaries of mysticism. The work *De Mysteriis Ægyptiorum* is the best sample of the views and aims of these philosophers. Their hopes rose high when their protégé, the enthusiastic, noble-minded, but mentally ill-balanced Julian, ascended the imperial throne (361–363). But the emperor himself lived long enough to see that his romantic policy of restoration was to leave no results; and after his early death all hope of extinguishing Christianity was abandoned.

But undoubtedly the victory of the church in the age of Valentinian and Theodosius had a purifying influence on Neoplatonism. During the struggle for supremacy, the philosophers had been driven to make common cause with everything that was hostile to Christianity. But now Neoplatonism was thrust from the great stage of history. The church and church theology, to whose guidance the masses now surrendered themselves, took in along with them their superstition, their polytheism, their magic, their myths, and all the machinery of religious witchcraft. The more all this settled and established itself—certainly not without opposition—in the church the purer did Neoplatonism become. While maintaining intact its religious attitude and its theory of knowledge, it returned with new zest to scientific studies, especially the study of the old philosophers. If Plato still remains the divine philosopher, yet we can perceive that after the year 400 the writings of Aristotle are increasingly read and valued. In the chief cities of the empire Neoplatonic schools flourished till the beginning of the 5th century; during this period, indeed, they were the training-schools of Christian theologians. At Alexandria the noble Hypatia taught, to whose memory her impassioned disciple Synesius, afterwards a bishop, has reared a splendid monument. But after the beginning of the 5th century the fanaticism of the church could no longer endure the presence of "heathenism." The murder of Hypatia was the death of philosophy in Alexandria, although the school there maintained a lingering existence till the middle of the 6th century. But there was one city of the East which, lying apart from the crowded highways of the world, had sunk to a mere provincial town, and yet possessed associations which the church of the 5th century felt herself powerless to eradicate. In Athens a Neoplatonic school still flourished. There, under the monuments of its glorious past, Hellenism found its last retreat. The school of Athens returned to a stricter philosophical method and the cultivation of scholarship. Still holding by a religious philosophy, it undertook to reduce the whole Greek tradition, as seen in the light of Plotinus, to a comprehensive and closely knit system. Hence the philosophy which arose at Athens was what may fairly be termed scholasticism. For every philosophy is scholastic whose subject-matter is imaginative and mystical, and which handles this subject-matter according to established rules in logical categories and distinctions. Now to these Neoplatonists, the books of Plato, along with certain divine oracles, the Orphic poems, and much more which they assigned to a remote antiquity, were documents of canonical authority; they were inspired divine writings. Out of these they drew the material of their philosophy, which they then proceeded to elaborate with the appliances of dialectic.

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[1] It was condemned by an edict of the emperors Theodosius II. and Valentinian, in the year 448.

The most distinguished teachers at Athens were Plutarch (*ob.* 433), his disciple Syrianus (who did important work as a commentator on Plato and Aristotle, and further deserves mention for his vigorous defence of the freedom of the will), but above all Proclus (411–485). Proclus is the great schoolman of Neoplatonism. It was he who, combining religious ardour with formal acuteness, connected the whole mass of traditional lore into a huge system, making good defects, and smoothing away contradictions by means of distinctions and speculations. "It was reserved for Proclus," says Zeller, "to bring the Neoplatonic philosophy to its formal conclusion by the rigorous consistency of his dialectic, and, keeping in view all the modifications which it had undergone in the course of two centuries, to give it that form in which it was transferred to Christianity and Mohammedanism in the Middle Ages." Forty-four years after the death of Proclus the school of Athens was closed by Justinian (529 A.D.); but it had fulfilled its mission in the work of Proclus, and might with advantage retire from the scene. It had nothing new to say; it was ripe for the grave, and an honourable burial awaited it. The works of Proclus, as the last testament of Hellenism to the church and the Middle Ages, exerted an incalculable influence on the next thousand years. They not only formed one of the bridges by which the mediæval thinkers got back to Plato and Aristotle; they determined the scientific method of thirty generations, and they partly created and partly nourished the Christian mysticism of the Middle Ages, both in the East and in the West.

The disciples of Proclus are not eminent (Marinus, Asclepiodotus, Ammonius, Zenodotus, Isidorus, Hegias, Damascius). The last president of the Athenian school was Damascius. When Justinian issued the edict for the suppression of the school, Damascius along with Simplicius (the painstaking commentator of Aristotle) and five other Neoplatonists set out for Persia. They were under the delusion that Persia was the land of the East, the home of wisdom, righteousness, and devotion. In a few years they came back to the Byzantine empire, sadder and wiser men.

At the beginning of the 6th century Neoplatonism had ceased to exist in the East as an independent philosophy. Almost at the same time, however—and the coincidence is not accidental—it made new conquests in the church theology through the writings of the pseudo-Dionysius. It began to bear fruit in Christian mysticism, and to diffuse a new magical leaven through the worship of the church.

In the West, where philosophical efforts of any kind had been very rare since the 2d century, and where mystical contemplation did not meet with the necessary conditions, Neoplatonism found a congenial soil only in isolated individuals. We know that the rhetorician Marius Victorinus (*c.* 350) translated certain works of Plotinus, and that his translation had a decisive influence on the spiritual history of Augustine. It may be said that Neoplatonism influences the West only through the medium of the church theology, or, in some instances, under that disguise. Even Boetius (it may now be considered certain) was a catholic Christian, although his whole mode of thought was certainly Neoplatonic. His violent death in the year 525 marks the end of independent philosophy in the West. But indeed this last of the Roman philosophers stood quite alone in his century, and the philosophy for which he lived was neither original, nor well-grounded, nor methodically developed.

Neoplatonism and the Theology of the Church.—The question as to the influence of Neoplatonism on the development of Christianity is not easily answered, because it is scarcely possible to get a complete view of their mutual relations. The answer will depend, in the first instance, upon how much is included under the term "Neoplatonism." If Neoplatonism is understood in the widest sense, as the highest and fittest expression of the religious movements at work in the Græco-Roman empire from the 2d to the 5th century, then it may be regarded as the twin-sister of the church dogmatic which grew up during the same period; the younger sister was brought up by the elder, then rebelled against her, and at last tyrannized over her. The Neoplatonists themselves characterized the theologians of the church as intruders, who had appropriated the Greek philosophy, and spoiled it by the admixture of strange fables. Thus Porphyry says of Origen (Euseb., *H. E.*, vi. 19), "The outer life of Origen was that of a Christian, and contrary to law; but, as far as his views of things and of God are concerned, he thought like the Greeks, whose conceptions he overlaid with foreign myths." This verdict of Porphyry's is at all events more just and apt than that of the theologians on the Greek philosophers, when they accused them of having borrowed all their really valuable doctrines from the ancient Christian books. But the important point is that the relationship was acknowledged on both sides. Now, in so far as both Neoplatonism and the church dogmatic set out from the felt need of redemption, in so far as both sought to deliver the soul from sensuality, and recognized man's inability without divine aid—without a revelation—to attain salvation and a sure knowledge of the truth, they are at once most intimately related, and at the same time mutually independent. It must be confessed that when Christianity began to project a theology it was already deeply impregnated by Hellenic influences. But the influence is to be traced, not so much to philosophy, as to the general culture of the time, and the whole set of conditions under which spiritual life was manifested. When Neoplatonism appeared, the Christian church had already laid down the main positions of her theology; or if not, she worked them out alongside of Neoplatonism—*that* is not a mere accident—but still independently. It was only by identifying itself with the whole history of Greek philosophy, or by figuring as pure Platonism restored, that Neoplatonism could stigmatize the church theology of Alexandria as a plagiarism from itself. These assumptions, however, were fanciful. Although our sources are unfortunately very imperfect, the theology of the church does not appear to have learned much from Neoplatonism in the 3d century,—partly because the latter had not yet reached the form in which its doctrines could be accepted by the church dogmatic, and partly because theology was otherwise occupied. Her first business was to plant herself firmly on her own territory, to make good her position, and clear away old and objectionable opinions. Origen was quite as independent a thinker as Plotinus; only, they both drew on the same tradition. From the 4th century downwards, however, the influence of Neoplatonism on the Oriental theologians was of the utmost importance. The church gradually expressed her most peculiar convictions in dogmas, which were formulated by philosophical methods, but were irreconcilable with Neoplatonism (the Christological dogmas); and the farther this process went the more unrestrainedly did theologians resign themselves to the influence of Neoplatonism on all other questions. The doctrines of the incarnation, the resurrection of the flesh, and the creation of the world in time marked the boundary line between the church's dogmatic and Neoplatonism; in every other respect, theologians and Neoplatonists drew so closely together that many of them are completely at one. In fact, there were special cases, like that of Synesius, in which a speculative reconstruction of distinctively Christian doctrines by Christian men was winked at. If a book does not happen to touch on any of the above-mentioned doctrines, it may often be doubtful whether the writer is a Christian or a Neoplatonist. In ethical precepts, in directions for right living (that is, asceticism), the two systems approximate more and more closely. But it was here that Neoplatonism finally celebrated its greatest triumph. It indoctrinated the church with all its mysticism, its mystic exercises, and even its magical cultus as taught by Iamblichus. The works of the pseudo-Dionysius contain a gnosis in which, by means of the teaching of Iamblichus and Proclus, the church's theology is turned into a scholastic mysticism, with directions on matters of practice and ritual. And as these writings were attributed to Dionysius, the disciple of the apostles, the scholastic mysticism which they unfold was regarded as an apostolic, not to say a divine, science. The influence exercised by these writings, first on the East, and then—after the 9th (or 12th) century—on the West, cannot be overestimated. It is impossible to enlarge upon it here; suffice it to say that the mystical and pietistic devotion of our own day, even in the Protestant churches, is nourished on works whose ancestry can be traced, through a series of intermediate links, to the writings of the pseudo-Areopagite.

In the ancient world there was only one Western theologian who came directly under the influence of Neoplatonism; but that one is Augustine, the most important of them all. It was through Neoplatonism that Augustine got rid of scepticism and the last dregs of Manichæism. In the seventh book of his *Confessions* he has recorded how much he owed to the perusal of Neoplatonic works. On all the cardinal doctrines—God, matter, the relation of God to the world, freedom, and evil—Augustine retained the impress of Neoplatonism; at the same time he is the theologian of antiquity who most clearly perceived and most fully stated wherein Neoplatonism and Christianity differ. The best ever written by any church father on this subject is to be found in chaps. ix.–xxi. of the seventh book of the *Confessions*.

Why Neoplatonism succumbed in the conflict with Christianity is a question which the historians have never satisfactorily answered. As a rule, the problem is not even stated correctly. We have nothing to do here with our own private ideal of Christianity, but solely with catholic Christianity and catholic theology. These are the forces that conquered Neoplatonism, after assimilating nearly everything that it contained. Further, we must consider the arena in which the victory was won. The battlefield was the empire of Constantine and Theodosius. It is only when these and all other circumstances of the case are duly realized that we have a right to inquire how much the essential doctrines of Christianity contributed to the victory, and what share must be assigned to the organization of the church.

In mediæval theology and philosophy mysticism appears as the powerful opponent of rationalistic dogmatism. The empirical science of the Renaissance and the two following centuries was itself a new development of Platonism and Neoplatonism, as opposed to rationalistic dogmatism, with its contempt for experience. Magic, astrology, and alchemy—all the outgrowth of Neoplatonism—gave the first effectual stimulus to the observation of nature, and consequently to natural science, and in this way finally extinguished barren rationalism. Thus in the history of science Neoplatonism has played a part, and rendered services of which Plotinus or Iamblichus or Proclus never dreamt. So true is it that sober history is often stranger and more capricious than all the marvels of legend and romance.

Literature.—The best and amplest account of Neoplatonism will be found in Zeller, *Die Philosophie der Griechen*, 3d ed., 1881, iii. 2, pp. 419-865. Compare Hegel, *Gesch. d. Philos.*, iii. 3 *sq.*; Ritter, iv. pp. 571-728; Ritter and Preller, *Hist. phil. Græc. et Rom.*, pp. 531 *sq.*; the *Histories of Philosophy* by Schwegler, Brandis, Brucker, Thilo, Strümpell, Ueberweg (who gives the most complete survey of the literature), Erdmann, Cousin, Prantl, Lewes. See also Vacherot, *Hist. de l'école d'Alexandrie*, 1846–51; Simon, *Hist. de l'école d'Alexandrie*, 1845; Steinhart, arts. "Neuplatonismus," "Plotin," "Porphyrius," "Proklus," in Pauly's *Realencyklop. d. klass. Alterthums*; Wagenmann, art. "Neuplatonismus," in the second edition of Herzog's *Realencyklop. f. protest. Theol.*; Heintze, *Lehre vom Logos*, 1872; Richter, *Neuplatonische Studien*; Heigl, *Der Bericht des Porphyrius über Origenes*, 1835; Redepenning, *Origenes*; Dehaut, *Essai historique sur la vie et la doctrine d'Ammonius Saccas*, 1836; Kirchner, *Die Philosophie des Plotin*, 1854; Steinhart, *De dialectica Plotini ratione* (1829), and *Meletemata Plotiniana* (1840); Neander, "Ueber die welthistorische Bedeutung des 9. Buchs in der 2. Enneade des Plotinos," in the *Abhandl. der Berliner Akademie*, 1843; Valentiner, "Plotin u. s. Enneaden," in the *Theol. Stud. u. Kritiken*, 1864. For the biography of Plotinus, see Porphyry, Eunapius, Suidas,—the last two in particular for the later Neoplatonists as well. On Porphyry see Fabricius, *Bibl. Gr.*, v. p. 725 *sq.*; Wolff, *Porph. de philosophia ex oraculis haurienda librorum reliquiæ*, 1856; Müller, *Fragmenta hist. Gr.*, iii. 688 *sq.*; Mai, *Ep. ad Marcellam*, 1816; Bernays, *Theophrast*, 1866; Wagenmann in the *Jahrbücher f. deutsche Theol.*, vol. xxiii., 1878; Richter in the *Ztschr. f. Philos.*, vol. lii., 1867; Hebenstreit, *De Iamblichi doctrina*, 1764; Harless, *Das Buch von den ägyptischen Mysterien*, 1858; and Meiners, *Comment. Societ. Götting.*, iv. p. 50 *sq.* On Julian, see a catalogue of the copious literature in the *Realencyklop. f. protest. Theol.*, 2d ed., vol. vii. p. 287; Neumann, *Juliani libr. c. Christ. quæ supersunt*, 1880; Hoche, "Hypatia," in *Philologus*, vol. xv., 1860; Bach, *De Syriano philosopho*, 1862. On Proclus, see the biography of Marinus, and Freudenthal in *Hermes*, vol. xvi. p. 214 *sq.* On Boetius, compare Nitzsch, *Das System des Boethius*, 1860; and Usener, *Anecdoton Holderi*, 1877.

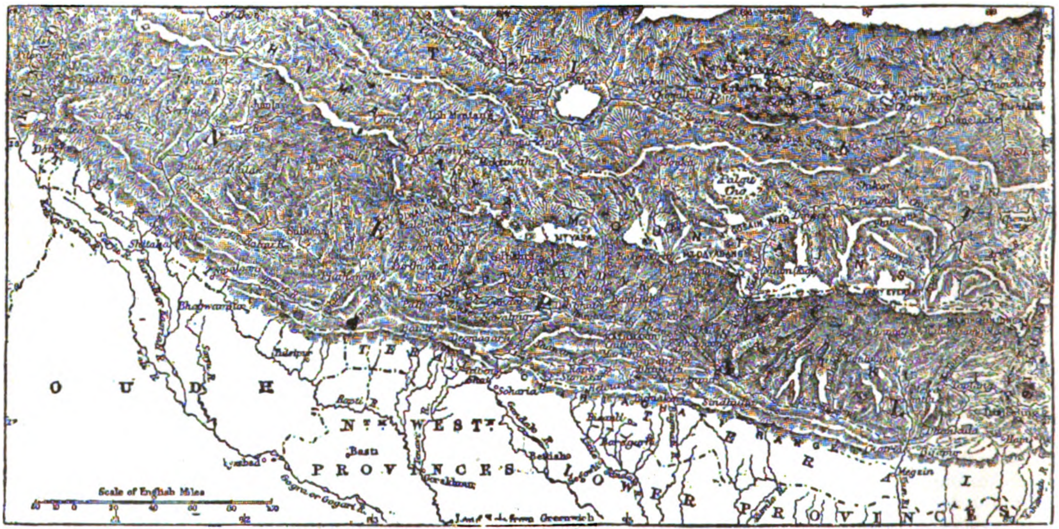
On the relation of Neoplatonism to Christianity, and the historical importance of Neoplatonism generally, see the *Church Histories* of Mosheim, Gieseler, Neander, Baur; and the *Histories of Dogma* by Baur and Nitzsch. Compare also Löffler, *Der Platonismus der Kirchenväter*, 1782; Huber, *Die Philosophie der Kirchenväter*, 1859; Tzschirner, *Fall des Heidenthums*, 1829; Burckhardt, *Die Zeit Constantin's des Grossen*, 1853; Chastel, *Hist. de la destruction du Paganisme dans l'empire d'Orient*, 1850; Beugnot, *Hist. de la destruction du Paganisme en Occident*, 1835; E. von Lasaulx, *Der Untergang des Hellenismus*, 1854; Vogt, *Neuplatonismus und Christenthum*, 1836; Ullmann, "Einfluss des Christenthums auf Porphyrius," in the *Stud. u. Kritiken*, 1832. On the relation of Neoplatonism to Monachism, compare Keim, *Aus dem Urchristenthum*, 1878. See further the monographs on Origen, the later Alexandrians, the three Cappadocians, Theodoret, Synesius, Marius Victorinus, Augustine, Pseudo-Dionysius, Maximus, Scotus Erigena, and the mediæval mystics. Specially noteworthy are—Jahn, *Basilius Plotinizans*, 1838; Dorner, *Augustinus*, 1875; Bestmann, *Qua ratione Augustinus notiones philos. Græcæ adhibuerit*, 1877; Loesche, *Augustinus Plotinizans*, 1881; Volkmann, *Synesios*, 1869. On the after-effects of Neoplatonism on the church's dogmatic, see Ritschl, *Theologie und Metaphysik*, 1881. (A. HA.)

NEOPTOLEMUS was the son of Achilles and Deidamia, one of the daughters of Lycomedes of Scyros, at whose court Achilles was concealed by his mother in female attire to keep him away from the Trojan War. He was brought to Troy in the last year of the war by Ulysses, whom he helped in persuading Philoctetes to come from Lemnos to aid the Greeks, and he was one of the warriors in the wooden horse. It was he who killed Priam during the sack of the city. Apart from these Trojan tales, Neoptolemus is a prominent figure in the legends of Epirus and of Delphi. He was the ancestor of the Molossian kings, who therefore claimed to be of pure Hellenic stock. His grave was at Delphi, and the festival in his honour every eighth year is described in the romance of Heliodorus as one of the most beautiful ceremonies in the Delphic ritual. It was said that he protected the temple in the Gaulish invasion.

NEPĀL, **NEPAUL**, or **NIPĀL**, is a small independent state, situated on the north-eastern frontier of Hindustān. It lies between 80° 15′ and 88° 10′ E. long. and 26° 20′ and 30° 10′ N. lat. Its extreme length is about 525 miles, and in breadth it varies from 90 to 140 miles. It is bounded on the N. by Tibet; on the E. by Sikhim and the British district of Dārjeeling; on the S. by the British districts of Purniah, Bhagalpur, Darbhanga, Muzaffarpur, Champārun, Gorakhpur, and Oudh; and on the W. by Kumāon, from which it is separated by the Kāli river. Its population is estimated by the natives at about 5,000,000, the common phrase used by the rulers in speaking of popular opinion being, "but what will the Bāwan [*i.e.*, fifty-two] Lākh say to this." Probably, however, this is an exaggerated statement.

Nepāl consists of two very distinct kinds of land:—(1) the terai, or strip of level cultivated and forest land lying along the southern border; and (2) the great mountainous tract stretching northwards to Tibet. Along the northern frontier stand many of the highest peaks of the Himalayan range, such as Diwalgiri (26,861 feet), Mutsiputra and Yāsa (24,000), Gosāīn Thān (26,000), numerous peaks varying from 20,000 to 24,000 feet, Mount Everest (29,000), and Kinchinjunga (28,156). In clear weather this magnificent snowy range may be seen in an almost continuous line from the top of some of the lower ranges near Kāthmāndū. South of these are numerous parallel lower ranges, varying from 16,000 to 6000 feet in height, which are broken up at intervals by cross ranges, thus forming a series of glens with a few hill-girt valleys interspersed.

These mountain ranges determine the course of the rivers, which are divided by the cross ranges into four groups. The first of these extends from Kumāon eastward as far as Diwalgiri, and consists of the affluents of the Kāli, Sārju, Kurnāli, Eastern Sārju, and Rāpti, all of which ultimately form the Gogra or Gogari, and flow into the Ganges. The second group, known to the Nepālese as the Sapt Gandaki, rise from the peaks between Diwalgiri and Gosāīn Thān, and unite at Trebēni Ghāt to form the Gandak. The third is a group of smaller rivers draining the great valley of Nepāl, the valleys of Chitlong, Banēpa, and Panouti, and portions of the terai around the Chiriyaghati range of hills. These are the various branches of the Bur Gandak, the lesser Rāpti, the Bāgmati, and Kumla. East of this again is the fourth group, known to the Nepalese as the Sapt Kūsi, rising from the peaks between Gosāīn Thān and Kinchinjunga, and uniting to form the Sān Kūsi, which falls into the Ganges.



Map of Nepal.

There is thus a natural division of the country into four portions. The most western is the country of the Bāīsi (or twenty-two) rājās, and contains the towns of Jumla, Doti, and Sulliāna. The second is the country of the Chaubīsi (or twenty-four) rājās, and contains the towns of Malebum, Pālpa, Gōrkha, and Noākote. The third is the district containing Nepāl proper, with the capital and many large towns to be mentioned afterwards. The fourth is the eastern portion of Nepāl, comprising the country of the Kirātis, and many small towns, such as Khatang and Bijāpur.

In a country possessing such a range of altitudes the flora and fauna are of course very varied, and the transitions from those of tropical to those of temperate and alpine regions are very rapid. For descriptive purposes, Nepāl may again be divided into three longitudinal zones. These are—(1) the terai and lower ranges of hills up to 4000 feet in height; (2) the central ranges and high-lying valleys, up to 10,000 feet; and (3) the alpine region, from 10,000 to 29,000 feet in height. These zones are not, however, sharply defined, as the climate varies according to the latitude, the height of intermediate ranges, and the depth of the valleys; so that tropical plants and animals are sometimes found far in the interior, and the more northern species descend along the loftier spurs into the southern zones.

The low alluvial land of the terai is well adapted for cultivation, and is, so to speak, the granary of Nepāl; but owing to scantiness of population and other causes the greater portion of it consists of swamps, jungles, and forests. The productions here are those of British India,—consisting of cotton, rice, wheat, pulse, sugar-cane, tobacco, opium, indigo, and the fruits and vegetables familiar in the plains of India. The forests yield a magnificent supply of sāl, sīsū, and other valuable forest trees; and the jungles abound with acacias, mimosas, cotton tree (*Bombax*), dâk (*Butea frondosa*), large bamboos, rattans, palms, and numerous ferns and orchids. On the Chiriyaghati range the common *Pinus longifolia* grows freely. Tea can be grown on the borders of this and the next zone at a height of from 2000 to 4000 feet. The middle zone supplies rice, wheat, maize, barley, oats, ginger, turmeric, chillies, potatoes, *Cucurbitaceæ*, pine-apples, and many varieties of European fruits, vegetables, and flowers. The forests contain tree rhododendrons, *Pinus longifolia*, oaks, chestnuts, walnuts, maples, hill bamboos, wild cherry, pear, allies of the tea plant, paper plants (*Daphne*), roses, and many other inhabitants of temperate climes, with various orchids, ferns, and wild flowers. In the alpine zone exist *Coniferæ* of many kinds, junipers, yew, box, hollies, birch, dwarf rhododendrons. and the usual alpine flora.

The wild animals follow a similar distribution, and the following typical species may be mentioned. In the lowest zone are found the tiger, leopards, wolves, hyænas, and jackals, the elephant and rhinoceros, the gaur (*Gavæus gaurus*), gayal (*Gavæus frontalis*), wild buffalo or arna, many species of deer, and the black bear (*Ursus labiatus*). Among the birds are found the pea-fowl, francolins, wild jungle fowl, and the smaller vultures, &c. In the middle zone there are leopards the Himalayan black bear (*Ursus tibetanus*), the wild dog, cats of many sorts, squirrels, hares, porcupines, the pangolin, and some species of deer and antelope. Among the birds are the larger vultures and eagles, the fowl pheasants (*Gallophasis*), chukor, hill partridges, &c. In the alpine zone are found the true bear (*Ursus isabellinus*, or brown bear), the yâk, musk deer, wild goats and sheep, marmots, &c. Among the birds are the eagle-vulture (*Gypaetus*), the blood pheasant (*Ithaginis cruentus*), snow pheasant (*Tetraogallus himalayensis*), snow partridge (*Lerwa nivicola*), the horned and crested pheasants, &c. Geese, ducks, waders of all sorts, and other migratory birds are found in abundance in the two lower zones.

The lowest zone in some directions abounds in fossils; and deposits of lignite, and even of true coal, are met with, the latter notably at a spot south of Pālpa. The middle zone is rich in limestone and marbles, and abounds with minerals, such as iron, copper, zinc, lead, and sulphur. Copper is found near the surface in many places, and there are remains of mines both at Mārkhu and in the great valley of Nepāl. Mineral springs, both hot and cold, are numerous. Traces of silver, and also of gold, have been found in the alpine zone.

The races occupying Nepāl are very numerous. To the north, inhabiting the higher mountains and valleys, dwell the Bhotiyas or Tibetans. To the west lie the Gurungs and Magars. The Murmis, Gōrkhālis, and Newārs occupy the central parts; and the Kirātis, Limbūs, and Lepchas occupy the eastern districts. Besides these there are many small tribes residing in the terai and some other malarious districts, known as Dāris, Bhrāmus, Kumhas, Manjis, &c., but generally classed together by the Nepalese as Āoulias, or dwellers in the malarious or āoul districts. These are probably descendants of immigrants from the lower castes of Hindus, occupying the borderlands of the terai. Among the forests of the lower eastern region are also to be found some small savage tribes, known as Chēpangs and Kusūndas.

All the races except the Gōrkhālis and Āoulias are of a decidedly Mongolian appearance, being generally short and robust, and having flat faces, oblique eyes, yellow complexions, straight black hair, and comparatively hairless faces. The Newārs, according to the *Vamçāvalī* or native history, trace their descent from the races of Bengal, but this is rendered more than doubtful both by their appearance and language. The Gōrkhālis (Gōrkhas or Ghoorkhas) are descendants of the Brāhmans and Rājputs who were driven out of Hindustān by the Moslems, and took refuge in the western hilly lands, where they ultimately became the dominant race. As a rule they still retain traces of their descent in face and figure, though they have become much mixed up with the other races by intermarriage.

The Bhotiyas, Newārs, Limbūs, Kerātis, and Lepchas are all Buddhists, but their religion has become so mixed up with Hinduism that it is now hardly recognizable. The Newārs have entirely abandoned the monastic institutions of Buddhism, and have in great measure adopted the rules of caste, though even these sit but lightly upon them. They burn their dead, eat the flesh of buffaloes, goats, sheep, ducks, and fowls, and drink beer and spirits. The Gōrkhālis, Magars, and Gurungs are Hindus, but the last two are by no means strict in the observance of their religion, though there are some peculiarities which they carefully preserve. Thus, for instance, the Magars will eat pork but not buffalo's flesh, whereas the Gurungs eat the buffalo but not the hog.

The various races have all separate languages, or at least dialects. The Gōrkhālis use Parbatiya, a modern dialect of Sanskrit, which is also used by the western tribes. The Newārs have a distinct language and alphabet, or rather alphabets, for three are known to their pandits, though only one is now in use. Their language greatly resembles the Tibetan, but is now corrupted with many Sanskrit words. The Bhotiyas use the Tibetan language and alphabet.

There are no public schools nor provision for education; but the children of all well-to-do people are taught by the family priests or their parents; and some of the higher classes send their children to be educated at Patna, Benares, or Calcutta, so that many of them speak English fluently. The bulk of the labouring classes is quite illiterate.

The modern literature of the country is undeserving of notice, being of the most frivolous description; but Nepāl is a perfect storehouse of ancient Sanskrit literature, and some of the oldest MSS. in that language as yet known to scholars have been found there.

The portion of Nepāl, exclusive of the terai, which is open to Europeans is the "valley of Nepāl," containing the capital of the country, and a few adjacent smaller valleys. There is only one means of access used by Europeans, and this indeed is in general resorted to by the natives, as the other routes to the capital are longer and far more difficult. The road runs nearly north from Segowli, passing through the terai and sāl forests, to Bichiakori; then through the beds of mountain streams, through a pass in the Chiriyaghati range, and through another sāl forest, to Hetoura; thence by a wide and good road to Bhimphedi at the foot of the Sisaghuri range of hills. So far the route is practicable for carts and baggage animals, but from this point the road is a mere rugged footpath over the mountains, through the Chitlong valley and over the Chandragiri range. The distance from Segowli to Kāthmāndū is 90 miles.

The valley in extreme length from east to west is about 20 miles, and in breadth from north to south about 15. The surrounding hills vary in height from 6000 to 9720 feet, the level of the valley itself being about 4500 feet above the sea. Tradition has it that Nepāl was once a lake, and appearances are in favour of this view. It is crossed longitudinally by a low limestone range, through which the waters have gradually forced a passage, and in like manner the collected rivers have escaped at the south-east corner of the valley. The former fissure, at Chowbahāl, is said to have been made by Vishnu, and the latter by Bodhisatwa Manjusri.

The surface of the valley consists of a series of table-lands (tārs) and wide beds of streams (khōlas), with here and there a few well-wooded knolls, generally surmounted by temples.

There are three principal streams, the Bagmati, Vishnumati, and Manohra, besides many small tributaries of these. All the rivers rise within the valley, except the Bagmati, which springs from the northern side of the Seopūri peak, and enters the valley through a ravine at the north-east corner. They all unite and pass through a long narrow gorge in the limestone range, already mentioned, at Chowbahāl, and ultimately escape from the valley at Kotwaldār.

There are three large towns, Kāthmāndū, the capital, with some 50,000 inhabitants, Pātan with about 30,000, and Bhātgāon with 30,000 also. The houses are from two to four stories in height, built of brick, and tiled. The windows and balconies are of wood, and are elaborately carved. There are numerous handsome temples in all the towns, the majority of which are pagoda-shaped and built of brick, with roofs of copper, which is sometimes gilt. The streets are narrow, and they, as well as the squares, are all paved with brick or stone. In front of the temples generally stand monoliths surmounted by figures of Garūr, or of the founder, made of brass gilt, or sometimes of black stone. Besides these three large towns, there are at least twenty smaller towns, and numerous villages, all of which possess many temples. Some of these, as for instance those of Pashupati, Bodhnātha, and Symbhunātha, are considered of great sanctity. Many thousands of pilgrims come at one festival to worship at Pashupati, and it is there that the dying are brought to be immersed in the Bagmati, the dead are burned, and satis are immolated.

In Nepāl, as in India, the year may be divided into the rainy, cold, and hot seasons. The rains begin in June and last till October, but the fall is not so heavy or continuous as in the plains of Hindustān. The cold season extends from the middle of October to the middle of April. During these months the climate is delicious. Hoar-frost and thin ice are common in the mornings, and the thermometer sometimes falls as low as 25° Fahr., but the days are bright and warm. From Christmas to the end of February there are occasional showers of rain; and snow falls on the surrounding low ranges, but is very rarely seen in the valley itself. From April to the beginning of the rains is the hot season, but the thermometer seldom reaches 85° in the shade. The result of observations extending over many years gives an average mean temperature of 60° Fahr., and an annual rainfall of about 60 inches. Violent thunderstorms are not uncommon, and occasionally severe earthquakes occur, as in 1833 and 1866, on the former of which occasions there were great destruction of houses and loss of life in all the large towns.

Where temples are so numerous (there are 2733 shrines in the valley) priests naturally abound, both of the Hindu and Buddhist religions. The festivals too are many in number, and in consequence holidays are incessant. The rāj gurū, or high priest, is an influential person in the state, a member of council, and has a large income from Government lands as well as from the fines for offences against caste, &c. Many other priests, gurūs and purohits, have lands assigned to them, and most of the temples have been richly endowed by their founders. Every family of rank has a special priest, whose office is hereditary

Astrologers are also numerous, and their services are in constant request. One cannot build a house, set out on a journey, commence a war, or even take a dose of physic, without having an auspicious moment selected for him.

All families of good position have at least one baid, or medical man, in constant attendance, and there are also many general practitioners. There are no hospitals nor dispensaries, except the small one attached to the British residency, which is much frequented by the poor. The diseases most prevalent in the country are rheumatism, chronic dyspepsia, skin diseases. syphilis, goitre, and leprosy. In the rains a number of cases of mild intermittent fever, diarrhœa, and dysentery are met with. Fever of a severe typhoid type is common in the crowded lanes and dirty villages; and cholera, when it does break out, commits fearful ravages. Smallpox is almost always present, in consequence of inoculation being greatly resorted to by the Parbatiyās, whilst the Newārs neither vaccinate nor inoculate. Of late years vaccination has been considerably practised by the residency surgeons, especially among the Bhotiyas and the children of the higher ranks.

Much attention is devoted by the Gōrkhālis to military matters, and the bulk of that race may be said to be soldiers. The standing army consists of about 16,000 men, divided into twenty-six regiments of infantry and two regiments of artillery. Besides this force there is a reserve, consisting of men who have served for a few years and taken their discharge, but who in case of necessity can be called on again to enter the ranks. The regiments are formed on the European system, and similarly drilled and officered. The arms are various, from the old flint musket to the most modern breech-loading rifle. Each man also carries a bayonet and a kukhri or native knife. The followers of some of the petty hill rājās are still armed with khoras (heavy curved swords) and bows and arrows. The cavalry is on a very small scale, consisting of only about one hundred men, as the country is not suited for horse exercise. The artillery, however, is on a larger scale, consisting of two regiments; and there is also an attempt at horse artillery. Of late years four mountain batteries drawn by mules have been established. There is a large arsenal well provided with supplies of gunpowder and military stores. There are extensive workshops too, where cannon are cast, and rifles and ammunition of all sorts turned out in large quantities. In the last war with Tibet, in 1854, when the resources of the country were strained to the utmost, the field force consisted of 27,000 men, with 29,000 partially armed coolies and camp followers, and 390,000 unarmed baggage coolies. About 7000 fighting men only were left to garrison the country.

While the Gōrkhālis are occupied in military affairs, the agriculture of the valley is carried on by the Newārs. The soil is varied in character, from light micaceous sand to dense ferruginous clay. The whole valley is cultivated and irrigated where practicable, and the slopes of the hills are carefully terraced, so that there is little grazing ground, and few sheep or cattle are kept. There are some milch cows and buffaloes, which are either stall-fed or grazed in the jungles at the foot of the hills. Animals for consumption and sacrifice are all imported, and are consumed as fast as they are brought in. In the cold season the Bhotiyas bring large flocks of sheep and goats laden with bags of borax, salt, and saltpetre. These are sold for consumption, except a few that are retained to carry back the bags. These droves are generally accompanied by ponies and some of the large Tibetan dogs. These dogs are powerful, fierce, shaggy animals, about the size of a small Newfoundland dog. Poultry are kept and used by the Newārs, especially ducks, the eggs of which are in great demand even among the orthodox Hindus. The crops grown in the valley consist of rice, both the transplanted and the dry-sown or gyah varieties, wheat, pulse, murwah, maize, buck-wheat, chillies, radishes, mustard, garlic, onions, ginger, turmeric, sugar-cane, potatoes, ground nuts, many species of cucumbers and pumpkins, &c. Space will not allow a description to be given of the modes of cultivating these. Nothing but articles of food is allowed to be grown in the valley; hence its capabilities for producing tea, cotton, and tobacco are unknown. All of these, however, are grown in other districts, both in the hills and the terai. Large cardamoms are extensively grown at the base of the hills, and form an important article of export. The hemp plant (*Cannabis indica*) grows wild, and is used both for manufacturing purposes and for producing the resinous extract and other intoxicating products which are exported. Plants producing dyes, such as madder or manjit, are grown in some places; and drugs, such as chirata and atees, are collected and exported. The better class of soils yields a return of about Rs. 180 per khait, and the poorest about Rs. 90 per khait. From some of the finer soils as many as three crops of various sorts are obtained annually. The land-measures in use are the jāna = 75 square yards, 4 jānas = 1 ropni, 25 ropnis = 1 khait, or 7500 square yards.

The Newārs are also fond of horticulture. Many European fruits, flowers, and vegetables have been introduced during the last fifty years, and grow freely. The country is famous for its oranges and pine-apples. Flowers are grown and sold for religious purposes, and even wild flowers are brought into the market and much used by the Newār women in adorning their hair, as well as for offerings at the shrines. Many wild fruits are collected and sold in the markets. Apples and pears, of English stock, thrive well; apricots and plums are good; peaches and grapes grow freely and are of large size, but they seldom ripen before the rains begin, when they rot.

All the trade and manufactures of the country are in the hands of the Newārs, and a few Kashmiris and natives of Hindustān. The trade in European goods is chiefly carried on by the latter, whilst the Newārs deal in corn, oil, salt, tobacco, and articles of domestic manufacture. The trade with India is carried on at numerous marts along the frontier, at each of which a customs station is established, and the taxes are collected by a thīkadār, or farmer. The Newārs also carry on the trade with Tibet, through a colony which has been for many years established at Lhāsa. There are two principal routes to Tibet. One of these runs north-east from Kāthmāndū to the frontier-station of Kūti or Nilām, crossing the Himalayan range at a height of 14,000 feet; the other passes out of the valley at the north-west corner, and runs at first upwards along the main branch of the Gandak, crossing the Himalayas, near Kirong, at a height of 9000 feet. All goods on these routes are carried on men's backs, except the salt, &c., carried in bags by the Bhotiya sheep and goats. The principal imports from Hindustān are raw cotton, cotton goods, woollen goods, silks and velvets, hardware, cutlery, beads, jewels, coral, saddlery, shoes, guns, gunpowder, vermilion, indigo, lac, tea, betel-nut, spices, paper, sugar, tobacco, oils, sheet copper, goats, cattle, buffaloes; and from Tibet, musk, medicines, yāks' tails, tea, woollen cloth, blankets, borax, salt, saltpetre, paper-plant, honey, wax, sheep, goats, yāks, ponies, silver, gold. The exports to Hindustān include wax, paper-plant, musk, yāks' tails, medicines, cardamoms, borax, sulphate of copper, brass pots, iron pots, ponies, elephants, hawks, hides and horns (buffalo), rice, ghee, oil seeds, red chillies, madder, potatoes, oranges; and to Tibet, broad cloth, raw cotton, cotton goods, tobacco, sugar, opium, coral, jewels, pearls, spices, betel-nut, copper pots, iron pots, and hardware.

To estimate the exact value of such an extensive trade, passing through so many channels, is almost impossible, especially as the Nepalese are utterly regardless of statistics. Recent estimates, however, value the exports and imports to and from the British provinces at £1,686,000 annually; and the value of those to and from Tibet is probably at least half that amount. Duties are levied on exports and imports, which will be noticed under the head of revenue.

The Newārs are skilful workmen. Their bricks are excellent, and so also is their pottery, for which certain towns are famous, such as Thēmi and Noākota. As carpenters they excel, though the use of the large saw is still unknown, and planks are cut with chisel and mallet. Some of the wood carvings on the temples and large houses are most artistic in design and bold in execution, though unfortunately they are too often of a most obscene character. The manufactures are few, consisting chiefly of coarse cotton cloths, paper made of the inner bark of the paper-plants (*Daphne*), bells, brass and iron utensils, weapons, and ornaments of gold and silver.

At one time Nepāl supplied Tibet with its silver coinage, but this was abandoned on account of the adulterations introduced by the Nepalese. The ancient coins, specimens of which are still to be met with, were made by hand.[1] The modern coinage is struck by machinery, a regular mint having been established by Sir Jung Bahādur at Kāthmāndū.

Gold.				Silver.				Copper.			
Nepalese Names.	Value in Anglo-Indian Coin.			Nepalese Names.	Value in Anglo-Indian Coin.			Nepalese Names.	Value in Anglo-Indian Coin.		
	R.	A.	P.		R.	A.	P.		R.	A.	P.
Ashrafī	20	0	0	Rūpī	0	13	4	Paisā	0	0	2
Pātlā	8	5	0	Mōhar	0	6	8	Dām	0	0	0½
Sūkā	4	2	8	Sūkā	0	3	4				
Sūkī	2	1	4	Sūkī	0	1	8				
Ānā	1	0	8	Ānā	0	0	10				
Dām	0	4	2	Dām	0	0	5				

The gold coinage and the silver rupee are seldom seen, the ordinary currency consisting of the copper dāms and paisā, and the mōhar or half rupee. Besides the machine-made paisā two other kinds are in general use. One, the Bhutwāliya paisā, is made at Teusan in the Palpa district, and consists of a square lump of pure copper with a rough stamp on it. The other, the Lohiya paisā, is also a rough square lump of copper, but is much adulterated with iron. It is chiefly used in the eastern districts. The total coinage in 1875–76 was—silver mōhars, Rs. 214,000; Bhutwāliya paisā, Rs. 186,000; Lohiya paisā, Rs. 43,000; flat paisā, Rs. 123,000.

However fond the Nepalese may be of asserting their independence, there is no doubt that they acknowledge the supremacy of China, as they periodically send an embassy with presents to Peking. The British too have considerable influence with the Government in regard to their foreign relations; but in all matters of domestic policy the Nepalese brook no interference, and they are most jealous of anything that has a tendency to encroach on their independence.

Theoretically the government of Nepāl is a pure despotism, and the rājā is paramount. Practically, for the last century, all real power has been in the hands of a prime minister and his faction; and much of the modern history of the country consists of accounts of the struggles of the various factions for power. Under the prime minister there is a council, consisting of the relations of the king, the rāj gurū, the generals, and a few other officials known as kājīs and sirdārs, which is consulted on all important business, and which forms a court of appeal for disputed cases from the courts of law. There are separate civil and criminal courts, but the distinction is not always observed, as difficult cases are often transferred from one to the other.

The old savage code with its ordeals by fire and water, and its punishments by mutilation and torture, was abolished by Sir Jung Bahādur after his return from England. Treason, rebellion, and desertion in time of war are punished by death. Bribery and peculation by public servants are punished by dismissal from office, and a fine with imprisonment, the latter of which may be commuted at the rate of Rs. 5 per mensem. Murder and the killing of cows are capital offences. Manslaughter and maiming cows are punished by imprisonment for life, and other offences against the person or property by imprisonment or fine. Offences against caste are heavily punished by fine and imprisonment. In some cases all the offender's property is confiscated, and he and his family may even be sold as slaves. Slavery is an institution of the country, and all families of rank possess many slaves, who are employed in domestic and field labour. They are in general well treated, and are carefully protected by law. The price of slaves ranges from Rs. 100 to Rs. 200. There are three large prisons in the valley, one for males and two for females. The prisoners are kept in irons, and employed in public works of various sorts. They are allowed six pice per diem for subsistence at the capital, and five pice in other districts. There are no bankruptcy laws, and the liability of a debtor descends from father to son. The marriage laws are somewhat peculiar. Among the Gōrkhālis of course the laws resemble those of other Hindus as regards the marriage of widows, polygamy, satī (suttee), &c. An offending wife is imprisoned for life, and her paramour, after his guilt has been proved before the law courts, is cut down in public by the injured husband. The culprit gets a start of a few yards and runs for his life. If he escapes he is free, but in general he is tripped up by the onlookers and his fate is certain, as the husband is entitled to strike thrice with his kukhri. Among some of the hill tribes polyandry is still practised, and the Bhotiyas seem to regard the marriage-tie with perfect indifference. Among the Newārs, every girl, while still an infant, is married with much ceremony to a bēl fruit, which is then thrown into some sacred stream. As the fate of the fruit is unknown, a Newārin is supposed never to become a widow. At the age of puberty a husband is selected, but the woman can at any moment divorce herself by placing a betel-nut under her husband's pillow and taking her departure. Adultery is therefore but slightly punished. The woman is merely divorced, and her paramour has to make good to the husband the expenses incurred at the marriage. A Newārin on the death of her husband may, if she chooses, become a satī, but the privilege is very seldom taken advantage of.

The revenue of Nepāl is about ninety-six lakhs of rupees, *i.e.*, £9,600,000. The chief sources of it are the land-tax, customs, mines, forests, and monopolies. About 10 per cent. of the terai lands, and 20 per cent. of the hill lands, are private property. Some lands were assigned by the Gōrkhāli rājās to Brāhmans, soldiers, and others, and these are untaxed. Others, which were the gifts of the old Newār kings, pay from 4 to 8 annas per bīgah. All such grants of land, however, are subject to a heavy fine on the coronation of a new rājā. Land which does not produce rice is lightly taxed, but in the valley of Nepāl, and wherever rice is grown, the Government tax or rent is one half of the produce of the land. Waste lands, when brought into cultivation, are rent free for ten years, after which for five years the tax is only 4 annas per bīgah, and the cultivator receives one-tenth of the cleared land rent free for his life. A considerable revenue in the shape of royalty is obtained from mines of copper, iron, &c. The taxes on merchandise amount to from 12 to 14 per cent. on the value of the goods carried to and from British India, and from 5 to 6 per cent. is charged on goods exported to Tibet. The revenue, when collected by the various sūbas, is transmitted under an escort to the Government treasury, and at the end of the year the surplus is deposited in the Mūl Dhūkatī, or Government cellars, whence it is never withdrawn except in great emergencies. A yearly surplus has been accumulating in this manner for many years.

There are three principal eras in use in Nepāl. The Samvat of Vikramāditya commences fifty-seven years before the Christian era, the Sāka era of Sālivāhana begins seventy-eight years after the Christian era, and the Nepalese Samvat dates from October 880 A.D. The Srī-Harsha and Kāligat eras are also sometimes used. The measurement of time is regulated by a copper vessel with a small hole in the bottom, which is floated on water and fills and sinks sixty times a day. Each time it sinks a gong or gharī is struck, in progressive numbers from dawn to noon; after noon the first gharī struck indicates the number of gharīs which remain of the day till sunset. Day is considered to begin when the tiles on a house can be counted, or when the hairs on the back of a man's hand can be discerned against the sky. Sixty bipalās = 1 palā; 60 palās = 1 gharī or 24 minutes; 60 gharīs = 1 day of 24 hours.

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[1] Some of the more antique are valuable to archæologists and historians on account of the dates and inscriptions. Specimens have been sent to the British Museum, the Fitzwilliam Museum at Cambridge, and to some Continental museums. Most of these have been examined by Mr C. Bendall, and described in his papers on the subject.

Nepāl and the somewhat similar country of Kashmir are peculiar among the Hindu states of India in possessing an historical literature. The Nepalese *Vamçāvalī* professes to start from a very early period in the Satya Yuga, when the present valley was still a lake. The earlier portion of it is devoted to the Satya and Trēta Yugas, and contains mythological tales and traditions having reference to various sacred localities in the country. During these two Yugas, and also the Dwāpur Yuga, the *Vamçāvalī* deals in round numbers of thousands of years.

In the beginning of the Kāli Yuga, the Gupta dynasty is said to have been founded by Nē-Muni, from whom the country takes its name of Nepāl. Lists are then given of the various dynasties, with the lengths of the reigns of the rājās. The dynasties mentioned are the Gupta, Ahir, Kirāti, Sōmavanshī, Suryavanshī, Thākurī or Rājput, Vaishya Thākurī, second Rājput, and Karnatakī dynasties. The country was then invaded by Mukundasēna, and after his expulsion various Vaishya Thākurī dynasties are said to have held the throne for a period of 225 years. The chronology of the *Vamçāvalī* up to this period is very confused and inaccurate; and, though the accounts of the various invasions and internal struggles, mixed up as they are with grotesque legends and tales, may be interesting and amusing, they can hardly be considered authentic. Some of the names of the rājās, and the dates of their reigns, have been determined by coins, the colophons of old MSS., and certain inscriptions on the temples and ancient buildings. For instance, Ançuvarma, of the Thākuri dynasty, reigned about 638 A.D., as he is mentioned by the Chinese traveller Hwen Tsang, who visited Nepāl. His name too is found in an inscription still extant. In like manner it is ascertained from MSS. that Rudra-dēva-Varma was reigning in 1008; Lakṣhmikāma-dēva from 1015 to 1040; Padma-dēva, of the Vaishya Thākuri dynasty, in 1065; Māna-dēva, of the second Rājput dynasty, in 1139; Ānanta-Malla, 1286–1302; Harisinha-dēva, 1324; Jayastithi-Malla, 1385–1391. Much information as to the chronology of the various dynasties can be obtained from the catalogue of the Cambridge MSS. compiled by Mr Cecil Bendall, M.A., and also from his papers on the ancient coins of the country. Inscriptions too have been edited by Professor Bühler in the *Indian Antiquary*, vol. ix. Detailed lists of the rājās are to be found in Kirkpatrick's *Account of Nepāl*, in Hodgson's *Essays*, Prinsep's papers in the *Asiatic Society's Journal*, and Wright's *History of Nepāl*.

The records begin to be more accurate from the time of the invasion and conquest of the country by Harisinha-dēva, the rājā of Simraungarh, 1324. This rājā was driven from Simraungarh by Tughlak Shāh of Delhi, but seems to have found little difficulty in the conquest of Nepāl. There were only four rājās of this Ayodhyā dynasty, and then the throne was occupied by Jayabhadra-Malla, a descendant of Abhaya-Malla, one of the Rājput dynasty, who reigned in the 13th century. There were eight rājās of this dynasty. The seventh, Jayastithi-Malla, who reigned for forty-three years (1386–1429), appears to have done much in forming codes of laws, and introducing caste and its rules among the Newārs. In the reign of the eighth rājā, Yaksha-Malla, the kingdom was divided into four separate states,—namely, Banēpa, Bhātgāon or Bhaktāpur, Kāntipur or Kāthmāndū, and Lalitāpur or Pātan. There was only one rājā of Banēpa, who died without issue. The Malla dynasty in the other three branches continued in power up to the conquest of the country by the Gōrkhālis in 1768.

The Gōrkhālis (Ghōrkhas or Ghoorkas) claim descent from the rājās of Chitaurgarh, in Rajputāna, near Tonk. They were driven out of their own country by the victorious Moslems, and took refuge in the hilly districts about Kumāon, whence they gradually pushed their way eastwards to Lamjung, Gōrkha, Noākōte, and ultimately to the valley of Nepāl, and as far as Sikhim.

Prithiwī-nārāyana Sāh came to the throne in 1742. From an early period he seems to have devoted all his energies to the conquest of Nepāl, but it took him upwards of twenty-five years to accomplish his object. During the early part of the 18th century Nepāl was visited by Italian missionaries, who founded a mission at Pātan, which appears to have been in a flourishing state at the time of the Gōrkhāli invasion. Father Giuseppe has given a short account of the conquest in vol. ii. of the *Asiatic Researches*, the details of which are fully corroborated by the *Vamçāvalī*. Strange to say, that work contains no reference whatever to the presence of Christians in the country. Prithiwī-nārāyana entered Kāthmāndū in 1768, and in the course of the following year also conquered Pātan and Bhātgāon. In the final struggle, which took place at Bhātgāon, Jayaprakāsa (the rājā of Kāthmāndū) was wounded, and shortly afterwards he died at Pashūpati. Ranjit-Malla, the aged rājā of Bhātgāon, was allowed to retire to Benares, where he ended his days. Tēj Narsinha, the rājā of Pātan, was kept in confinement till his death. During the latter years of the war Jayaprakāsa applied to the British for assistance, and a small force, under Captain Kinloch, was sent into the terai in 1765, but it was repulsed by the Gōrkhas.

Prithiwī-nārāyana died in 1774. He left two sons, Pratāpa-sinha Sāh and Bahādur Sāh. The former succeeded his father, but died in 1777, leaving an infant son, Rana Bahādur Sāh. On the death of Pratāpa-sinha, his brother, who had been in exile, returned to Nepāl and became regent. The mother of the infant king, however, was opposed to him, and he had again to flee to Bettiah, where he remained till the death of the rānī, when he again became regent, and continued so till 1795. During this time the Gōrkhas were busily annexing all the neighbouring petty states, so that in 1790 their territories extended from Bhutān to Kashmir, and from Tibet to the British provinces. At length, in 1790, they invaded Tibet, and were at first successful; but they were thus brought into contact with the Chinese, who in 1791 sent a large force to invade Nepāl. In 1792 the Chinese advanced as far as Noākote, and there dictated terms to the Nepalese.

In 1791 the Gōrkhas had entered into a commercial treaty with the British, and hence, when hard pressed, they applied for assistance against the Chinese to Lord Cornwallis. In consequence of this Colonel Kirkpatrick was despatched to Nepāl, and reached Noākote in the spring of 1792, but not till after peace had been concluded. One result of this embassy was the ratification of another commercial treaty on 1st March 1792.

In 1795 Rana Bahādur removed his uncle, Bahādur Sāh, from the regency, and two years subsequently put him to death. From this time up to 1799 the king, who seems to have been insane, perpetrated the most barbarous outrages, till at length his conduct became so intolerable that he was forced to abdicate in favour of his son, Girvān-yuddha Vikrama Sāh, who was still an infant. Rana Bahādur once again recovered the throne in 1804, but was assassinated in 1805.

In October 1801 another treaty was signed by the British and Nepalese authorities, and Captain W. D. Knox was appointed resident at the Nepalese court, which he reached in April 1802. He soon became dissatisfied with the conduct of the Nepalese, and he was withdrawn in 1803. From this time the Nepalese carried on a system of encroachment and outrage on the frontier, which led to a declaration of war by the British in November 1814. At first the British attacks were directed against the western portion of the Nepalese territory, and under Generals Marly, Wood, and Gillespie several disasters were met with. General Gillespie himself was killed while leading an assault on a small fort called Kalunga. General Ochterlony was more successful, and the Gōrkhas were driven beyond the Kāli river, and began to negotiate for peace. Arms, however, were soon taken up again, and Ochterlony, who was put in command, in January 1816, advanced directly on the capital in the line of the route that is now in use. He soon fought his way as far as Mukwānpūr, and the Nepalese sued for peace. A treaty was concluded in March, by which the Nepalese relinquished much of their newly acquired territory, and agreed to allow a British residency to be established at Kāthmāndū. In November the rājā died, and was succeeded by his infant son, the reins of government being held by General Bhīmasēna Thāpa.

From this time the records for many years furnish little of interest except a history of struggles for office between the Thāpa and Pānrē factions, and futile attempts at forming combinations with other states in Hindustān against the British.

In 1817 Dr Wallich visited Nepāl, and pursued his botanical researches for a year.

In 1839 Bhīmasēna's enemies succeeded in driving him from power, and he committed suicide, or was murdered, in prison. The Kāla Pānrē faction then came into power, and there were frequent grave disputes with the British. War, however, was averted by the exertions of the resident, Mr B. H. Hodgson.

In 1843 Mātabar Singh, the nephew of Bhīmasēna, returned from exile, soon got into favour at court, and, as a necessary consequence, speedily effected the destruction of his old enemies the Kāla Pānrēs, who were seized and executed in May 1843. At this time mention begins to be made of a nephew of Mātabar Singh, Jang Bahādur, the eldest of a band of seven brothers, sons of a kāji or state official. He rose rapidly in the army and in favour at the court, especially with one of the rānīs, who was of a most intriguing disposition. In 1844 he was a colonel in the army, and Mātabar Singh expressed some alarm at his growing influence to Sir Henry (then Major) Lawrence, the resident at the time. This alarm proved well founded, for on the 18th of May 1845 Jung Bahādur effected the murder of his uncle, and immediately thereafter, with the aid of the rānī, took a prominent part in the government. After a short but turbulent interval of intrigue, Jung Bahādur determined to get rid of his enemies at one fell swoop, and most thoroughly carried out his design by what is known as the Kōt massacre, on the 15th September 1846. From that time till the day of his death Jung Bahādur was in reality the ruler of Nepāl. His old friend, the intriguing rānī, was banished, and all posts of any consequence in the state were filled by Jung, his brothers, and other relatives. In 1850, finding himself securely seated in power, Jung Bahādur paid a visit to England, which made a great impression on his acute intellect, and ever after he professed and proved himself to be a staunch friend of the British. On his return in 1851, he at once devoted himself to reforming the administration of the country. Every department in the state in turn felt the benefit of his resolute will, and, whatever may have been the means by which he gained power, it must be allowed that he exercised it so as to prove himself the greatest benefactor his country has ever possessed. In 1853 a treaty for the extradition of criminals was proposed, but it was not ratified till February 1855. In 1854 the Nepalese entered into a war with Tibet, which lasted with varying success till March 1856, when peace was concluded on terms very favourable to Nepāl.

In June 1857 intelligence of the mutiny of the native troops in Hindustān reached Nepāl, and produced much excitement. Jung Bahādur, in spite of great opposition, stood firm as a friend of the British. On the 26th June 4000 troops were sent off to assist, and these rendered good service in the campaign against the mutineers. Jung himself followed on the 10th of December, with a force of 8000 men, 500 artillerymen and 24 guns, but somewhat late to be of much use. Many of the mutineers and rebels, including the infamous Nāna Sāhib, took refuge in the Nepalese terai, and it was not till the end of 1859 that they were finally swept out of the country. The Nāna was said to have died of fever in the terai, along with several others of the rebel leaders, and it is probable that this was the case, although for many years tales were circulated of his being still alive, and of his having been seen in various parts of Nepāl and British India. His wives and a few attendants resided for many years near Kāthmāndū.

In return for the aid afforded to the British, Jung Bahādur was well rewarded. He was created a G.C.B., and in 1873 a G.C.S.I., honours of which he was not a little proud. The troops employed received food and pay from the day of leaving Kāthmāndū; handsome donations were given to those severely wounded, and to the relatives of the killed; great quantities of muskets and rifles were presented to the Nepalese Government; and, to crown all, a large portion of the terai was restored to Nepāl. This ground contains most valuable sāl and sisū forests, and yields a revenue of several lākhs of rupees yearly.

From the termination of the mutiny Nepalese history has been uneventful. The country has been prosperous, and the relations with the British have continued to be most friendly. Nevertheless the restrictions on commerce, and the prohibitions against Europeans entering the country, or travelling beyond certain narrow limits, are as rigidly enforced as they were a hundred years ago. Sir Jung Bahādur died suddenly in the terai in 1877. In spite of all the exertions he had made to bring about a better state of things, three of his wives were allowed to immolate themselves on his funeral pyre. His brother, Sir Ranadip Singh Bahādur, G.C.S.I., succeeded him as prime minister. Shortly after his accession to power a plot was formed against him, but he showed himself as prompt to meet such an emergency as his late brother had been, for nearly forty of the conspirators were seized and executed in a summary manner, and others, who escaped, are now living in exile.

The rājās of the Gōrkhālī line in Nepāl, with dates of accession, are—Prithiwī-nārāyana Sāh (1768), Pratāpa-sinha Sāh (1774), Rana Bahādur Sāh (1777), Girvān-yuddha Vikrama Sāh (1799), Rājendra Vikrama Sāh (1816), Surendra Vikrama Sāh (1847), Prithiwī Vīr Vikrama Sāh (1881). (D. WR.)

NEPHRITE. See JADE.

NEPOMUK, ST JOHN OF. See JOHN, vol. xiii. p. 718.

NEPOS, CORNELIUS, a Roman historian, friend of Catullus, Cicero, and Pomponius Atticus, was probably a native of Verona. Nothing is known of his life, but he is recorded to have written a universal history under the title *Chronica*, letters to Cicero, and other works, especially a series of biographies styled *De Viris Illustribus*. It is one of the problems of Latin literature whether or not any of these works have been preserved. There is a series of biographies, chiefly of Greek generals, first printed at Venice in 1471 under the title *Æmilii Probi de Vita Excellentium*. Other later editions bear slightly varying titles, and add the lives of Cato and Atticus. Many MSS. expressly assign the last to Cornelius Nepos, and in 1569 Lambinus, in a famous edition of the *Lives*, maintained that the whole of them were the work of Nepos. The chief argument in favour of this view is founded on the language, which is a model of chaste, elegant Latinity. The view of Lambinus has been very generally accepted; the only question debated is whether all the lives are in the original condition, or whether some of them have been modified or abridged by Æmilius Probus. The editions of Nepos's *Lives* are extremely numerous, the book having long been much read in schools.

NEPOS, JULIUS, the last but one of the Roman emperors of the West, from 474 to 475, was a nephew of that Marcellinus who in the latter half of the 5th century had established a semi-independent principality in Dalmatia. After the death of Olybrius, on October 23, 472, the throne of the West remained for some months vacant, during which Italy was abandoned to lawless barbarians. On the 5th of March 473, the army, at the instigation of Gundobald the Burgundian, who had succeeded to the power and authority of his uncle Ricimer, raised Glycerius, an obscure officer, to the imperial dignity. Meanwhile Leo I., emperor of the East, was discussing with his council the election of a new colleague for the Western empire. At length choice was made of Nepos, who married a niece of the empress Verina. After considerable delay he landed in Italy and took Glycerius prisoner at Portus at the mouth of the Tiber in 474. Glycerius, being compelled to enter the church, was appointed bishop of Salona. The only event of the reign of Nepos was the inglorious cession to the Visigoths of the province of Auvergne. In 475 Orestes, father of Augustulus, who afterwards was the last emperor of the West, raised the standard of revolt and marched against Nepos at Ravenna. The emperor fled into Dalmatia, and continued to reside at Salona until his assassination by two of his own officers in 480. There exists some doubt, however, whether his death was, as Gibbon affirms caused by his former rival, the bishop of Salona.

NEPTUNE, the Roman god of the sea, is probably adopted from Greek religion. The earliest reference to his worship is on the occasion when the Sibylline books included him among the gods to whom the first lectisternium was dedicated, 399 B.C. (Livy v. 13). In the poets no trait of Neptune occurs that is not directly borrowed from the Greek Poseidon. His festival, Neptunalia, was celebrated on July 23, and his temple stood near the Circus Flaminius. His worship was never popular or widespread in Rome. The god Portunus was thanked for naval victories in earlier times; but Sextus Pompey called himself son of Neptune, and Agrippa dedicated to Neptune a temple in the Campus Martius in honour of the naval victory of Actium.

NÉRAC, a town of France, formerly the capital of the duchy of Albret, is situated in the department of Lot-et-Garonne, on both banks of the Bayse, a navigable tributary of the Garonne, 16 miles west-south-west of Agen. It is a pretty and flourishing little place of 4803 inhabitants (1881; commune 7384), with cloth factories, cork-works, and a number of flour-mills; the ruins of its castle are entered in the Government list of historical monuments; and in the old royal park (La Garenne) it has one of the finest promenades of the south of France.

Roman ruins of hot baths, villas, &c., discovered at Nérac in 1831-33 show that the site must have been occupied in the 3d century. In 1250 a Benedictine monastery was established, and in 1306 the lords of Albret expelled the monks and began to build a castle for themselves, which gradually grew into an imposing edifice Here Marguerite d'Angoulême held court as queen of Navarre, and gathered round her the Protestant literati of her time, Beza, Marot, &c.; here Henry IV. spent a large part of his youth; and here Catherine de' Medici in 1579 held a conference with the Protestant leaders. The town was dismantled in 1622 by Louis XIII. because it had sided with the Protestant party.

NERBUDDA (properly NARBADÁ), one of the great rivers of India, traditionally regarded as the boundary between Hindustan proper and the Deccan. It rises on the summit of Amarkantak hill in Rewah state, in 22°

41′ N. lat., 89° 41′ E. long., and after a westward course of 800 miles through the Central Provinces and Guzerat, falls into the sea in 21° 38′ N. lat., 72° 0′ 30″ E. long., in the Bombay district of Broach. During its passage through the Central Provinces several falls interrupt its course, the principal of which are a series of glittering cascades and rapids for some hundreds of feet down the heights of Amarkantak, and the well-known falls of the "Marble rocks" 9 miles below Jabalpur. After leaving the Central Provinces, the river widens out in the fertile district of Broach, with an average breadth of from half a mile to a mile. Below Broach city it forms an estuary which is 13 miles broad where it enters the Gulf of Cambay. The Nerbudda is nowhere utilized for irrigation, and navigation is confined to the lower section. In the rainy season boats of considerable size sail about 60 miles above Broach city. Sea-going ships of about 70 tons frequent the port of Broach, but they are entirely dependent on the tide. In sanctity the Nerbudda ranks only second to the Ganges among the rivers of India, and along its whole course are special places of pilgrimage. The most meritorious act that a pilgrim can perform is to walk from the sea to the source of the river and back along the opposite bank. This pilgrimage is chiefly undertaken by devotees from Guzerat and the Deccan, and takes from one to two years to accomplish.

NEREUS, the old man of the sea, as his name (comp. *νάω*, modern Greek *νερό*, water) denotes, was described in Greek legend as full of wisdom and knowledge, friendly to men, but requiring compulsion before he reveals to them all that he knows. The struggle in which Heracles wrestles and overcomes him is a favourite subject of early Greek art; Heracles, the representative of toiling active man, bends to do his will even the power of the sea, *ἅλιος γέρων*. The fifty daughters of Nereus, the Nereids, are personifications of the smiling, quiet sea with all the gifts which it offers to men. None of the Nereids have any individual character except Thetis, Amphitrite, and Galatea. Thetis and Amphitrite are the queen or mistress of the sea in the legend of different localities; Galatea is a Sicilian figure, who plays with and deludes her rustic lover of the shore, Polyphemus. It is impossible to treat in brief of the religious conceptions on which the mythology of Nereus is founded, or of the connexion between the early representations of Nereus and Heracles and similar subjects in pre-Hellenic art.

NERI, PHILIP (1515–1595). Filippo Neri, one of the most remarkable and individual figures amongst the ecclesiastics of the 16th century, was born at Florence, July 21, 1515, the youngest child of Francesco Neri, a lawyer of that city, and his wife Lucrezia Soldi, a woman of higher birth than her husband, and descended from a family whose members had held important public offices in the time of the republic. They were both devout persons, and Francesco was accustomed to intercourse with the monastic bodies in Florence, notably with the Dominicans. The child was carefully brought up, and displayed from infancy a winning, gentle, intelligent, playful, and yet obedient disposition, which earned him the title of the "good Pippo" (*bon Pippo*) amongst his young companions. He received almost his earliest teachings from the friars at San Marco, the famous Dominican monastery in Florence, and was accustomed in after life to ascribe most of his progress to the teaching of two amongst them, Zenobio de' Medici and Servanzio Mini. When he was about sixteen years old, a fire destroyed nearly all his father's property, and it became therefore expedient to seek some means of recruiting the family fortunes. His father's brother Romolo, a merchant at San Germano, a Neapolitan town in the Terra di Lavoro, near the base of Monte Cassino, was wealthy and childless, and to him Philip was sent in 1531, to assist him in his business, and with the hope that he might inherit his possessions. So far as gaining Romolo's confidence and affection, the plan was entirely successful, but it was thwarted by Philip's own resolve to adopt the ecclesiastical calling, a determination at which he arrived in the course of frequent visits to a solitary chapel on a rock overlooking the Bay of Gaeta. In 1533 he left San Germano, and betook himself to Rome, where he found shelter, food, and protection in the house of a Florentine gentleman named Galeotto Caccia, to whose two children he became tutor, continuing in that post for several years, and pursuing his own studies independently, while also practising habitual austerities, and beginning those labours amongst the sick and poor which gained him in later life the title of "Apostle of Rome," besides paying nightly visits for prayer and meditations to the basilican churches of the city, and to the catacombs. In 1538 he entered on that course of home mission work which was the distinguishing characteristic of his life, and which bears in much of its method a curious resemblance to the manner in which Socrates was accustomed to set the Athenians thinking, in that he traversed the city, seizing opportunities of entering into conversation with persons of all ranks, and of leading them on, now with playful irony, now with searching questions, and again with words of wise and kindly counsel, to consider the topics he desired to set before them.

In 1548 he founded the celebrated confraternity of the Santissima Trinità de' Pellegrini e de' Convalescente, whose primary object is to minister to the needs of the thousands of poor pilgrims accustomed to flock to Rome, especially in years of jubilee, and also to relieve the patients discharged from hospitals, but still too weak for labour. In 1551 he passed through all the minor orders, and was ordained deacon, and finally priest on May 23. He settled down, with some companions, at the hospital of San Girolamo della Carità, and while there tentatively began, in 1556, the institute with which his name is more especially connected, that of the Oratory, after a plan he had formed of proceeding as a missionary to India was abandoned at the instance of shrewd advisers, who saw that there was abundant work to be done in Rome, and that he was the man to do it. The scheme of the Oratory at first was no more than a series of evening meetings in his own room, at which there were prayers, hymns, readings from Scripture, from the fathers, and from the *Martyrology*, followed by a lecture, or by discussion of some religious question proposed for consideration. It afterwards was developed further, and the members of the society were employed in various kinds of mission work throughout Rome, notably in preaching sermons in different churches every evening, a wholly novel agency at that time. In 1564 the Florentines, who regarded themselves as having a special claim upon him as their fellow-citizen, requested him to leave San Girolamo, and to take the oversight of their peculiar church in Rome, San Giovanni dei Fiorentini, then newly built. He was at first reluctant, but the pope (Pius IV.) was induced to enjoin him to accept, permitting him, however, to retain the charge of San Girolamo, where the exercises of the Oratory were still kept up. At this time the new society included amongst its members Cæsar Baronius the ecclesiastical historian, Tarrugi, afterwards archbishop of Avignon, and Paravicini, all three subsequently cardinals, and also Gallonius, author of a well-known work on the *Sufferings of the Martyrs*, Ancina, Bordoni, and other men of ability and distinction.

The Florentines, however, built in 1574 a large oratory or mission-room for the society contiguous to San Giovanni, in order to save them the fatigue of the daily journey to and from San Girolamo, and to provide a more convenient place of assembly, and the headquarters were transferred thither. As the community grew, and its mission work extended, the need of having a church entirely its own, and not subject to other claims, as were San Girolamo and San Giovanni, made itself felt, and the offer of the small parish church of Santa Maria in Vallicella, conveniently situated in the middle of Rome, was made and accepted. The building, however, as not large enough for their purpose, was pulled down, and a splendid church erected on the site. It was immediately after taking possession of their new quarters that Filippo Neri formally organized, under permission of a bull dated July 15, 1575, a community of secular priests, entitled the Congregation of the Oratory. The new church was consecrated early in 1577, and the clergy of the new society at once resigned the charge of San Giovanni dei Fiorentini, but Neri himself did not migrate from San Girolamo till 1583, and then only in virtue of an injunction of the pope that he, as the superior, should reside at the chief house of his congregation. He was at first elected for a term of three years (as is usual in modern societies), but in 1587 was nominated superior for life. He was, however, entirely free from personal ambition, and had no desire to be general over a number of dependent houses, so that he desired that all congregations formed on his model outside Rome should be autonomous, governing themselves, and without endeavouring to retain control over any new colonies they might themselves send out,—a regulation afterwards formally confirmed by a brief of Gregory XV. in 1622. Much as he mingled with society, and with persons of importance in church and state, his single interference in political matters was in 1593, when his persuasions induced the pope, Clement VIII., to withdraw the excommunication and anathema of Henry IV. of France, and the refusal to receive his ambassador, even though the king had formally abjured Calvinism. Neri saw that the pope's attitude was more than likely to drive Henry to a relapse, and probably to rekindle the civil war in France, and directed Baronius, then the pope's confessor, to refuse him absolution, and to resign his office of confessor, unless he would withdraw the anathema. Clement yielded at once, though the whole college of cardinals had supported his policy; and Henry, who did not learn the facts till several years afterwards, testified lively gratitude for the timely and politic intervention. Neri continued in the government of the Oratory until his death, which took place on May 26, 1595, in the eightieth year of his age. There are many anecdotes told of him which attest his possession of a playful humour, united with shrewd mother-wit, often urging him to acts with a ludicrous aspect, but which were well calculated to serve his purpose of divesting religion of the hyper-professional garb it wore in his day, and bringing it within the area of ordinary lay experience. This, rather than the atmosphere of supernaturalism with which he is surrounded in the various biographies of him which have appeared, and that to a much greater degree than is common in similar writings, is the true key to his popularity, and to the fact that his name figures often in the folk-lore of the Roman poor, whom he loved so well and served so long. He was beatified by Paul V. in 1600, and canonized by Gregory XV. in 1622.

"Practical commonplaceness," to cite the words of Frederick William Faber in his panegyric of Philip Neri, was the special mark which distinguishes his form of ascetic piety from the types accredited before his day. "He looked like other men . . . . he was emphatically a modern gentleman, of scrupulous courtesy, sportive gaiety, acquainted with what was going on in the world, taking a real interest in it, giving and getting information, very neatly dressed, with a shrewd common sense always alive about him, in a modern room with modern furniture, plain, it is true, but with no marks of poverty about it,—in a word, with all the ease, the gracefulness, the polish of a modern gentleman of good birth, considerable accomplishments, and a very various information." Accordingly, he was ready to meet the needs of his day to an extent and in a manner which even the versatile Jesuits, who much desired to enlist him in their company, did not rival; and, though an Italian priest and head of a new religious order, his genius was entirely unmonastic and unmediæval; he was the active promoter of vernacular services, frequent and popular preaching, unconventional prayer, and unsystematized, albeit fervent, private subjective devotion.

Philip Neri was not a reformer, save in the sense that in the active discharge of pastoral work he laboured to reform individuals. He had no difficulties in respect of the teaching and practice of his church, being in truth an ardent Ultramontane in doctrine, as was all but inevitable in his time and circumstances, and his great merit was the instinctive tact which showed him that the system of monasticism could never be the leaven of secular life, but that something more homely, simple, and everyday in character was needed for the new time.

Accordingly, the institute he founded is of the least conventional nature, rather resembling a residential clerical club than a monastery of the older type, and its rules would have appeared incredibly lax, nay, its religious character almost doubtful, to a Bruno, a Stephen Harding, a Francis, or a Dominic. It admits only priests aged at least thirty-six, or ecclesiastics who have completed their studies, and are ready for ordination. The members live in community, and each pays his own expenses, having the usufruct of his private means,—a startling innovation on the monastic vow of poverty. They have indeed a common table, but it is kept up precisely as a regimental mess, by monthly payments from each member. Nothing is provided by the society except the bare lodging, and the fees of a visiting physician. Everything else —clothing, books, furniture, medicines—must be defrayed at the private charges of each member. There are no vows, and every member of the society is at liberty to withdraw when he pleases, and to take his property with him. The government, strikingly unlike the Jesuit autocracy, is of a republican form; and the superior, though first in honour, has to take his turn in discharging all the duties which come to each priest of the society in the order of his seniority, including that of waiting at table, which is not entrusted in the Oratory to lay brothers, according to the practice in most other communities. Four deputies assist the superior in the government, and all public acts are decided by a majority of votes of the whole congregation, in which the superior has no casting voice. To be chosen superior, fifteen years of membership are requisite, as a qualification, and the office is tenable, as all the others, for but three years at a time. No one can vote till he has been three years in the society; the deliberative voice is not obtained before the eleventh year. Each house can call its superior to account, can depose, and can restore him, without appeal to any external authority, although the bishop of the diocese in which any house of the Oratory is established is its ordinary and immediate superior, though without power to interfere with the rule. Their churches are non-parochial, and they can perform such rites as baptisms, marriages, &c., only by permission of the parish priest, who is entitled to receive all fees due in respect of these ministrations. The Oratory chiefly spread in Italy, but a branch established in Paris by Cardinal de Bérulle in 1611 had a great success and a distinguished history. It fell in the crash of the Revolution, but was revived by Père Pététot, curé of St Roch, in 1852; while an English house, founded in 1847, is celebrated as the place at which Cardinal Newman fixed his abode after his submission to the Roman Catholic Church. The society has never thriven in Germany, though a few houses have been founded there, in Munich and Vienna.

Authorities.—Marciano, *Memorie istoriche della Congregazione dell' Oratorio*, 5 vols. folio, Naples, 1693–1702; Bacci, *Life of Saint Philip Neri*, translated by Faber, 2 vols. 8vo, London, 1847; Crispino, *La Scuola di San Filippo Neri*, 8vo, Naples, 1675; Faber, *Spirit and Genius of St Philip Neri*, 8vo, London, 1850; Agnelli, *Excellencies of the Oratory of St Philip Neri*, translated by F. A. Antrobus, London, 1881; articles by F. Theiner in Wetzer und Welte's *Kirchenlexicon*, and by Reuchlin in Herzog's *Real-Encyklopädie*. (R. F. L.)

NERO (37–68 A.D.), Roman emperor, the only child of Cn. Domitius Ahenobarbus and the younger Agrippina, was born at Antium on December 15, 37 A.D., nine months after the death of the emperor Tiberius. Though on both his father's and his mother's side he came of the blood of Augustus, and the astrologers are said to have predicted that he would one day be emperor, the circumstances of his early life gave little presage of his future eminence. His father Domitius, at best a violent, pleasure-seeking noble, died when Nero was scarcely three years old. In the previous year (39 A.D.) his mother had been banished by order of her brother the emperor Caligula on a charge of treasonable conspiracy, and Nero, thus early deprived of both parents, found a bare shelter in the house of his aunt Domitia, where two slaves, a barber and a dancer, commenced the training of the future emperor. With the death of Caligula in 41 A.D. his prospects improved, for Agrippina was recalled from exile by her uncle, the new emperor Claudius, and resumed the charge of her young son. Nero's history during the next thirteen years is summed up in the determined struggle carried on by his mother to win for him the throne which it had been predicted should be his. The fight was a hard one. Messalina, Claudius's wife, was all powerful with her husband, and her son Britannicus was by common consent regarded as the next in succession. But on the other hand Claudius was weak and easily led, and Agrippina daringly aspired to supplant Messalina in his affections. To outweigh Britannicus's claims as the son of the reigning emperor, she relied on the double prestige which attached to her own son, as being at once the grandson of the popular favourite Germanicus and the lineal descendant of Augustus himself. Above all, she may well have put confidence in her own great abilities, indomitable will, and untiring energy, and in her readiness to sacrifice everything, even her personal honour, for the attainment of the end she had in view. Her first decisive success was gained in 48 by the disgrace and execution of Messalina. In 49 followed her own marriage with her uncle Claudius, and her recognition as his consort in the government of the empire.[1] She now freely used her ascendency to advance the interests of her son. The Roman populace already looked with favour on the grandson of Germanicus, but in 50 his claims obtained a more formal recognition from Claudius himself, and the young Domitius was adopted by the emperor under the title of Nero Claudius Cæsar Drusus Germanicus.[2] Agrippina's next step was to provide for her son the training needed to fit him for the brilliant future which seemed opening before him. The philosopher L. Annæus Seneca was recalled from exile and appointed tutor to the young prince. On December 15, 51, Nero completed his fourteenth year, and Agrippina, in view of Claudius's failing health, determined to delay no longer his adoption of the toga virilis. The occasion was celebrated in a manner which seemed to place Nero's prospects of succession beyond the reach of doubt. He was introduced to the senate by Claudius himself. The proconsular imperium and the title of "princeps juventutis" were conferred upon him.[3] He was specially admitted as an extraordinary member of the great priestly colleges, and his name was included by the Arval Brethren in their prayers for the safety of the emperor and his house. Largesses and donations delighted the populace and the soldiery, and at the games in the circus Nero's appearance in triumphal dress contrasted significantly with the simple toga prætexta worn by Britannicus. During the next two years Agrippina followed up this great success with her usual energy. Britannicus's leading partisans were banished or put to death, and the all-important command of the prætorian guard was transferred to Afranius Burrus, formerly a tutor of Nero's, and devoted to his service. Nero himself was put prominently forward whenever occasion offered. The petitions addressed to the senate by the town of Bononia and by the communities of Rhodes and Ilium were gracefully supported by him in Latin and Greek speeches, and during Claudius's absence in 52 at the Latin festival it was Nero who, as prefect of the city, administered justice in the forum to crowds of suitors. Early in 53 his marriage with Claudius's daughter, the ill-fated Octavia, drew still closer the ties which connected him with the imperial house, and now nothing but Claudius's death seemed wanting to secure his final triumph. This event, which could not in the course of nature be long delayed, Agrippina determined to hasten, and the absence, through illness, of the emperor's trusted freedman Narcissus, favoured her schemes. On October 13, 54, Claudius died, poisoned, as all our authorities declare, by the orders of his unscrupulous wife. For some hours the fact of his death was concealed, but at noon the gates of the palace were thrown open, and Nero was presented to the soldiers on guard as their new sovereign. From the steps of the palace he proceeded to the prætorian camp to receive the salutations of the troops, and thence to the senate-house, where he was fully and promptly invested with all the honours, titles, and powers of emperor.[4]

Agrippina's bold stroke had been completely successful. Its suddenness had disarmed opposition: only a few voices were raised for Britannicus; nor is there any doubt that Rome was prepared to welcome the new emperor with genuine enthusiasm. To his descent from Germanicus and from Augustus he owed a prestige which was strengthened by the general belief in his own good qualities. He was young, generous, and genial. His abilities, really considerable, were skilfully assisted and magnified by Seneca's ready dexterity, while the existence of his worse qualities—his childish vanity, ungovernable selfishness, and savage temper—was as yet unsuspected by all but those immediately about him. His first acts confirmed the favourable impressions thus produced. With graceful modesty he declined the venerable title of "pater patriæ." The memory of Claudius, and that of his own father Domitius were duly honoured. The senate listened with delight to his promises to rule according to the maxims of Augustus, and to avoid the errors and abuses which had multiplied under the rule at once lax and arbitrary of his predecessor, while his unfailing clemency, liberality, and affability were the talk of Rome. Much no doubt of the credit of all this is due to Seneca, and his faithful ally Burrus. Seneca had seen from the first that the real danger with Nero lay in the savage vehemence of his passions, and he made it his chief aim to stave off by every means in his power the dreaded outbreak of "the wild beast" element in his pupil's nature. He indulged him to the full in all his tastes, smoothed away opposition, and, while relieving him as far as possible of the more irksome duties of government, gave him every facility for easily winning the applause he craved for by acts of generosity which cost him little. Nor is it certain that any other policy would have succeeded better with a nature like Nero's, which had never known training or restraint, and now revelled with childish delight in the consciousness of absolute power. Provided only that the wild beast did not taste blood, it mattered little if respectable society was scandalized at the sight of an emperor whose chief delight was in pursuits hitherto left to Greek slaves and freedmen. At any rate the policy succeeded for the time. During the first five years of his reign, the golden "quinquennium Neronis," little occurred to damp the hopes excited by his behaviour on succeeding to the throne. His clemency of temper was unabated. His promises of constitutional moderation were amply fulfilled, and the senate found itself free to discuss and even to decide important administrative questions. Abuses were remedied, the provincials protected from oppression, and the burdens of taxation lightened. On the frontiers, thanks chiefly to Corbulo's energy and skill, no disaster occurred serious enough to shake the general confidence in the government, and even the murder of Britannicus seems to have been easily pardoned at the time as a necessary measure of self-defence. But Seneca's fears of what the consequences would be, should Nero's sleeping passions once be roused, were fully verified by the result, and he seems to have seen all along from what quarter danger was to be apprehended. Agrippina's imperious temper and insatiable love of power made it certain that she would not willingly abandon her ascendency over her son, and it was scarcely less certain that her efforts to retain it would bring her into collision with his ungovernable self-will. At the same time the success of Seneca's own management of Nero largely depended on his being able gradually to emancipate the emperor from his mother's control. During the first few months of Nero's reign the chances of such an emancipation seemed remote, for he not only treated his mother with elaborate respect, but consulted her on all affairs of state. In 55, however, Seneca found a powerful ally in Nero's passion for the beautiful freedwoman Acte, a passion which he deliberately encouraged for his own purposes. Agrippina's injured pride provoked her to angry remonstrances, which served only to irritate her wayward son, and the caresses by which she endeavoured to repair her mistake equally failed in their object. Furious at her discomfiture, she rashly tried intimidation, and threatened to espouse the cause of the injured Britannicus. But her threats only served to show that her son, if once his will was crossed, or his fears aroused, could be as unscrupulous and headstrong as his mother. Britannicus was poisoned as he sat at table. Agrippina, however, still persisted. She attempted to win over Nero's neglected wife Octavia, and to form a party of her own within the court. Nero replied by dismissing her guards, and placing herself in a sort of honourable confinement.[1] This second defeat seems to have decided Agrippina to acquiesce in her deposition from the leading position she had filled since 49. During nearly three years she disappears from the history, and with her retirement things again for the time went smoothly. In 58, however, fresh cause for anxiety appeared. For the second time Nero was enslaved by the charms of a mistress. But Poppæa Sabina, the new favourite, was a woman of a very different stamp from her predecessor. High-born, wealthy, and accomplished, she had no mind to be merely the emperor's plaything. She was resolved to be his wife, and with consummate skill she set herself at once to remove the obstacles which stood in her way. Her first object was the final ruin of Agrippina. By taunts and caresses she drove her weak and passionate lover into a frenzy of fear and baulked desire. She taught him easily enough to hate and dislike his mother as an irksome check on his freedom of action, and as dangerous to his personal safety. To get rid of her, no matter how, became his one object, and the diabolical ingenuity of Anicetus, a freedman, and now prefect of the fleet at Misenum, devised a means of doing so without unnecessary scandal. Agrippina was invited to Baiæ, and after an affectionate reception by her son, was conducted on board a vessel so constructed as, at a given signal, to fall to pieces and precipitate its passengers into the waters of the lake. But the manœuvre failed. Agrippina saved herself by swimming to the shore, and at once wrote to her son, announcing her escape, and affecting entire ignorance of the plot against her. The news filled Nero with consternation, but once again Anicetus came to his rescue. A body of soldiers under his command surrounded Agrippina's villa, and murdered her in her own chamber.[2] The deed done, Nero was for the moment horrorstruck at the enormity of the crime, and terrified at its possible consequences to himself. But a six months' residence in Campania, and the congratulations which poured in upon him from the neighbouring towns, where the report had been officially spread that Agrippina had fallen a victim to her own treacherous designs upon the emperor's life, gradually restored his courage. In September 59 he re-entered Rome amid universal rejoicing, fully resolved upon enjoying his dearly bought freedom. A prolonged carnival followed, in which Nero revelled in the public gratification of the tastes which he had hitherto ventured to indulge only in comparative privacy. Chariot races, musical and dramatic exhibitions, games in the Greek fashion, rapidly succeeded each other. In all the emperor was a prominent figure, and the fashionable world of Rome, willingly or unwillingly, followed the imperial example. These revels, however, extravagant as they were, at least involved no bloodshed, and were humanizing and civilized compared with the orthodox Roman gladiatorial shows. A far more serious result of the death of Agrippina was the growing influence over Nero of Poppæa and her friends; and in 62 their influence was fatally strengthened by the removal of the trusty advisers who had hitherto stood by the emperor's side. Burrus died early in that year, it was said from the effects of poison, and his death was immediately followed by the retirement of Seneca from a position which he felt to be no longer tenable. Their place was filled by Poppæa, and by the infamous Tigellinus, whose sympathy with Nero's sensual tastes had gained him the command of the prætorian guards in succession to Burrus. The two now set themselves to attain a complete mastery over the emperor. The haunting fear of conspiracy, which had unnerved stronger Cæsars before him, was skilfully used to direct Nero's fierce suspicions against possible opponents. Cornelius Sulla, who had been banished to Massilia in 58, was put to death on the ground that his residence in Gaul was likely to arouse disaffection in that province, and a similar charge proved fatal to Rubellius Plautus, who had for two years been living in retirement in Asia.[3] Nero's taste for blood thus whetted, a more illustrious victim was next found in the person of the unhappy Octavia. At the instigation of Poppæa she was first divorced and then banished to the island of Pandateria, where a few days later she was barbarously murdered. Poppæa's triumph was now complete. She was formally married to Nero; her head appeared on the coins side by side with his; and her statues were erected in the public places of Rome.

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[1] Tac., *Ann.*, xii. 26, 36; see also Schiller, *Nero*, 67.

[2] Tac., *Ann.*, xii. 26; Zonaras, xi. 10.

[3] Tac., *Ann.*, xii. 41.

[4] Tac., *Ann.*, xii. 96; Suet., *Nero*, 8.

This series of crimes, in spite of the unvarying applause which still greeted all Nero's acts, had excited gloomy forebodings of coming evil, and the general uneasiness was increased by the events which followed. In 63 the partial destruction of Pompeii by an earthquake, and the news of the evacuation of Armenia by the Roman legions, seemed to confirm the belief that the blessing of the gods was no longer with the emperor. A far deeper and more lasting impression was produced by the great fire in Rome, an event which more than almost any other has thrown a lurid light round Nero's reign. The fire broke out on the night of July 18, 64, among the wooden booths at the south-east end of the Circus Maximus. Thence in one direction it rapidly spread over the Palatine and Velia up to the low cliffs of the Esquiline, and in another it laid waste the Aventine, the Forum Boarium, and Velabrum till it reached the Tiber and the solid barrier of the Servian wall. After burning fiercely for six days, and when its fury seemed to have exhausted itself, it suddenly started afresh in the northern quarter of the city, and desolated the two regions of the Circus Flaminius and the Via Lata. By the time that it was finally quenched only four of the fourteen regiones remained untouched; three had been utterly destroyed, and seven reduced to ruins. The conflagration is said by all authorities later than Tacitus to have been deliberately caused by Nero himself.[1] But Tacitus, though he mentions rumours to that effect, declares that its origin was uncertain, and his description of Nero's energetic conduct at the time justifies us in acquitting the emperor of so reckless a piece of incendiarism. By Nero's orders, the open spaces in the Campus Martius were utilized to give shelter to the homeless crowds, provisions were brought up from Ostia, and the price of corn lowered. In rebuilding the city every precaution was taken against the recurrence of such a calamity. Broad regular streets replaced the narrow winding alleys. The new houses were limited in height, built partly of hard stone, and protected by open spaces and colonnades. The water supply, lastly, was carefully regulated. But there is nevertheless no doubt that this great disaster told against Nero in the popular mind. It was regarded as a direct manifestation of the wrath of the gods, even by those who did not share the current suspicions of the emperor's guilt. This impression no religious ceremonies, nor even the execution of a number of Christians, hastily pitched upon as convenient scapegoats, could altogether dispel. Nero, however, undeterred by forebodings and rumours, proceeded with the congenial work of repairing the damage inflicted by the flames. In addition to the rebuilding of the streets, he gratified his love of magnificence by the erection of a splendid palace for himself. The wonders of his "golden house" were remembered and talked of long after its partial demolition by Vespasian. It stretched from the Palatine across the low ground, afterwards occupied by the Colosseum, to the Esquiline. Its walls blazed with gold and precious stones; masterpieces of art from Greece adorned its walls; but most marvellous of all were the grounds in which it stood, with their meadows and lakes, their shady woods, and their distant views. To defray the enormous cost, Italy and the provinces, says Tacitus, were ransacked, and in Asia and Achaia especially the rapacity of the imperial commissioners recalled the days of Mummius and of Sulla.[2] It was the first occasion on which the provincials had suffered from Nero's rule, and the discontent it caused helped to weaken his hold over them at the very moment when the growing discontent in Rome was gathering to a head. For early in 65 Nero was panic-stricken amid his pleasures by the discovery of a formidable conspiracy against his life and rule. Such conspiracies, prompted partly by the ambition of powerful nobles and partly by their personal fears, had been of frequent occurrence in the history of the Caesars, and now Nero's recent excesses, and his declining popularity, seemed to promise well for the success of the plot. Among the conspirators were many who held important posts, or belonged to the innermost circle of Nero's friends, such as Faenius Rufus, Tigellinus's colleague in the prefecture of the praetorian guards, Plautius Lateranus, one of the consuls elect, the poet Lucan, and, lastly, not a few of the tribunes and centurions of the praetorian guard itself. Their chosen leader, whom they destined to succeed Nero, was C. Calpurnius Piso, a handsome, wealthy, and popular noble, and a boon companion of Nero himself. The plan was that Nero should be murdered when he appeared as usual at the games in the circus, but the design was frustrated by the treachery of a freedman Milichus, who, tempted by the hope of a large reward, disclosed the whole plot to the emperor. In a frenzy of sudden terror Nero struck right and left among the ranks of the conspirators. Piso was put to death in his own house; and his fall was rapidly followed by the execution of Faenius Rufus, Lucan, and many of their less prominent accomplices. Even Seneca himself, though there seems to have been no evidence of his complicity, could not escape the frantic suspiciousness of the emperor, stimulated as it may have been in his case by the jealousy of Tigellinus and Poppaea. The order for his death reached him in his country house near Rome, and he met his fate with dignity and courage. For the moment Nero felt safe; but, though largesses and thanksgivings celebrated the suppression of the conspiracy, and the dazzling round of games and shows was renewed with even increased splendour, the effects of the shock were visible in the long and dreary list of victims who during the next few months were sacrificed to his restless fears and savage resentment. Conspicuous among them was Paetus Thrasea, whose irreconcilable non-conformity and unbending virtue had long made him distasteful to Nero, and who was now suspected, possibly with reason, of sympathy with the conspirators. The death of Poppaea in the autumn of 65 was probably not lamented by any one but her husband, but the general gloom was deepened by a pestilence, caused, it seems, by the overcrowding at the time of the fire, which decimated the population of the capital. Early, however, in the summer of 66, the visit of the Parthian prince Tiridates to Italy seemed to shed a ray of light over the increasing darkness of Nero's last years. Corbulo had settled matters satisfactorily in Armenia. The Parthians were gratified by the elevation to the Armenian throne of their king's brother, and Tiridates, in return, consented to receive his crown from the hands of the Roman emperor. In royal state he travelled to Italy, and at Rome the ceremony of investiture was performed with the utmost splendour. Delighted with this tribute to his greatness, Nero for a moment dreamt of rivalling Alexander, and winning fame as a conqueror. Expeditions were talked of to the shores of the Caspian Sea and against the remote Ethiopians, but Nero was no soldier, and he quickly turned to a more congenial field for triumph. He had long panted for an opportunity of displaying his varied artistic gifts before a worthier and more sympathetic audience than could be found in Rome. With this view he had already, in 64, appeared on the stage before the half-Greek public of Naples. But his mind was now set on challenging the applause of the Greeks themselves in the ancient home of art. Towards the end of 66 he arrived in Greece, accompanied by a motley following of soldiers, courtiers, musicians, and dancers, determined to forget for a time Rome and the irksome affairs of Rome with its conspiracies and intrigues. No episode in Nero's reign has afforded such plentiful material for the imagination of subsequent writers as his visit to Greece; but, when every allowance is made for exaggeration and sheer invention, it must still be confessed that the spectacle presented was unique.[3] The emperor appeared there professedly as merely an enthusiastic worshipper of Greek art, and a humble candidate for the suffrages of Greek judges. At each of the great festivals, which to please him were for once crowded into a single year, he entered in regular form for the various competitions, scrupulously conformed to the tradition and rules of the arena, and awaited in nervous suspense the verdict of the umpires. The dexterous Greeks, flattered by his genuine enthusiasm, humoured him to the top of his bent. Everywhere the imperial competitor was victorious. Crowns were showered upon him, and crowded audiences importuned him to display his talents. The delighted emperor protested that only the Greeks were fit to hear him, and their ready complaisance was rewarded when he left by the bestowal of immunity from the land tax on the whole province, and the gift of the Roman franchise to his appreciative judges, while as a more splendid and lasting memorial of his visit, he planned and actually commenced the cutting of a canal through the Isthmus of Corinth. If we may believe report, Nero found time in the intervals of his artistic triumphs for more vicious excesses. The stories of his mock marriage with Sporus, his execution of wealthy Greeks for the sake of their money, and his wholesale plundering of the temples were evidently part of the accepted tradition about him in the time of Suetonius, and are at least credible. Far more certainly true is his ungrateful treatment of Domitius Corbulo, who, when he landed at Cenchreæ, fresh from his successes in Armenia, was met by an order for his instant execution, and at once put an end to his own life.

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[1] Tac., *Ann.*, xiii. 12-20.

[2] *Ibid.*, xiv. 1-13.

[3] Tac., *Ann.*, xiv. 59.

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[1] Tac., *Ann.*, xv. 38; Suet., *Nero*, 38; Dio Cass., lxii. 16; Pliny, *N.H.*, xvii. 5.

[2] Tac., *Ann.*, xv. 42; Suet., *Nero*, 31; *cf.* Friedländer, *Sittengeschichte*, iii. 67–69.

[3] Suet., *Nero*, 19–24; Dio Cass., *Epit.*, lxiii. 8–16.

But while Nero was revelling in Greece the dissatisfaction with his rule, and the fear and abhorrence excited by his crimes, were rapidly taking the shape of a resolute determination to get rid of him. That movements in this direction were on foot in Rome may be safely inferred from the urgency with which the imperial freedman Helius insisted upon Nero's return to Italy; but far more serious than any amount of intrigue in Rome was the disaffection which now showed itself in the rich and warlike provinces of the west. In northern Gaul, early in 68, the standard of revolt was raised by Julius Vindex, governor of Gallia Lugdunensis, and himself the head of an ancient and noble Celtic family. South of the Pyrenees, P. Sulpicius Galba, governor of Hispania Tarraconensis, and Poppæa's former husband, Marcus Salvius Otho, governor of Lusitania, followed Vindex's example. At first, however, fortune seemed to favour Nero. It is very probable that Vindex had other aims in view than the deposition of Nero and the substitution of a fresh emperor in his place, and that the liberation of northern Gaul from Roman rule was part of his plan.[1] If this was so, it is easy to understand both the enthusiasm with which the chiefs of northern Gaul rallied to the standard of a leader belonging to their own race, and the opposition which Vindex encountered from the Roman colony of Lugdunum, and from the Roman legions on the Rhine. For it is certain that the latter at any rate were not animated by loyalty to Nero. They encountered Vindex and his Celtic levies at Vesontium (Besançon), and in the battle which followed Vindex was defeated and slain. But the next step of the victorious legionaries was to break the statues of Nero and offer the imperial purple to their own commander Verginius Rufus; and the latter, though he declined their offer, appealed to them to declare for the senate and people of Rome. Meanwhile in Spain Galba had been saluted imperator by his legions, had accepted the title, and was already on his march towards Italy. On the road the news met him that Vindex had been crushed by the army of the Rhine, and for the moment he resolved to abandon his attempt in despair, and even thought of suicide. Had Nero acted with energy he might still have checked the revolt. But he did nothing. He had reluctantly left Greece early in 68, but returned to Italy only to renew his revels. When on March 19 the news reached him at Naples of the rising in Gaul, he allowed a week to elapse before he could tear himself away from his pleasures. When he did at last re-enter Rome, he contented himself with the empty form of proscribing Vindex, and setting a price on his head. In April the announcement that Spain also had revolted, and that the legions in Germany had declared for a republic, terrified him into something like energy. But it was too late. The news from the provinces fanned into flame the smouldering disaffection in Rome. During the next few weeks the senate almost openly intrigued against him, and the populace, once so lavish of their applause, were silent or hostile. Every day brought fresh instances of desertion, and the fidelity of the prætorian sentinels was more than doubtful. When finally even the palace guards forsook their posts, Nero despairingly stole out of Rome to seek shelter in a freedman's villa some four miles off. In this hiding-place he heard of the senate's proclamation of Galba as emperor, and of the sentence of death passed on himself. On the approach of the horsemen sent to drag him to execution, he collected sufficient courage to save himself by suicide from this final ignominy, and the soldiers arrived only to find the emperor in the agonies of death. Nero died on June 9, 68, in the thirty-first year of his age and the fourteenth of his reign, and his remains were deposited by the faithful hands of Acte in the family tomb of the Domitii on the Pincian Hill. With his death ended the line of the Cæsars, and Roman imperialism entered upon a new phase. His statues were broken, his name everywhere erased, and his golden house demolished; yet, in spite of all, no Roman emperor has left a deeper mark upon subsequent tradition. His brief career, with its splendid opening and its tragic close, its fantastic revels and frightful disasters, acquired a firm hold over the imagination of succeeding generations. The Roman populace continued for a long time to reverence his memory as that of an open-handed patron, and in Greece the recollections of his magnificence, and his enthusiasm for art, were still fresh when the traveller Pausanias visited the country a century later. The belief that he had not really died, but would return again to confound his foes, was long prevalent, not only in the remoter provinces, but even in Rome itself; and more than one pretender was able to collect a following by assuming the name of the last of the race of Augustus. More lasting still in its effects was the implacable hatred cherished towards his memory by those who had suffered from his cruelties. Roman literature, faithfully reflecting the sentiments of the aristocratic salons of the capital, while it almost canonized those who had been his victims, fully avenged their wrongs by painting Nero as a monster of wickedness. In Christian tradition he appears in an even more terrible character, as the mystic Antichrist, who was destined to come once again to trouble the saints. Even in the Middle Ages, Nero is still the very incarnation of splendid iniquity, while the belief lingered obstinately that he had only disappeared for a time, and as late as the 11th century his restless spirit was supposed to haunt the slopes of the Pincian Hill.

The chief ancient authorities for Nero's life and reign are Tacitus (*Annals*, xiii.–xvi.), Suetonius, Dio Cassius (*Epit.*, lxi., lxii., lxiii.), and Zonaras (*Ann.*, xi.). The most important modern works are Merivale's *History of the Romans under the Empire*; H. Schiller's *Nero*, and his *Geschichte d. Kaiserzeit*; Lehmann, *Claudius und Nero*. (H. F. P.)

NERTCHINSK, a district town of eastern Siberia, situated in the government of Transbaikalia, 178 miles to the east of Tchita, on the left bank of the Nertcha, 3 miles from its junction with the Shilka. It is badly built of wood, and its lower part frequently suffers from inundations. The 4000 inhabitants support themselves mainly by agriculture, tobacco-growing, and cattle breeding; a few merchants also carry on an active trade in furs and cattle, in brick-tea from China, and manufactured wares from Russia,—Nertchinsk being the trading centre for all that part of Dahouria which is situated on the eastern slope of the Stanovoy ridge.

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[1] Suet. *Nero*, 40; Dio Cass., *Epit.*, lxiii. 22; Plut., *Galba*, 4; cf. also Schiller's *Nero*, pp. 261 *sq.*; Mommsen in *Hermes*, xiii. 90.

The fort of Nertchinsk dates from 1654, and the town was founded in 1658 by Pashkoff, who in that year opened direct communication between the Russian settlements in Transbaikalia and those on the Amur which had been founded by Cossacks and fur-traders coming from the Yakutsk region. The mutual help thus given proved, however, insufficient, and two years after the fall of Albasin—the chief Russian fort on the Amur—the Russian envoy Golovin, meeting at Nertchinsk the Chinese envoys, who were supported by a strong military force encamped on the banks of the Shilka, signed in 1689 the well-known "treaty of Nertchinsk," which stopped for two centuries the further advance of Russians into the basin of the Amur. Nertchinsk, which in the following year received municipal institutions and was more strongly fortified, soon became the chief centre for the trade with China. The opening of the western route through Mongolia, by Urga, and the establishment of a custom-house at Kiachta in 1728, diverted this trade into a new channel; so that towards the end of the 18th century Nertchinsk lost its commercial importance; but it acquired a new consequence from the influx of immigrants, mostly exiles, into eastern Transbaikalia, the discovery of rich mines, and the arrival of great numbers of convicts. It ultimately became the chief town of Transbaikalia, and in 1812 was transferred from the banks of the Shilka to its present site, on account of the floods. After the foundation, in 1851, of Tchita, the present capital of Transbaikalia, it was reduced to the rank of a district town, and is now rapidly falling into decay.

NERTCHINSK (in full Nertchinskiy Zavod), a town and silver-mine situated in the government of Transbaikalia, 185 miles E.S.E. of the Nertchinsk noticed above (with which it is very often confounded), on the Algacha river, a few miles above its junction with the Argun. It lies in a narrow valley between barren mountains, and consists of town, silver-mine, and village, with an aggregate of 5000 inhabitants. It is much better built than any of the district towns of eastern Siberia, and its shops carry on an active trade. It has a chemical laboratory supported by the crown for mining purposes, and a first-class meteorological observatory (51° 18′ N. lat., 119° 37′ E. long., 2450 feet above the sea-level), where meteorological and magnetical observations have been made every hour since 1842. The average yearly temperature, calculated from twenty-six years' observations, is 24°·8 F. Nertchinskiy Zavod is the chief town and administrative centre of the

Nertchinsk Mining District, an area of more than 2700 square miles, extending for nearly 270 miles from north to south, and comprising all the silver-mines and gold-fields situated between the Shilka and the Argun, together with a few on the left bank of the Shilka. It is traversed by several parallel chains of mountains which run from south-west to north-east, having their base on the eastern Transbaikalian plateau, while their summits rise to about 4500 feet. These are intersected by a complicated system of deep, narrow valleys, densely wooded, with a few expansions along the larger rivers, where the inhabitants with difficulty raise some rye and wheat. The mountains, so far as they have been geologically explored, consist of crystalline slates and limestones—probably Upper Silurian and Devonian—interspersed with granite, syenite, and diorite; they contain rich ores of silver, lead, tin, and iron, while the diluvial and alluvial valley formations contain rich auriferous sands. Several of the villages that have sprung up around the silver-mines are more populous than the district towns of eastern Siberia.

The Nertchinsk silver mines began to be wrought in 1704, but during the first half of the 18th century their yearly production did not exceed 700 lb. From 1765 to 1777 the annual average was 64 cwts.; and the total amount for the first hundred and fifty years (1704–1854) amounted to 8600 cwts. The lead was mostly neglected on account of the difficulties of transport, but its production is at present on the increase, and recently reached about 2000 cwts. Gold was first discovered in 1830, and between 1850 and 1854 no less than 131 cwts. of gold dust were obtained, but this fell to 24·3 cwts. in 1860. In 1864, private gold mining having been permitted in the western parts of the district, a large number of auriferous beds were discovered, and the production greatly increased. Until 1863 all the labour in the silver and gold mines of the district was performed by serfs, who were the property of the emperor, and by convicts, numbering usually nearly four thousand. The serfdom was partially abolished in 1851, and finally in 1863, when a great number of mines were abandoned by the crown.

NERVA (32–98 A.D.), Roman emperor from 96 to 98, was called to the throne on the murder of Domitian (September 18, 96; Suet., *Dom.*, 17; *Corp. Inscr. Lat.*, vi. 472). His full name was Marcus Cocceius Nerva (Henzen, 5435), and his family, though of no great antiquity, had attained to considerable distinction under the emperors. The M. Cocceius Nerva who was consul in 36 B.C. was probably his great-grandfather. His grandfather of the same name (consul *c.* 22 A.D.) was a lawyer of high reputation and an intimate friend of the emperor Tiberius (Tac., *Ann.*, iv. 58, vi. 26; Front., *De Aquæd.*, 102). His father is usually identified with the "Nerva filius" who is mentioned in the *Digest* as a prominent jurist, and who was possibly consul in 40 A.D. Of his mother a single inscription tells us that she was Sergia Plautilla, daughter of Lænas (Orelli 777).

Nerva must have been born in 32 A.D., for he was sixty-four years old at the time of his accession in 96 A.D. In early manhood he had been on friendly terms with Nero, whose taste for versification he shared (Martial, viii. 70; Pliny, *Ep.*, v. 3), and by whom, in 65, he was decorated with the "insignia triumphalia" (Tac., *Ann.*, xv. 72). He had been prætor (?66) and twice consul, in 71 with the emperor Vespasian for colleague (Orelli, 1634), and again in 90 with Domitian. Towards the close of the latter's reign he is said to have excited suspicion and to have been banished to Tarentum on a charge of conspiracy (Dio Cass., *Epit.*, lxvii. 15; Philostr., *Apoll. Tyan.*, vii. 8). He is described as a quiet, kindly, dignified man, honest of purpose, but unfitted by age and temperament, as well as by feeble health, to bear the weight of empire. Nevertheless his selection by Domitian's murderers as that prince's successor seems to have been generally approved, and his short rule, in spite of occasional exhibitions of weakness, justified the choice. His accession brought a welcome relief from the terrible strain of the last few years. The reign of terror was at an end and liberty restored. The new emperor recalled those who had been exiled by Domitian; what remained of their confiscated property was restored to them, and a stop was put to the vexatious prosecutions which Domitian had encouraged. But the popular feeling demanded more than this. The countless informers of all classes who had thriven under the previous régime now found themselves swept away, to borrow Pliny's metaphor (Pliny, *Paneg.*, 35), by a hurricane of revengeful fury, which threatened to become as dangerous in its indiscriminate ravages as the system it attacked. It was finally checked by Nerva, who was stung into action by the sarcastic remark of the consul Fronto that, "bad as it was to have an emperor who allowed no one to do anything, it was worse to have one who allowed every one to do everything" (Dio Cass., *Epit.*, lxviii. 1).

Nerva seems to have followed the custom established by his predecessors of announcing at the outset the general lines of his future policy. Domitian had been arbitrary and high-handed, and had heaped favours on the soldiery while humiliating the senate: Nerva naturally enough assumed the opposite attitude, and showed himself anxious in every way to respect the traditional privileges of the senate, and such maxims of constitutional government as still survived. He pledged himself to put no senator to death. His chosen councillors in all affairs of state were senators, and the hearing of claims against the fiscus was taken from the imperial procuratores and entrusted to the more impartial jurisdiction of a prætor and a court of "judices" (Dio Cass., *Epit.*, lxviii. 2; *Digest*, i. 2, 2; Pliny, *Paneg.*, 36). It was thus, as Pliny magniloquently says, that Nerva united the "principate" with "freedom."

No one probably expected from Nerva a vigorous administration either at home or abroad. But he seems to have set himself honestly enough to carry through such reforms as were either suggested by his own benevolent inclinations, or imperatively demanded by the necessities of the moment. The economical condition of Italy evidently excited his alarm and sympathy. The last mention of a "lex agraria" in Roman history is connected with his name, though how far the measure was strictly speaking a "law" is uncertain. Under the provisions of this "lex," large tracts of land were bought up and allotted to poor citizens. The cost was defrayed partly from the imperial treasury, but partly also from Nerva's private resources, and the execution of the scheme was entrusted to commissioners (*Dig.*, xlvii. 21, 3; Dio Cass., *Epit.*, lxviii. 2; Pliny, *Ep.*, vii. 31; *Corp. Inscr. Lat.*, vi. 1548). This agrarian law was probably as shortlived in its effects as preceding ones had been, but a reform more lasting in its results was the provision of a regular maintenance at the public cost for the children of poor parents in the towns of Italy (Aur. Vict., *Ep.*, 24), the provision being presumably secured by imposing a yearly charge for this purpose on state and municipal lands. On coins of the year 97 Nerva is represented seated upon his curule chair and stretching out a helping right hand to a boy and a girl. The legend on the coins is "tutela Italiæ" (Eckhel, vi. 408; Marquardt, *Staatsverwaltung*, ii. 138, note 6). Private individuals were also encouraged to follow the imperial example; and among those who responded was the younger Pliny, whose charitable institution in his own town of Comum seems to have followed directly on that of the emperor himself (*Hermes*, iii. 101; Pliny, *Ep. ad T.*, 8). In the hands of Trajan, Hadrian, and the Antonines, Nerva's example bore fruit in the institution of the "alimentationes," the most genuinely charitable institution of the pagan world. These measures Nerva supplemented by others which aimed at lightening the financial burdens which already weighed heavily on the declining industry of Italy. The cost of maintaining the imperial postal system was transferred to the "fiscus," from the same source apparently money was found for repairing the public roads and aqueducts, and lastly the lucrative but unpopular succession duty "vicesima hereditatum," was so readjusted as to remove the grosser abuses connected with it (Pliny, *Paneg.*, 37). At the same time Nerva did his best to reduce the overgrown expenditure of the state (Pliny, *Ep.*, ii. 1). A commission was appointed to consider the best modes of retrenchment, and the outlay on shows and games was cut down to the lowest possible point. It was these efforts which earned for him the epithet "frugalissimus" (Pliny, *Paneg.*, 51). Nerva seems nevertheless to have soon wearied of the uncongenial task of governing, and his anxiety to be rid of it was quickened by the discovery that not even his blameless life and mild rule protected him against intrigue and disaffection. Early, apparently, in 97 he detected a conspiracy against his life headed by L. Calpurnius Crassus, but he contented himself with a hint to the conspirators that their designs were known, and with banishing Crassus to Tarentum. This ill-judged lenity provoked a few months later an intolerable insult to his dignity. The prætorian guards had keenly resented the murder of their patron Domitian, and now, at the instigation of one of their two prefects, Casperius Ælianus, whom Nerva had retained in office, they imperiously demanded the execution of Domitian's murderers, the chamberlain Parthenius, and Petronius Secundus, Ælianus's colleague. Nerva vainly strove to save, even at the risk of his own life, the men who had raised him to power, but the soldiers, disregarding his protests, brutally murdered the unfortunate men, and finally forced Nerva to propose a vote of thanks for the deed (Dio Cass., *Epit.*, lxviii. 4; Aur. Vict., *Ep.*, 24). This crowning humiliation convinced Nerva of the necessity of placing the reins of government in stronger hands than his own. Following the precedent set by Augustus, Galba, and Vespasian, he resolved to adopt as his colleague and destined successor a younger and more vigorous man, and his choice fell upon M. Ulpius Trajanus, already well known as a distinguished soldier, and at the time in command of the legions on the Rhine. In October 97, in the temple of Jupiter on the Capitol, Trajan was formally adopted as his son, and declared his colleague in the government of the empire (Pliny, *Paneg.*, 8). For three months Nerva ruled jointly with Trajan (Aur. Vict., *Ep.*, 24); but on January 27, 98, he died somewhat suddenly. He was buried in the sepulchre of Augustus, and divine honours were paid him by his successor. The verdict of history upon his reign is best expressed in his own words,—"I have done nothing which should prevent me from laying down my power, and living in safety as a private man." In the Rome of to-day the memory of Nerva is still preserved by the ruined temple in the Via Alessandrina (il Colonacce) which marks the site of the Forum begun by Domitian, but which Nerva completed and dedicated (Suet., *Dom.*, 5; Aur. Vict., 12).

Authorities.—Dio Cass., *Epit.*, lxviii. 1-4; Aurelius Victor, 12, and *Epit.*, 24; Zonaras, xi. 20; compare also Pliny, *Epistolæ* and *Panegyricus*; Tillemont, *Histoire des Empereurs Romains*; Merivale, *History of the Romans under the Empire*; H. Schiller, *Geschichte d. Kaiserzeit.* (H. F. P.)

NERVAL. See GÉRARD DE NERVAL, vol. x. p. 441.

NERVOUS SYSTEM. See PHYSIOLOGY.

NESSELRODE, CHARLES ROBERT (1780-1862), long foreign minister of Russia, was born at Lisbon, where his father was Russian ambassador, in December 1780. Like so many other Russian statesmen and soldiers, he was sprung from German ancestors settled in Livonia. He entered early upon a diplomatic career, and at the age of twenty-five was attached to the Russian embassy in Paris. When the alliance of Tilsit was breaking down, Nesselrode was recalled to St Petersburg, and during the events that followed Napoleon's invasion of Russia he rose high in the favour of the czar Alexander. From the time when Romanzoff, the advocate of a peace-policy, was dismissed, Nesselrode was employed in all the great diplomatic transactions of his master. He was present, though not as a plenipotentiary, at the congress of Prague, and signed the treaty of Chaumont, in which the allies pledged themselves to continue the struggle against Napoleon, if necessary, for twenty years. In the negotiations as to the future of France, both in 1814 and 1815, he seems to have encouraged the czar in his policy of moderation. At the congress of Vienna his duties were shared by Capodistrias, and a certain rivalry existed then and afterwards between the two statesmen. In Capodistrias the czar found more sympathy both with his own earlier liberal tendencies and with his religious sentimentality. In the subsequent congresses of Troppau and Laibach, when Metternich, as the champion of European conservatism, set himself to repress any sympathies that the czar might have for constitutional rule in Naples and for Greek independence, it was with Nesselrode that he allied himself; Capodistrias, a Greek and a man of more modern ideas, was now treated as a dangerous person, and ultimately had to retire from office. Nesselrode followed the fluctuating and reactionary course of the czar's thoughts, and remained in favour till the death of Alexander in 1825. Nicholas kept him in office, and Nesselrode now promptly adapted himself to the more vigorous policy that suited his new master, especially in Eastern affairs. He conducted the diplomacy of Russia throughout the contention which led to the war of 1828 and to the peace of Adrianople. Years passed by, and he grew old in office, pursuing with patience and discretion the ends which Russian statesmanship has always set before itself. Belonging rather to the cautious than the adventurous school of politicians, and attaching great value to the support of the German powers, he viewed with no great pleasure the approach of the Crimean war. He continued in office, however, until its close; and it is remarkable that a man who was at the head of Russian diplomacy during the conflict with Napoleon I. should have lived to conclude the peace of Paris under Alexander II. in 1856. He died in 1862, still retaining the office of chancellor of Russia, though he had ceased to hold the ministry of foreign affairs.

NESTOR, the old warrior of the *Iliad*, the wise councillor of the Greek leaders, was the son of Neleus and Chloris. He succeeded his father as king of Pylus. In the *Iliad* he is represented as too old to be of use in battle, but always ready to give advice and counsel to the younger warriors, and to entertain them with long accounts of his own exploits in his youth. According to Homer, he had ruled over three generations of men, and was wise as the immortal gods. In the *Odyssey* he is described as still ruling over Pylus, where he is visited by Telemachus. There is no real connexion between the legends of Nestor and those of Neleus; but, as the former belonged to Pylus, the legend is bound to place him in genealogical relation with the representative king of the land.

NESTOR (*c.* 1056–*c.* 1114), the patriarch of Russian literature, concerning whom, however, we have but little information, except that he was a monk of the Pestcherski cloister of Kieff from 1073. The only other fact of his life told us is that he was commissioned with two other monks to find the relics of St Theodosius, a mission which he succeeded in fulfilling. His history begins with the deluge, as those of most chroniclers of the time did. He appears to have been acquainted with the Byzantine historians; he makes use especially of John Malala and George Armatolus. He also had in all probability other Slavonic chronicles to compile from, which are now lost. The labours of the Byzantine annalists, some of which were translated into Palæo-Slavonic, would stimulate the production of such works. Of course there are many legends mixed up with Nestor's *Chronicle*; the style is occasionally so poetical that we may easily fancy that he has incorporated *bilini* which are now lost. The early part is rich in these quaint stories, among which may be cited the arrival of the three Varangian brothers, the founding of Kieff, the murder of Askold and Dir, the death of Oleg, who was killed by a serpent concealed in the skeleton of his horse, and the vengeance taken by Olga, the wife of Igor, on the Drevlians, who had murdered her husband. The account of the labours of Cyril and Methodius among the Slavs is also given in a very interesting manner, and to Nestor we owe the tale of the summary way in which Vladimir suppressed the worship of Peroun and other idols at Kieff. As an eye-witness he could only describe the reigns of Vsevolod and Sviatopolk (1078–1112), but he gathered many interesting details from the lips of old men, two of whom are especially mentioned, Giourata Rogovich, an inhabitant of Novgorod, who furnished him with information concerning the north of Russia, Petchora, and other places, and Jan, a man ninety years of age, who died in 1106, and was son of Vishata the waywode of Yaroslavl and grandson of Ostromir the Posadnik, for whom the *Codex* was written. Besides the historical portion, many of the ethnological details given by Nestor of the various races of the Slavs are of the highest value.

This interesting work has come down to us in several manuscripts, but unfortunately no contemporary ones, the oldest being the so-called Lavrientski of the 14th century (1377). It was named after the monk Lavrentii, who copied it out for Dimitri Constantinovich, the prince of Souzdal. The work, as contained in this manuscript, has had many additions made to it from previous and contemporary chronicles, such as those of Volinia and Novgorod. Solovieff, the Russian historian, justly remarks that Nestor cannot be strictly called the earliest Russian chronicler, but he is the first writer who took anything like a national point of view in his history, the others being merely local writers. The language of his work, as shown in the earliest manuscripts just mentioned, is Palæo-Slavonic with many Russisms. It has formed the subject of a valuable monograph by Professor Miklosich.

Nestor's *Chronicle* has been translated into Polish, Bohemian, German, and French, but no version has appeared in our own language. Besides his historical work, Nestor was also the author of the *Lives* of Boris and Gleb, the martyrs, and of the St Theodosius previously mentioned. In recent times the genuineness of his *Chronicle* has been attacked by Ilovaiski and others, but the accusations have hardly been considered serious in Russia, and have been completely refuted, if they needed refutation, by Pogodin. The body of the ancient chronicler may still be seen among the relics preserved in the Pestcherski monastery at Kieff. His work is of primary importance for the study of early Russian history, and, although devoid of literary merit in the strictest sense of the term, is not without its amusing and well-told episodes of a somewhat Herodotean character.

NESTOR, the name applied to a small but remarkable group of Parrots peculiar to the New Zealand Subregion, of which the type is the *Psittacus meridionalis* of Gmelin, founded on a species described by Latham (*Gen. Synopsis*, i. p. 264), and subsequently termed by him *P. nestor*, in allusion to its hoary head, but now usually known as *Nestor meridionalis*, the "*Kaka*" of the Maories and English settlers in New Zealand, in some parts of which it was, and even yet may be, very abundant, though its numbers are fast decreasing. Forster, who accompanied Cook in his second voyage, described it in his MSS. in 1773, naming it *P. hypopolius*, and found it in both the principal islands. The general colour of the Kaka is olive-brown, nearly all the feathers being tipped with a darker shade, so as to give a scaly appearance to the body. The crown is light grey, the ear-coverts and nape purplish-bronze, and the rump and abdomen of a more or less deep crimson-red; but much variation is presented in the extent and tinge of the last colour, which often becomes orange and sometimes bright yellow. The Kaka is about the size of a Crow; but a larger species, generally resembling it, though having its plumage varied with blue and green, the *Nestor notabilis* of Gould, was discovered in 1856 by Mr Walter Mantell, in the higher mountain ranges of the Middle Island. This is the "*Kea*" of the Maories, and has of late incurred the enmity of colonists by developing, they say, when pressed by hunger in winter, an extraordinary habit of assaulting sheep, picking holes with its powerful beak in their side, wounding the intestines, and so causing the animals' death. The lacerations are said to be made so uniformly in one place as to suggest deliberate design; but the bird's intent has yet to be investigated, though it is admittedly an eater of carrion in addition to its ordinary food, which, like that of the Kaka, consists of fruits, seeds, and the grubs of wood-destroying insects, the last being obtained by stripping the bark from trees infested by them. The amount of injury the Kea inflicts on flock-masters, as always happens in similar cases, has doubtless been much exaggerated, for Dr Menzies states that on one "run," where the loss was unusually large, the proportion of sheep attacked was about one in three hundred, and that those pasturing below the elevation of 2000 feet are seldom disturbed.

On the discovery of Norfolk Island (10th October 1774) a Parrot, thought by Forster to be specifically identical with the Kaghåå (as he wrote the name) of New Zealand,—though his son (*Voyage*, ii. p. 446) remarked that it was "infinitely brighter coloured,"—was found in its hitherto untrodden woods. Among the drawings of Bauer, the artist who accompanied Robert Brown and Flinders, is one of a *Nestor* marked "Norfolk Isl. 19 Jan. 1805," on which Herr von Pelzeln in 1860 founded his *N. norfolcensis*. Meanwhile Latham, in 1822, had described, as distinct species, two specimens evidently of the genus *Nestor*, one said, but doubtless erroneously, to inhabit New South Wales, and the other from Norfolk Island. In 1836 Gould described an example, without any locality, in the museum of the Zoological Society, as *Plyctolophus productus*, and when some time after he was in Australia, he found that the home of this species, which he then recognized as a *Nestor*, was Phillip Island, a very small adjunct of Norfolk Island, and not more than five miles distant from it. Whether the birds of the two islands were specifically distinct or not we shall perhaps never know, since they are all extinct (see BIRDS, vol. iii. p. 735), and no specimen undoubtedly from Norfolk Island seems to have been preserved; while, now that we are aware of the great diversity in colour, size, and particularly in the form of the beak, to which the New-Zealand members of the genus are subject, it would be unsafe to regard as specific the differences pointed out by Herr von Pelzeln from Bauer's drawing. The Phillip-Island *Nestor* may be distinguished from both of the New-Zealand species by its somewhat smaller size, orange throat, straw-coloured breast, and the generally lighter shade of its tints.

The position of the genus *Nestor* in the Order *Psittaci* must be regarded as uncertain. Garrod removes it altogether from the neighbourhood of the Lories (*Proc. Zool. Society*, 1874, p. 597), to which indeed the structure of its tongue, as previously shewn by him (*op. cit.*, 1872, p. 789), indicates only a superficial resemblance. Like so many other New-Zealand forms, *Nestor* seems to be isolated, and may fairly be deemed to represent a separate Family—*Nestoridæ*—a view which is fully justified by a cursory examination of its osteology, though this has hitherto been only imperfectly described and figured (Eyton, *Osteol. Avium*, p. 72; A. B. Meyer, *Abbild. von Vogel-Skeletten*, p. 18, pl. 23).

Further knowledge of this very interesting form may be facilitated by the following references to the *Transactions and Proceedings of the New Zealand Institute*, ii. pp. 64, 65, 387; iii. pp. 45–52, 81–90; v. p. 207; vi. pp. 114, 128; ix. p. 340; x. p. 192; xi. p. 377; and of course to Mr Buller's *Birds of New Zealand*. (A. N.)

NESTORIUS AND NESTORIANS. Nestorius, patriarch of Constantinople from 428 to 431, was a native of Germanicia, at the foot of Mount Taurus, in Syria. The year of his birth is unknown. At an early age he was sent for his education to Antioch, where it is probable, though not certain, that Theodore of Mopsuestia was for some time his master. As monk in the neighbouring monastery of Euprepius, and afterwards as presbyter, he became celebrated in the diocese for his asceticism, his orthodoxy, and his eloquence; hostile critics, such as Socrates, allege that his arrogance and vanity were hardly less conspicuous. On the death of Sisinnius, patriarch of Constantinople (December 427), Theodosius II., indifferent to or possibly perplexed by the various claims of the local clergy, appointed the distinguished preacher of Antioch to the vacant see. The consecration took place on April 10, 428, and then, or almost immediately afterwards, in what is said to have been his first patriarchal sermon, Nestorius exhorted the emperor in the famous words—"Purge me, O Cæsar, the earth of heretics, and I in return will give thee heaven. Stand by me in putting down the heretics and I will stand by thee in putting down the Persians." In the spirit of this utterance, steps were at once instituted by the new prelate (Socrates says five days after his consecration) to suppress the assemblies of the Arians; these, by a stroke of policy which seems to have been as successful as it was bold, anticipated his action by themselves setting fire to their meeting-house, Nestorius being forthwith nicknamed "the incendiary." The Novatians and the Quartodecimans were the next objects of his orthodox zeal,—a zeal which in the case of the former at least was reinforced, according to Socrates, by his envy of their bishop; and it led to serious and fatal disturbances at Sardis and Miletus. The toleration the followers of Macedonius had long enjoyed was also rudely broken, the (foreign) Pelagians alone finding any favour. While these repressive measures were being carried on outside the pale of the catholic church, equal care was taken to instruct the faithful in such points of orthodoxy as their spiritual head conceived to be the most important or the most in danger. One of these was that involved in the practice, now grown almost universal, of bestowing the epithet Θεοτόκος, "Mother of God," upon Mary the mother of Jesus. In the school of Antioch the impropriety of the expression had long before been pointed out, by Theodore of Mopsuestia, among others, in terms precisely similar to those afterwards attributed to Nestorius. From Antioch Nestorius had brought along with him to Constantinople a copresbyter named Anastasius, who enjoyed his confidence and is called by Theophanes his "syncellus." This Anastasius, in a pulpit oration which the patriarch himself is said to have prepared for him, caused great scandal to the partisans of the Marian cultus then beginning by saying, "Let no one call Mary the mother of God, for Mary was a human being; and that God should be born of a human being is impossible." The opposition, which was led by one Eusebius, a "scholasticus" or pleader who afterwards became bishop of Dorylæum, chose to construe this utterance as a denial of the divinity of Christ, and so violent did the dispute upon it become that Nestorius judged it necessary to silence the remonstrants by force; an overzealous monk who had withstood him to his face was scourged and sent into exile, while many of the mob who sympathized were also punished with the lash. The exact chronological order of the recorded incidents in this stage of the controversy is somewhat difficult to determine, but an important part in it was taken by Proclus, bishop of Cyzicus, who, preaching in the cathedral before the patriarch, and at his invitation (429), on one of the festivals of the Virgin, asserted so firmly the propriety of the disputed epithet that Nestorius was constrained to rise and reply.[1] Dorotheus, bishop of Marcianopolis, on the other hand, anathematized from the same pulpit all who persisted in using the expression; his audience retorted by uproariously leaving the church, while a large body of clergy and laity formally withdrew from communion with Nestorius, whose friend Dorotheus was.

Matters were soon ripe for foreign intervention, and the notorious CYRIL (*q.v.*) of Alexandria, in whom the antagonism between the Alexandrian and Antiochene schools of theology, as well as the perhaps inevitable jealousy between the patriarchate of St Mark and that of Constantinople, found an exponent of unexampled determination and unscrupulosity, did not fail to make use of the opportunity. He stirred up his own clergy, he wrote to encourage the dissidents at Constantinople, and he addressed himself to the sister and wife of the emperor (Theodosius himself being known to be still favourable to Nestorius). Nestorius himself, on the other hand, having occasion to write to Pope Celestine I. about the Pelagians (whom he was not inclined to regard as heretical), gave from his own point of view an account of the disputes which had recently arisen within his patriarchate. This implied appeal, however, was the reverse of successful, for the pope, in a synod which met in 430, decided in favour of the epithet Θεοτόκος, and bade Nestorius retract his erroneous teaching, on pain of instant excommunication, at the same time entrusting the execution of this decision to the patriarch of Alexandria. On hearing from Rome, Cyril at once held a synod and drew up a doctrinal formula for Nestorius to sign, and also twelve anathemas covering the various points of the Nestorian dogmatic. Nestorius, instead of yielding to the combined pressure of his two great rivals, merely replied by a counter excommunication.

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[1] The substance of this discourse has been preserved in a Latin translation by Marius Mercator, which is given in Galland's *Biblioth. Patr.*, vol. viii.

In this situation of affairs the demand for a general council became irresistible, and accordingly Theodosius and Valentinian III. issued letters summoning the metropolitans of the catholic church to meet at Ephesus at Whitsuntide 431, each bringing with him some able suffragans. Nestorius, with sixteen bishops and a large following of armed men, was among the first to arrive; soon afterwards came Cyril with fifty bishops. Juvenal of Jerusalem and Flavian of Thessalonica were some days late. It was then announced that John of Antioch had been delayed on his journey and could not appear for some days; he, however, is stated to have written politely requesting that the opening of the synod should not be delayed on his account. Cyril and his friends accordingly assembled in the church of the Theotokos on the 22d of June, and summoned Nestorius before them to give an account of his doctrines. The reply they received was that he would appear as soon as all the bishops were assembled; and at the same time the imperial commissioner, Candidian, presented himself in person and formally protested against the opening of the synod. Notwithstanding these circumstances, Cyril and the one hundred and fifty-nine bishops who were with him proceeded to read the imperial letter of convocation, and afterwards the letters which had passed between Nestorius and his adversary. Almost immediately the entire assembly with one voice cried out anathema on the impious Nestorius and his impious doctrines, and after various extracts from the writings of church fathers had been read the decree of his exclusion from the episcopate and from all priestly communion was solemnly read and signed by all present, whose numbers had by this time swelled to one hundred and ninety-eight. When the decision was known the populace, who had been eagerly waiting from early morning till night to hear the result, accompanied the members with torches and censers to their lodgings, and there was a general illumination of the city. A few days afterwards (June 26 or 27) John of Antioch arrived, and efforts were made by both parties to gain his ear; whether inclined or not to the cause of his former co-presbyter, he was naturally excited by the precipitancy with which Cyril had acted, and at a "conciliabulum" of forty-three bishops held in his lodgings shortly after his arrival he was induced by Candidian, the friend of Nestorius, to depose the bishops of Alexandria and Ephesus on the spot. The efforts, however, to give effect to this act on the following Sunday were frustrated by the zeal of the Ephesian mob. Meanwhile a letter was received from the emperor declaring invalid the session at which Nestorius had been deposed unheard; numerous sessions and counter-sessions were afterwards held, the conflicting parties at the same time exerting themselves to the utmost to secure an effective superiority at court. In the end Theodosius decided to confirm the depositions which had been pronounced on both sides, and Cyril and Memnon as well as Nestorius were by his orders laid under arrest. Representatives from each side were now summoned before him to Chalcedon, and at last, yielding to the sense of the evident majority, he gave a decision in favour of the "orthodox," and the council of Ephesus was dissolved. Maximian, one of the Constantinopolitan clergy, a native of Rome, was promoted to the vacant see, and Nestorius was henceforward represented in the city of his former patriarchate only by one small congregation, which also a short time afterwards became extinct. The commotion which had been thus raised did not so easily subside in the more eastern section of the church; the Antiochenes continued to maintain for a considerable time an attitude of antagonism towards Cyril and his creed, and were not pacified until an understanding was reached in 433 on the basis of a new formula involving some material concessions by him. The union even then met with resistance from a number of bishops, who, rather than accede to it, submitted to deposition and expulsion from their sees; and it was not until these had all died out that, as the result of stringent imperial edicts, Nestorianism may be said to have become extinct throughout the Roman empire. Their school at Edessa was closed by Zeno in 489. As for Nestorius himself, immediately after his deposition he withdrew into private life in his old monastery of Euprepius, Antioch, until 435, when the emperor ordered his banishment to Petra in Arabia. A second decree, it would seem, sent him to Oasis, probably the city of the Great Oasis, in Upper Egypt, where he was still living in 439, at the time when Socrates wrote his *Church History*. The invasions of savage tribes compelled him to seek refuge in the Thebaid, where, however, the governor caused him to be dragged to Elephantis and subsequently to Panopolis. The time, place, and circumstances of his death are unknown; but zeal for theological truth and retributive justice has led at least one historian to exercise his invention in providing a fit end for the friendless heretic. The followers of Nestorius found toleration under the rulers of Persia, from which empire they gradually spread into India and even into Arabia and China. They also succeeded in securing a foothold among the Tartars. Their patriarch had his see for a considerable time at Seleucia-Ctesiphon, afterwards in Baghdad, and then in Alḳósh. In the 13th century he is said to have hád twenty-five metropolitans under him. The sect was almost extirpated by Timur.

What is technically and conventionally meant in dogmatic theology by "the Nestorian heresy" has been briefly indicated elsewhere (vol. xiii. p. 671). As Eutychianism is the doctrine that the God-man has only one nature, so Nestorianism is the doctrine that He has two complete persons. So far as Nestorius himself is concerned, however, it is certain that he never formulated any such doctrine; nor does any recorded utterance of his, however casual, come so near the heresy called by his name as Cyril's deliberately framed third anathema (that regarding the "physical union" of the two hypostases or natures) approaches Eutychianism. It must be remembered that Nestorius was as orthodox at all events as Athanasius on the subject of the incarnation, and sincerely, even fanatically, held every article of the Nicene creed. Hefele himself, one of the most recent as well as most learned and acute of Cyril's partisans, is compelled to admit that Nestorius accurately held the duality of the two natures and the integrity of each, was equally explicitly opposed to Arianism and Apollinarianism, and was perfectly correct in his assertion that the Godhead can neither be born nor suffer; all that he can allege against him is that "the fear of the *communicatio idiomatum* pursued him like a spectre." But in reality the question raised by Nestorius was not one as to the *communicatio idiomatum*, but simply as to the proprieties of language. He did not refuse to speak of Mary as being the mother of Christ or as being the mother of Emmanuel, but he thought it improper to speak of her as the mother of God. And there is at least this to be said for him that even the most zealous desire to frustrate the Arian had never made it a part of orthodoxy to speak of David as θεοπάτωρ or of James as ἀδελφόθεος. The secret of the enthusiasm of the masses for the analogous expression Theotokos is to be sought not so much in the Nicene doctrine of the incarnation as in the recent growth in the popular mind of notions as to the dignity of the Virgin Mary, which were entirely unheard of (except in heretical circles) for nearly three centuries of the Christian era (see MARY, vol. xv. p. 590–1). (J. S. BL.)

MODERN NESTORIANS.—The remnants of the Aramæan Nestorians are to be found in diminishing numbers partly on Turkish, partly on Persian territory. Since the close of the 17th century the Roman Catholic mission, with its headquarters at Aleppo, has, through the powerful support of the French consuls, met with great success among the Nestorians, and has formed the converts into the so-called Chaldæans, or Nestorians connected with the Roman Catholic Church. Those Nestorians who still adhere to their ancient creed are settled on Turkish soil mainly in the wild and inaccessible regions of eastern Kurdistan, and on Persian soil in the highly fertile plain to the west of the Lake of Urmia. In the former district Nestorians have lived along with the uncivilized Kurds (Iranians) from a very early period, and their numbers have probably been increased by immigrants driven from the lowlands of the Euphrates and Tigris by Moslem persecution. Till quite recently they have maintained there a comparative independence in spite of the perpetual hostility of the Kurds. In those districts where the Kurds are numerically superior they have the ascendency over the scattered Nestorian communities; but there were formerly districts mainly or, as in the case of Tiyâri (Tyari), almost completely occupied by Nestorians, and in these the Kurds were the subject race. As in those regions the conditions of life are the same for both, there is little difference between Christians and Mohammedans; the Nestorians wear nearly the same garb as their Kurd neighbours, the most noteworthy article being the breeches. The mountain Nestorians have generally striped jackets and felt caps, and frequently a staff (the stony mountain roads being mere footpaths, or at best only available for mules). Stock-breeding is the chief occupation; and in summer the herds are taken up to the higher regions, where, however, sheep and goats are exposed to the attacks of wild animals, especially bears and wolves. The alpine character of some of those districts has been greatly admired by the few travellers who, in spite of risks from brigands, have ventured to visit them. In certain valleys, as, for instance, in that of the Zab, there is luxuriant vegetation: the chief trees are the willow and the poplar; rice is cultivated, though at the risk of intermittent fever. To avoid the mosquitoes the people spend the summer nights in the open air on the top of a scaffolding of poles. Their ordinary houses are generally very wretched, often consisting of but a single room, and sometimes even being formed underground, after a fashion that becomes common in Armenia. Besides making most of their own utensils, the mountaineers work certain copper and sulphur mines, and earn a little money by gathering gall-nuts. Their basket-work, for which the district of Tchelu is particularly famous, deserves to be specially mentioned; travelling basketmakers from this region are to be found in all parts of western Asia. The montaineers do a good deal of hand-spinning and stocking-working, even their priests engaging in these forms of industry as well as in tillage. Wooden spoons are made in the mountains. The people as a rule are very poor; many of them migrate for a time (to Mesopotamia for the most part), but come back with their petty gains to their homes, to which they are much attached. This applies, however, only to certain districts; from the central highlands of Tiyâri, for instance, emigration is rare. The supply of food in the mountains is very meagre; wheat does not thrive well, and the people depend on millet-bread, roasted meal, and dried mulberries. Great labour has to be expended in carrying soil up to the terraces which they cultivate on the mountain sides. Milk and its preparations are largely used; and bee-keeping receives some attention. The hospitality of the mountaineers stands high; they willingly share their last morsel with a stranger. Intellectually they are not unlike the Kurds: the latter are proverbially stupid, and these Nestorians also are reproached not only with ignorance but with lack of capacity. The clergy, ignorant to an extraordinary degree, live a miserable life, and give themselves little concern about the education of their flocks. They receive, however, no small respect from their people, who also show a touching and reverential attachment to their creed. Even the churches are objects of peculiar devotion. The accusation sometimes brought against the mountain Nestorians that they resemble the Kurds in a tendency to raiding and brigandage is not altogether without foundation; but this may be at once explained and excused by the fact that they live in the midst of a hostile and rapacious population, from whose attacks they can defend themselves only by reprisals. In warlike courage they are not behind the Kurds. Among both races the women, judged by Oriental standards, occupy a high position. The mountain Nestorians are governed by hereditary village sheikhs called meliks ("kings"; compare the "kings" of the Canaanites). Great influence is possessed by the patriarch residing at Kotchannes near Julamerg, who always bears the name of Mar Shimun (*i.e.*, Lord Simeon); the civil jurisdiction over the independent tribes is in his hands. The patriarchal dignity is hereditary in one family; the woman destined to be the mother of the future patriarch must refrain during her pregnancy from eating flesh, a diet which is absolutely forbidden to the patriarch himself. It may sometimes happen that the patriarch resorts to ecclesiastical excommunication against those who have opposed him in secular affairs; but the Nestorians are quite contented under their theocratic government, and have always shown a strong feeling of independence. Things went hard with them in 1846, when their independence was destroyed. In concert with the Turkish pasha in Mosul, to whom the freedom of the mountaineers was a perpetual offence, three powerful Kurdish chieftains (of whom Nurulla of Revandiz and Bedr Khan of Buhtan have attained unenviable celebrity) decided to make a common attack upon the Christians. Taken completely by surprise, and basely deserted by their patriarch, these could offer but a feeble resistance; their property was pillaged, and more than 10,000 of their number were massacred. On a small scale similar proceedings are repeated from time to time; and the Turkish Government not only remains powerless to prevent them, but if any advantage accrues to itself looks on with malignant approval. Frequently the Kurdish beys make raids with comparative impunity even in the richer lowland regions, as, for example, to Azerbijan in 1882.

The Nestorians on Persian territory (in Azerbijan) live, even the few who inhabit the mountains, under essentially different conditions; the greater proportion, however, dwell on the rich and fruitful plain which lies round the city of Urmia (Urmi). The date of their settlement in this district is not known, but Urmia is mentioned as early as 1111 as the see of a Nestorian bishop. Nestorians from the mountains may have gradually advanced eastwards into the plain, where they found more favourable conditions of life. If not particularly healthy, it is abundantly watered, and the fruit which it produces in profusion forms their principal means of subsistence. Even here, indeed, they are subject to poverty, for the soil belongs in great part to Mohammedan proprietors. Catholic missions have had some success among them, and there is a Chaldæan bishopric at Khosrava; but since 1831 the field has been more especially worked by the American Board, which has sought to accomplish its purpose by utilizing through the clergy the actually existing church, and by founding schools and introducing the press. In education a decided improvement may be observed. Formerly out of two hundred Nestorians hardly one could read and write; the proportion is now much higher. The development of the moral and religious character of the people is, however, a difficult task; partly on account of their pride in their old church and old beliefs, and partly because, to some extent through Persian influence, their morale has undergone great degradation. Volatile, sensuous, intemperate, and full of all kinds of superstition, while they are certainly more talented and sharper-witted than their brethren among the mountains, they are also much less truthful and trustworthy. As their garb is similar to that of the Persians, so also are many of their manners and customs. Many intelligent countenances are to be found among them. It has even been asserted that these are of the Jewish type, and some travellers have proposed an identification of the Nestorians with the lost tribes of Israel. The ethnographic arguments in favour of this Jewish connexion are, however, of no value; for many of the individual characteristics in which the Nestorians agree with the ancient Jews are common to all Oriental nations; and, what is of more importance, the type itself is not the Jewish one. The Nestorians have round heads, and frequently light hair and hazel eyes. Among the mountain Nestorians the complexion is usually a ruddy brown. That through all the centuries of nominal Mohammedan domination the national type should have been preserved must be ascribed exclusively to their isolated situation. They still speak Aramæan (Syriac); but their dialect is not a lineal descendant of the classical and literary language. In the mountains most of the Nestorians understand Kurdish, and in the low country of Azerbijan Turkish; and both languages have exercised a great influence on their native tongue. The low-country dialect has greatly suffered from phonetic decay; that of the mountaineers preserves many of the older forms, and is pronounced with greater correctness. The Nestorians, it may be added, call themselves in their own language Sûrâyi, and do not recognize the designation Nestorians bestowed upon them by people of other creeds. The patriarch bears the title of patriarch of the Chaldæans.

The Nestorians have a number of peculiar customs and manners. Their marriage ceremonies are very interesting, as also are some of their other festivals, during which, at least in the Urmia plain, there is always plenty of dancing, drinking, and in the end fighting. The mountain Nestorians more particularly are fond of hunting and hawking. One custom may be mentioned as peculiarly European; not only do they kiss the hands of their clergy, but they lift their caps to them—a mark of respect nowhere else in use in the East. Blood-revenge is in full vogue both in mountains and lowlands; but there are asylums for homicides. Pork is never eaten. As to creed, the Nestorians are strongly opposed to image worship, have no auricular confession, know nothing of a purgatory, and allow their priests to marry. The Lord's Supper is a kind of magical ceremony with them, and several curious customs are connected with its observance. As a matter of course their peculiarities are better preserved in places like Urmia on the one side or the mountain district of Tiyâri on the other, where they live together in considerable numbers.

In regard to the total numerical strength of the Nestorians, authorities differ greatly. Perkins spoke of 140,000, and assigned 50,000 to Tiyâri alone. The most trustworthy data are probably those of Badger, based, in the main, on information furnished by the patriarch, but with the number of families reduced one-third throughout (the figures given having, in some instances, been seen to be greatly exaggerated). The total number of families being 11,878, it may be estimated that the individuals amount to about 70,000. In the following table the enumeration of families as 4500 in Nos. 7 and 8 is purely approximate.

Dioceses.	Metropolitan.	Bishops.	Priests.	Churches.	Families.
1. Akra	1	0	9	13	249
2. Berwâri	1	0	18	20	848
3. Buhtân	0	2	16	22	220
4. Central Kurdistan	0	0	62	75	2,778
5. Tkhoma, Tchelu, &c.	1	0	24	37	1,979
6. Gawar, &c.	1	0	18	34	1,082
7. Shemdina	3	5	84	88	4,500
8. Urmia, &c.					
9. Lewun and Nudes	0	0	7	9	222
	7	7	188	249	11,878

The first-named diocese is the most southerly; it embraces the districts of Akra, Zebur, Mesuriye, and Jebel Gara to the north of Mosul. It is there more especially that, since the date of the collection of the figures given above, there have probably been accessions to the Chaldæan Church. The second diocese, comprising Berwâri, Nerwi, and Supna, lies to the north of the first, and nearer the mountains; the third, farther to the west and north-west, is mainly occupied by independent Kurds, and is still practically unexplored; the fourth, directly subject to the patriarch, contains, besides the county of Tiyâri (upper and lower), almost exclusively inhabited by Nestorians, Ashitha to the west, and Kotchannes, Diz, &c., to the north. North-eastward towards the Persian frontier lies the sixth diocese, including, in addition to Gawar, Albak and some other small isolated parishes; to the north of Tiyâri is the (ninth) diocese of Lewun and Nudes (Nurdus?), and to the east (fifth diocese) two leading districts of the Tkhoma mountains and the inhospitable Tchelu, along with Bar, Rekan, and Tchall. The seventh diocese, called also Be Shems-ud-din, lies to the east of Tchelu, and includes also Baradost, as well as Tergawer, Marjaver, &c., within Persian territory.

See G. P. Badger, *The Nestorians and their Rituals*, 2 vols., London, 1852; J. Perkins, *A Residence of Eight Years in Persia among the Nestorian Christians*, Andover, 1843; Asahel Grant, *The Nestorians or the Lost Tribes*, 2d ed., London, 1843; and also compare Layard's *Nineveh* and Ritter's *Asia*. (A. SO.)

NESTS. See BIRDS, vol. iii. p. 771.

NET. A net consists of a fabric of thread, twine, or cord, the intersections of which are firmly knotted so as to form meshes or interspaces of fixed dimensions,—the meshes being usually lozenges of uniform size. The art of netting is intimately related to weaving, knitting, plaiting, and pillow-lace and machine-lace making, from all of which, however, it is distinguished by the knotting of the intersections of the cord. It is one of the most ancient and universal of arts, having been in all times commonly practised among the rudest and most primitive tribes, to whom the net is of great importance in hunting and fishing.

Net-making, as a modern industry, is principally concerned with the manufacture of the numerous forms of net used in fisheries, but netting is also largely employed for many and varied purposes, as for catching game and birds, for the temporary division of fields, for protecting fruit in gardens, for collecting insects, for hammocks, and ship use, for screens and other furniture purposes, for ladies' hair, house bags, &c. While to a large extent net-making continues to be a handicraft, since the early part of the 19th century numerous forms of machine have been invented for netting, and several of these have been successfully introduced on a large scale in factories for the manufacture of fishing nets. Such fishing nets were formerly made principally from hemp fibre—technically called "twine"; but since the adaptation of machinery to net-making cotton has been increasingly used. Cotton nets, being more flexible and lighter than those made of twine, are much more easily handled and stowed, and in practice they are rapidly superseding all others.

The forms of fishing nets vary according to the manner in which they are intended to act. This is either by entangling the fish in their complicated folds, as in the trammel; receiving them into pockets, as in the trawl; suspending them by the body in the meshes, as in the mackerel-net; imprisoning them within their labyrinth-like chambers, as in the stake-net; or drawing them to shore, as in the seine (See FISHERIES, vol. ix. p. 247). The parts of a net are the head or upper margin, along which the corks are strung upon a rope called the head rope; the foot is the opposite or lower margin, which carries the foot-rope, on which in many cases leaden plummets are made fast. The meshes are the squares composing the net. The width of a net is expressed by the term "over"; *e.g.*, a day-net is three fathoms long and one over or wide. The lever is the first row of a net. There are also accrues, false meshes, or quarterings, which are loops inserted in any given row, by which the number of meshes is increased. To bread or breathe a net is to make a net. Dead netting is a piece without either accrues or stole (stolen) meshes, which last means that a mesh is taken away by netting into two meshes of the preceding row at once.

Hand-Netting.—Net-making as a handicraft is a simple and easily acquired art; the labour is not hard; and the implements and materials are easily obtained and inexpensive, while a little practice in meshing is sufficient to develop wonderful dexterity of movement. The tools used in netting are the needle, an instrument for holding and netting the material; it is made with an eye E, a tongue T, and a fork F (fig. 1). The twine is wound on it by being passed alternately between the fork and round the tongue, so that the turns of the string lie parallel to the length of the needle, and are kept on by the tongue and fork. A spool or mesh-pin is a piece of wood on which the loops are formed (round, as in fig. 2, or flat, as in fig. 3), the circumference or the spool determining the size of the loops. Each loop contains two sides of the square mesh; therefore, supposing that it be required to make a mesh 1 inch square,—that is, measuring 1 inch from knot to knot,—a spool 2 inches in circumference must be used. Large meshes may be formed by giving the twine two or more turns round the spool, as occasion may require; or the spool may be made flat, and of a sufficient width, having a portion cut away to admit the finger and thumb to grasp it conveniently (fig. 3). The method of making the hand-knot in nets known as the fisherman's knot is more easily acquired by example than described in writing. Fig. 4 shows the course of the twine in forming a single knot. From the last-formed knot the twine passes over the front of the mesh-pin *h*, and is caught behind by the little finger of the left hand, forming the loop *s*, thence it passes to the front and is caught at *d* by the left thumb, then through the loops *s* and *m* as indicated, after which the twine is released by the thumb and the knot is drawn "taut" or tight. Fig. 5 shows the form of the fisherman's knot, and fig. 6 is a bend knot used for uniting two ends of twine.

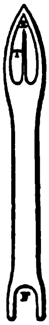


Fig. 1.

Fig. 2.

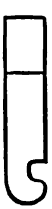


Fig. 3.

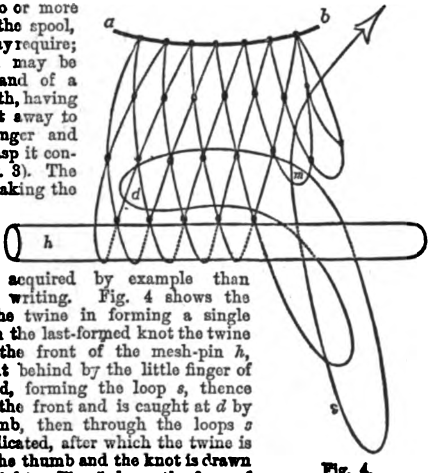


Fig. 4.

Machine-Netting.—So long ago as 1778 a netting-machine was patented by William Horton, William Ross, Thomas Davies, and John Golby. From that time till the end of the 18th century several other patents for similar machines were secured in Great Britain, but there is no evidence that any of them was practically successful. In 1802 the French Government, through the Société d'Encouragement pour l'Industrie Nationale, offered a reward of 10,000 francs to the person who should invent an automatic machine for net-making. The reward attracted the attention of Jacquard, who submitted a model of a machine which was brought under the notice of Napoleon I. and Carnot. Jacquard was summoned to Paris by the emperor, who, with forcible if profane point, asked of the inventor—"Are you the man who pretends to do what God Almighty cannot—tie a knot in a stretched string?" Jacquard's model, which is incomplete, was deposited in the Conservatoire des Arts et Métiers; it was awarded a prize, and he himself received an appointment in the Conservatoire, where he was not long in perfecting his famous Jacquard attachment to the common loom. In 1806 M. Buron of Bourgthéroulde (Eure) submitted to the Société d'Encouragement a model of a netting-machine for which he was awarded a gold medal. His model is also deposited in the Conservatoire. Meantime attention continued to be given to the problem in the United Kingdom, and the first to succeed practically in inventing an efficient machine and in establishing the industry of machine net-making was Mr James Paterson of Musselburgh. Paterson, originally a cooper, served in the army through the Peninsular war, and was discharged after the battle of Waterloo. From his early days he had devoted his mind to the invention of a net-making machine, and on his retirement from the army he set himself to carry out his purpose. After much labour he succeeded, and established a machine net factory in Musselburgh about 1820. The early form of machine was, however, imperfect, the knots it formed slipped readily, and, there being much prejudice against machine nets, the demand for his manufactures was small. Mr Walter Ritchie, a native of Musselburgh, devised a method for forming the ordinary hand-knot on the machine nets, and the machine, so improved, and patented in July 1835, became the foundation of an extensive and flourishing industry. Paterson's factory about 1849 passed into the hands of Messrs J. & W. Stuart, by whom the machine and processes have been still further developed and perfected.

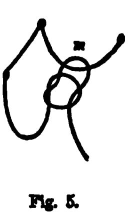


Fig. 5.

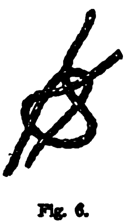


Fig. 6.

The mechanism of the Paterson net-loom or machine is complex, and not to be understood without elaborate diagrams or actual inspection. It consists of an arrangement of hooks, needles, and sinkers, one of each being required for every mesh in the breadth being made. The needles hold the meshes, while the hooks seize the lower part of each and twist it into a loop. Through the series of loops so formed a steel wire is shot, carrying with it twine for the next range of loops. This twine the sinkers successively catch and depress sufficiently to form the two sides and loop of the next mesh to be formed. The knot formed by threading the loops is now tightened up, the last formed mesh is freed from the sinkers and transferred to the hooks, and the process of looping, threading, and knotting thus continues.

Another form of efficient net-loom, working on a principle distinct from that of Paterson, was invented and patented in France by M. Onésiphore Pecqueur in 1840, and again in France and in the United Kingdom in 1849. The machine of Pecqueur was improved on by many subsequent inventors; and especially the additions made by MM. Beudouin and Jouannin, patented in the United Kingdom in 1861, greatly perfected its principle. In this machine separate threads or cords running longitudinally for each division of the mesh are employed, as will be seen from fig. 7, which represents a section of the net with the knots loose to show their structure. It will also be observed that the alternate threads *a* and *b* are differently disposed—the *a* series being drawn into simple loops over and through which the threads of the *b* series have to pass. On the machine the *a* series of threads are arranged vertically, while the *b* series are placed horizontally in thin lenticular spools. Over the horizontal *b* series is a range of hooks equal in number with the threads, and set so that they seize the *b* threads, raise them, and give them a double twist, thus forming a row of open loops. The loops are then depressed, and, seizing the vertical *a* threads, draw them crotchet-like through the *b* loops into loops sufficiently long and open to pass right over the spools containing the *b* threads (fig. 8), after which it only remains to tighten the threads and the mesh is complete. The machines work well with steam-power; and each requires only one female attendant.

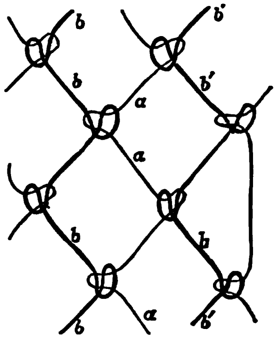


Fig. 7.

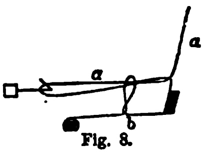


Fig. 8.

Bobbin Net, which is the foundation of machine-made lace, is made by the intertwisting—not knotting—of contiguous threads (see LACE, vol. xiv. p. 185).

Wire-netting, which is in extensive demand for garden use, poultry coops, and numerous like purposes, is also a twisted structure made principally by machine power. The chief centre of wire-net making is Warrington in Lancashire. (J. PA.)

NETHERLANDS, Kingdom of the. See Holland.

NETSCHER, Gaspar (1639-1684), portrait and genre painter, was born at Heidelberg in 1639. His father died when he was two years of age, and his mother, fleeing from the dangers of a civil war, carried him to Arnheim, where he was adopted and educated by a benevolent physician named Tullekens. At first he was destined for the profession of his patron, but his great aptitude for painting soon caused the plan of his future career to be altered. He was placed under an artist named De Koster, and, having also studied under Terburg, he set out for Italy to complete his education there. Marrying, however, at Liége, he proceeded no farther. He settled at Bordeaux, and toiled hard to earn a livelihood by painting fancy subjects. But those small cabinet pictures which are now so highly valued on account of their exquisite finish brought but a small remuneration; and, after removing to the Hague, he turned his attention to portrait-painting. In this branch of his art he was more successful. He was patronized by William III., and his earnings soon became so considerable that he was enabled at times to gratify his own taste and fancy by depicting musical and conversational pieces. It was in these that Netscher's genius was first fully displayed. The choice of these subjects, and the habit of introducing female figures, dressed in rich, glossy satins, were imitated from Terburg; they possess easy yet delicate pencilling, brilliant and correct colouring, and pleasing light and shade; but frequently their refinement passes into weakness, and they err through over-finish. The painter soon attracted notice, and was rapidly gaining both fame and wealth, when he was cut off in 1684 at the premature age of forty-five.

The paintings of Netscher are rare. The most extensive collection of them, numbering eight subjects, is at Dresden; and examples may be studied in the Louvre, in the galleries of Florence, the Hague, Cassel, Copenhagen, and St Petersburg, in the London National Gallery, and in the Bridgewater, Ashburton, and Apsley House collections. The style of Netscher was imitated by his two sons Theodore and Constantine; but these, though meritorious painters, were far inferior to their father.

NETTLE is the vernacular equivalent of the Latin *Urtica*, which again gives its name to the *Urticaceæ*. The species of *Urtica* are herbs covered with stinging hairs, and with unisexual flowers on the same or on different plants. The male flowers consist of a perianth of four greenish segments enclosing as many stamens, which latter, when freed from the restraint exercised upon them by the perianth-segments while still in the bud, suddenly uncoil themselves, and in so doing liberate the pollen. The female perianth is similar, but encloses only a single seed-vessel with a solitary seed. The stinging hairs consist, at the base, of a bulbous reservoir filled with acrid fluid, and prolonged into a long slender tube, the extremity of which is finely pointed. By means of this point the hair penetrates the skin and discharges its irritant contents beneath the surface. Some tropical species of *Urtica* produce a fluid of such potency that the most serious consequences ensue from coming into contact with the plant. Nettle tops, or the very young shoots of the nettle, may be used as a vegetable like spinach; but from the abundance of crystals (cystolithes) they contain they are apt to be gritty, though esteemed for their antiscorbutic properties. The fibre furnished by the stems of several species is, however, of more economic importance, being used for the purpose of cordage or paper-making. Three species of nettle are wild in the British Isles, although from their general presence in the neighbourhood of houses, or in spots where house refuse is deposited, it has been suggested that they are not really natives, a supposition that to some extent receives countenance from the circumstance that the young shoots are very sensitive to frost. In any case they follow man in his migrations, and by their presence usually indicate a soil rich in nitrogen. The trailing subterranean root-stock renders the common nettle somewhat difficult of extirpation.

NETTLERASH, or Urticaria, a disorder of the skin characterized by an eruption resembling the effect produced by the sting of a nettle, namely, raised red or red and white patches occurring in parts or over the whole of the surface of the body, and attended with great itching and irritation. It may be acute or chronic. In the former variety the attack appears to be connected with digestive derangements, and often comes on after indulgence in certain articles of diet, particularly various kinds of fruit, shell-fish, cheese, pastry, &c., also occasionally from the use of certain drugs, such as henbane, copaiba, cubebs, turpentine, &c. There is at first considerable feverishness and constitutional disturbance, together with sickness and faintness, which either precede or accompany the appearance of the rash. The eruption may appear on any part of the body, but is most common on the face and trunk. In the former position it causes swelling and disfigurement while it lasts, and is apt to excite alarm in persons unacquainted with its nature. The attack may pass off in a few hours, or may last for several days, the eruption continuing to come out in successive patches. The chronic variety consists in an eruption similar to that above described, but lasting with interruptions for a length of time often extending to months or years. This form of the disease occurs independently of errors in diet, and is not attended with the feverish symptoms characterizing the acute attack. It is probably connected with constitutional conditions, and is occasionally observed in the gouty. As regards treatment, the acute variety generally yields quickly to a purgative and the use of some antacid, such as magnesia or liquor potassæ. The local irritation is allayed by sponging with a warm alkaline solution (soda, potash, or ammonia), or a solution of acetate of lead. In the chronic form, in addition to these remedies, any constitutional morbid condition will demand special attention.

NETTLE TREE is the name applied to certain trees of the genus *Celtis*, and belonging to the family *Urticaceæ*. The best-known species have usually obliquely ovate, or lanceolate leaves, serrate at the edge, and marked by three prominent nerves. The flowers are inconspicuous, usually hermaphrodite, with a 4- or 5-parted perianth, as many stamens, a hairy disk, and a 1-celled ovary with a 2-parted style. The fruit is succulent like a little drupe, a character which serves to separate the genus alike from the nettles and the elms, to both of which it is closely allied. The wood of *Celtis australis* of southern Europe (also cultivated in England) is made use of for a variety of purposes, while the leaves serve as forage. An oil for burning is extracted from the seed of *Celtis occidentalis*. A North-American species is used for like purposes. *Celtis australis* was one of those to which the term "lotus" was applied by Dioscorides and the older authors, its berries or drupes having a sweet pleasant taste.

NEU-BRANDENBURG, a flourishing town in Mecklenburg-Strelitz, Germany, situated on a small lake called the Tollenser-See, about 60 miles to the west of Stettin. It is still partly surrounded with walls, and possesses four interesting old Gothic gates, dating from 1304. The principal buildings are the Marienkirche, a Gothic building of the 14th century, the synagogue, the town-house, and the gymnasium. Iron-founding, machine-making, wool-spinning, and the making of paper, tobacco, and musical instruments are carried on here, and the trade in wool and agricultural products is very considerable. The horse fair is also important. Neu-Brandenburg was founded in 1248, and has belonged to Mecklenburg since 1292. The population in 1880 was 8406.

NEUBURG, a small town of Bavaria, in the district of Schwaben und Neuburg, is pleasantly situated on the Danube, and in 1880 contained 7690 inhabitants, three-fourths of whom are Roman Catholics. It is a place of very ancient origin, but is chiefly noteworthy from the fact that for three centuries (1503–1802) it was the capital of the independent duchy of Pfalz-Neuburg. The most important building is the old ducal chateau, the handsomest part of which is in the Renaissance style of the 16th century. A considerable trade in agricultural products is carried on by the Danube.

NEUCHÂTEL, or **Neufchâtel** (Germ., *Neuenburg*), a canton of Switzerland, consisting of a section of the Jura system (see Jura) between the Doubs valley and the Lake of Neuchâtel, lies between 46° 50′ and 47° 10′ N. lat. and 6° 25′ and 7° 5′ E. long. It is bounded on the N.E. and E. by Bern, on the S.E. by its lake, which separates it from Freiburg and Vaud, on the S. by Vaud, and on the W. and N.W. by France (department of Doubs). The greatest length is about 30 miles, the average breadth 11, and the area 312 square miles. It consists for the most part of the longitudinal ridges and valleys characteristic of the Jura mountains, which here have an average elevation of over 3000 feet, and reach their highest point in the Creux du Vent (4900 feet). The drainage is divided by the Thièle or Zihl, which flows into the Aar, and by the Doubs, the former receiving by far the larger portion. The lowest part of the canton, stretching along the shore of the lake, and known by the name of Vignobles, has, as the name implies, the vine for its characteristic growth. It extends from about 1425 to upwards of 1800 feet above the level of the sea. An intermediate region represented by the Val de Travers and the Val de Ruz, ranging from 1800 to about 2700 feet in height, produces cereals (only a fifth, however, of the total required by the population). The higher valleys are occupied by meadow and forest. About one-fifth of the total area of the canton is under wood, and nearly a fourth is ranked as unproductive. The geological structure is explained under Jura. The most valuable mineral product of the canton is asphalt, of which there is a large and rich deposit in the Val de Travers, from which upwards of 2000 tons are annually taken (see vol. ii. p. 716). The wine of the Vignobles (both sparkling and still) is plentiful and has a good reputation, being exported in large quantities. On the mountain pasture lands large herds of cattle are reared; in 1876 the number was 19,469, and there were besides 3009 horses, 3433 pigs, 3586 sheep, 2853 goats, and 4723 beehives. Absinthe is manufactured in the Val de Travers, and exported to the extent of 200,000 bottles annually; lace is also largely made, especially in that valley, but the characteristic industry of the canton is that of watchmaking in all its branches, carried on chiefly in and around the lofty and secluded villages of Chaux-de-Fonds and Le Locle. The former, which is upwards of 3200 feet above the level of the sea, had a population of 22,456 in 1880, the latter (upwards of 3000 above sea-level) had 10,464,—the annual value of the total production of watches exceeding £1,000,000. The population of the canton in 1880 was 103,732 (50,169 males). The proportion of Protestants to Catholics is nearly 8 to 1; there are also a small number of Jews. The language of three-fourths of the inhabitants is French.

The territory of Neuchâtel was inhabited during the Roman period by the Gallic Sequani. It is not again mentioned in history until the beginning of the 11th century, when it passed from Burgundy to the German empire. In 1288 it was given by Rudolph of Hapsburg to John II. of Chalons, with the title of count. In 1444 the count of Neuchâtel joined the Swiss league against Austria, and ever afterwards enjoyed Swiss protection. In the beginning of the 16th century the countship passed to the house of Orleans-Longueville, and in 1579, being conjoined with the countship of Valendis, it became a principality, which in the beginning of the 18th century was inherited by Frederick I. of Prussia (his claims being preferred by the people over those of numerous other candidates). In 1806, after the treaty of Tilsit, it was given by Napoleon to Marshal Berthier, but it was restored to Prussia in 1814, though Neuchâtel was at the same time recognized as holding a place in the Swiss confederacy, being the only non-republican canton. In 1848 a republican constitution was established, the king of Prussia protesting; and in 1856 an attempt was made by a royalist party to re-establish monarchy, but without success. The ultimate result of the negotiations which ensued was that, by a treaty at Paris in 1857, an amnesty was granted to the insurgents, and the king of Prussia resigned all claim to sovereignty while still retaining the right to bear the title of prince of Neuchâtel.

Neuchâtel, the capital of the above canton, stands near the north end of the lake, at the mouth of the Seyon, partly on low alluvial ground and partly on the slope of the Jura. The castle (whence the name Neocomum, Neoburgum, Novum Castrum), which is situated on an eminence, is a considerable building, now occupied by the Government offices. It was formerly the residence of the princes of Neuchâtel, and the most ancient portion, recently restored, dates from the Burgundian period. Near it is the Temple du Haut, a church dating from the 12th century; it contains a handsome monument (1372) to Count Louis of Neuchâtel, and a memorial stone to the Reformer Farel, who frequently laboured here. His statue in front was erected in 1875. On the lake stands the gymnasium or college, containing a library, an archæological museum, and a valuable natural history collection founded by Agassiz. The town also possesses a picture gallery, a good observatory, and considerable charitable institutions, mostly due to the munificence of private citizens,—the municipal hospital, founded by David de Pury, whose statue stands in the Place Pury, and the Pourtalès hospital, founded by M. Pourtalès. The Préfargier lunatic asylum, presented to the canton in 1844 by M. de Meuron, is situated 3 miles to the west of the town. Neuchâtel has a considerable trade in the products of the canton, the chief items being wine, watches, lace, and liqueurs. It has railway communication by Yverdon with Lausanne and Pontarlier, by Bienne with Basel, by Chaux-de-Fonds with Locle and also with Basel, and by the Val de Travers with Pontarlier. The population in 1880 was 15,612.

NEUCHÂTEL, The Lake of, along with the connected lakes of Morat and Bienne, is the modern representative of the large body of water which at one time occupied the whole lower valley of the Aar. It is 25 miles in length, at its broadest part it measures 6 miles, its maximum depth is 500 feet, and the area is 92 square miles. The Thièle (Germ., Zihl), which flows into it at the south-west angle, rises in the heights above La Sarras close to the edge of the Geneva basin; the Broye, which joins it on the north-east, comes from the Lake of Morat (Lacus Aventicensis). It is also fed by the Reuse, which drains the Val de Travers, and by the Seyon from the Val de Ruz (Rudolfsthal). It drains by the Thièle into the Lake of Bienne and thence into the Aar. Its elevation above sea-level, lowered 7 feet by a recent enlargement of the outlet, is 1424 feet. The north-west shore is cultivated and populous, but the opposite bank is rocky, overgrown with wood, and comparatively thinly peopled. The scenery, though pleasing, cannot compare with that of the more famous Swiss lakes. Besides Neuchâtel, the principal towns upon its banks are Estavayer and Yverdon—the ancient Eburodunum or Ebredunum, from which came its Roman name (Lacus Eburodunensis). It abounds in fish;

and a considerable traffic, by steam and otherwise, is borne by its waters. It is subject to violent westerly storms. Interesting remains of ancient lake dwellings have been discovered at Estavayer and Cortaillod.

NEUHÄUSEL (in Hungarian, *Ersek-Ujvár*), a town of Hungary, in the district of Neutra, is situated on the river Neutra and on the railway from Pressburg to Pesth, about 60 miles from each of these towns. It was formerly a strong fortress, and played an important part in the wars with the Turks, and in the risings of Bethlen Gabor and Prince Rakoczky, but the works were razed in 1724. Its inhabitants, numbering 10,584 at the census of 1880, are partly of Slovak origin, and are occupied with agriculture, vine-growing, and cloth-weaving. Important cattle and horse markets are held here.

NEUHOF, THEODOR, BARON VON (*c.* 1690–1756), who for a short time was nominally king of Corsica as Theodore I., was the son of a Westphalian noble, and was born at Metz about 1690. His father, an officer in the French service, had won the special favour of the duchess of Orleans, and on his death in 1695 his son and daughter were taken under her protection. The young baron was thus early initiated into the usages of courts, and received a thorough training in all the accomplishments best fitted to gain him influence with the great. Losses in play having compelled him to leave Paris, he entered the service of Charles XII. of Sweden, by whom he was sent on a secret diplomatic mission in connexion with a project for the restoration of the Stuarts. In connexion with the same intrigue he was also resident for a short time in London. In 1718 he came to Spain, where, obtaining the favour of the duke of Ripperda, he received the commission of colonel, and married Lady Sarsfield, one of the maids of honour of the queen. Finding his position at the court insecure, he made his escape with his wife's jewels. After various adventures he came in 1732 to Florence as representative of the emperor Charles VI. Having here made the acquaintance of several Corsican patriots, he succeeded by expressing strong sympathy with their cause, and promising to gain assistance for them in their resistance to the Genoese, in being accepted as a candidate for the Corsican throne. After fruitless endeavours to interest various European sovereigns in their behalf, he made his way to the dey of Tunis. From him he obtained a shipload of supplies and ammunition, with which he landed at Corsica on the 14th March 1736. He was received with the utmost enthusiasm, and in the following April was crowned king as Theodore I. By the help of a body-guard of 400 men, and the lavish distribution of new titles, he succeeded for some time in retaining his position, but failing in an effort to capture Bastia from the Genoese, he at the end of eight months resigned his power into the hands of a council of regency, and left the island with the view of arousing sympathy in behalf of his oppressed subjects. Making his way finally to Amsterdam, he was thrown into prison by some of his old creditors, but, succeeding in satisfying their demands, he appeared before Corsica in September 1738 with a considerable supply of provisions and war matériel, only to find it under the power of the French, who had become allies of the Genoese. After the departure of the French in 1743 he endeavoured to re-establish his authority, but found the faction against him so strong that he was soon compelled again to leave Corsica, and went to England, where he suffered several years imprisonment in the King's Bench prison at the instance of his Dutch creditors. Through the efforts of Horace Walpole a subscription was raised in his behalf, and, an understanding having been arrived at with his creditors, he obtained his freedom in 1756. He died 11th December of the same year.

Neuhof's son, who entered the service of the duke of Würtemberg, published an account of his father's life under the title *Mémoires pour servir à l'histoire de Corse*, 1768 See also Filippini, *Histoire des Révolutions de l'Île de Corse et de l'Elévation de Théodore I. sur le Trône de cet État*, The Hague, 1738; D'Argentcourt, *De Gekroonde Moff of Theodorus op Stelten* (Utrecht, 1739), and *De Dwaalende Moff of Verfolg van Theodorus op Stelten* (Deventer, 1740); *A General Account of the Island of Corsica, with authentic Memoirs of Baron de Neuhoff*, London, 1839; *History of Theodore I., King of Corsica*, London, 1843; Varnhagen von Enso, *Biographische Denkmale*, part i.

NEUILLY-SUR-SEINE, a town of France, at the head of a canton in the arrondissement of St Denis (department of Seine), lies between the line of the Paris fortifications, the Bois de Boulogne, the right bank of the Seine, and the village of Levallois-Perret, which was formerly included within its limits. It is only 3½ miles from the centre of Paris by the road to St Germain (a continuation in the form of a boulevard of the middle avenue of the Champs Elysées), and is practically a mere suburb; but its broad drives and leafy gardens make it a favourite resort for invalids and city people who wish to enjoy a little country air. Unlike St Denis and Clichy, Neuilly has no large manufactories: convents, boarding-schools, maisons de santé, laundries, &c., give character to the place, which also contains establishments connected with Paris houses for the manufacture of preserved meats, patent leather, colours, chemicals. The population is 25,235.

A castle at Neuilly, built by the count of Argenson in the 18th century, ultimately became the property and favourite residence of the duke of Orleans (Louis Philippe), the birthplace of nearly all his children, and the scene of the offer of the crown in 1830. The buildings, which comprised 30 state apartments, accommodation for 500 attendants, and stabling for 200 horses, were pillaged and burned by the mob in 1848. The park which extended from the fortifications to the river, as well as the neighbouring park of Villiers (also belonging to the princes of Orleans), was broken up into building lots, and is now occupied by a large number of small middle-class houses and a few fine villas. Within the line of the fortifications, but on Neuilly soil, stands the chapel of St Ferdinand erected in the Byzantine style on the spot where the duke of Orleans died July 13th, 1842, from the results of a carriage accident. The stained glass windows were made at Sèvres after designs by Ingres; the ducal cenotaph, designed by Ary Scheffer, was sculptured by M. de Triquety; and the chapel farther contains a "Descent from the Cross," by the last-named artist, a picture by Jacquand, representing the royal family gathered round the dying prince, and an angel executed in Carrara marble by the princess Marie his sister. The castle of Bagatelle, once the property of the count of Artois, now belongs to Sir Richard Wallace.

NEUMANN, CARL FRIEDRICH (1798–1870), the well-known Orientalist, was born of Jewish parents at Reichmansdorf near Bamberg, on the 22d December 1798. He began life in a merchant's office at Frankfort, but finding commerce unsuited to his taste he resigned his desk, and in 1816 entered as a student at the university of Heidelberg. From thence he went to Munich, where, under the influence of the liberal opinions which were fast gaining possession of his mind, he deserted his hereditary faith for the Lutheran communion. Once more he sought another alma mater, and finally completed his studies at Göttingen. In 1822 he was appointed to a professorship in a gymnasium at Spires, but the same freedom of thought which had led him to leave the religion of his fathers brought him into conflict with the authorities of that institution, who, believing the religious tendency of his historical teaching to be heterodox, dismissed him from his office. About this time he appears to have entered on the serious study of Armenian, and in 1827 we find him at Venice devoting himself to that language under the guidance of the monks of the monastery of San Lazaro. In the following year he visited Paris for the purpose of pursuing a more general study of the Oriental languages, among which Chinese had for him a special attraction. It was not, however, until he reached London in 1829 that he first contemplated visiting China, a project which in 1830 he carried into execution. While in that country he gathered together a library of 10,000 volumes, consisting of works in all departments of literature, and he also purchased a collection of works in 2400 volumes for the royal library at Berlin. On his return to Europe in 1831 he presented the 10,000 volumes to the royal library at Munich, and was most appropriately installed by the Government as curator of his gift, as well as professor of Chinese at the university. His lectures at this period of his career were no less conspicuous for the deep and wide knowledge they displayed of the languages and history of the East than for the zeal for social progress which was apparent in them. During the disturbed years which preceded the revolutionary period of 1848 the natural tendency of his mind placed him in the fore front among the "friends of the people," and when the outbreak came he was elected a member of the Bavarian Provisional Parliament. The prominent position thus accorded to him cost him his professorship when four years afterwards the royalists found themselves sufficiently powerful to make such reprisals. He, however, still remained at Munich pursuing his favourite studies until 1864, when he removed to Berlin, where he died on the 17th March 1870.

Among the best known works of this indefatigable student are his *Pilgerfahrten buddhistischer Priester aus China und Indien*, Leipsic, 1883; *Mémoire sur la vie et les ouvrages de David, philosophe arménien du cinquième siècle de notre ère*, Paris, 1829; *Geschichte des Englisch-Chinesischen Krieges*, Leipsic, 1846; *Supplement to Bürck's Marco Polo*, Leipsic, 1846; *Geschichte des Englischen Reiches in Asien*, 2 vols., Leipsic, 1857; *Ostasiatische Geschichte vom ersten Chinesischen Krieg bis z. den Verträgen in Peking*, 1840–60, Leipsic, 1861; translations from Armenian of the *History of Vartan* by Elisæus (London, 1880), and of Vahram's *Chronicle of the Armenian Kingdom in Cilicia* (London, 1831); from the Chinese of the *Catechism of the Shamans* (London, 1881), and of the *History of the Pirates who infested the Chinese Seas from* 1807 *to* 1810 (London, 1831); and from the Italian of the *Versuch einer Geschichte der armenischen Literatur* (Leipsic, 1838). Besides these works he published *Lehrsaal des Mittelreiches*, 1836; his *Asiatische Studien*, 1837; *Die Völker des südlichen Russlands in ihrer geschichtlichen Entwickelung*, 1847, for the last of which papers he gained a prize from the French Institute.

NEU-MÜNSTER, a town of Prussia, in the province of Schleswig-Holstein, district of Kiel, lies on both banks of the small river Schale, in the basin of the Stör. It is the centre of the railway system of Holstein, and after Altona the most important industrial town in the province, containing upwards of seventy cloth-factories, besides manufactories of cotton, wadding, carpets, paper, and bonbons. Its trade is also brisk. The name is derived from an Augustine monastery, founded by Vicelin, and mentioned as "Novum Monasterium" in a document of 1136. Its industrial importance began in the 17th century, when the cloth-workers of Segeberg, a town to the south-east, migrated to it. In 1880 it contained 11,623 inhabitants, almost exclusively Protestant.

NEUNKIRCHEN, or OBER-NEUNKIRCHEN, a small manufacturing town of Prussia, in the district of Treves and circle of Ottweiler, is situated on the Blies, 12 miles to the north-west of Saarbrücken. The principal industrial establishment is a huge iron-foundry, employing upwards of 2000 hands, and producing about 80,000 tons of manufactured iron per annum; but there are also boiler-works, soap manufactories, and a brewery. It lies in an important coal-basin, in which about 4 million tons of coals, worth £1,500,000, are raised annually. The 14,647 inhabitants (1880) consist of Protestants and Roman Catholics in almost equal proportions.

NEURALGIA, literally *nerve pain*, is a term which is frequently employed both technically and popularly in a somewhat loose manner, to describe pains the origin of which is not clearly traceable. In its strict sense it denotes the existence of pain in some portion or throughout the whole of the distribution of a nerve without any distinctly recognizable structural change in the nerve or nerve centres. This strict definition, if adhered to, however, would not be applicable to a large number of cases of neuralgia; for it is well known that in not a few instances the pain is connected with some source of irritation, by pressure or otherwise, in the course of the affected nerve; and hence the word is generally used to indicate pain affecting a particular nerve or its branches from any cause. There are few ailments which give rise to greater human suffering than neuralgia, and some of the chief causes concerned in its production, or the conditions most frequently found associated with it, may be briefly alluded to.

It may be stated generally that neuralgia rarely occurs in the midst of good health. On the contrary its existence usually betokens a depressed or enfeebled state. Constitutional conditions inherited or acquired are among the most powerful of the predisposing influences in the production of neuralgia. Thus it is often found to affect the hereditarily rheumatic or gouty. In weakened conditions of the system from improper or insufficient food, or as a result of any drain upon the body, or in anæmia from any cause, and in certain disease poisons, such as syphilis or malaria, neuralgia is a frequent concomitant. Further, any strain upon the nervous system, such as mental overwork or anxiety, is a predisposing cause of recognized potency. Among the exciting causes of an attack of neuralgia by far the most common is exposure to cold and damp, which seems to excite irritation in a nerve already predisposed to suffer. But irritation may be produced by numerous other causes besides this,—such as a decayed tooth, diseased bone, local inflammations in which nerves are implicated, by some source of pressure upon a nerve trunk, or by swelling of its sheath in its passage through a bony canal or at its exit upon the surface. Further, there would appear to be causes of a reflex character which are capable of setting up neuralgia at a distance, such as intestinal or uterine derangements. The practical importance of ascertaining the probable nature of the cause is obvious.

The pain of neuralgia is generally localized, but may come to extend beyond the immediate area of its first occurrence. It is usually of paroxysmal character, and not unfrequently periodic, occurring at a certain time of the day or night. It varies in intensity, being often of the most agonizing character, or less severe and more of a tingling kind. Various forms of perverted nerve function may be found co-existing with or following neuralgia. Thus there may be hyperæsthesia, anæsthesia, paralysis, or alterations of nutrition, such as wasting of muscles, whitening of the hair, &c. Attacks of neuralgia are liable to recur, particularly when the general health is low, and some persons unhappily continue to suffer from occasional attacks during the greater part of their lifetime.

The nature of the disease and its manifestations will be best understood by a reference to the forms in which neuralgia most commonly shows itself. These are facial neuralgia or tic douloureux, migraine (hemicrania or brow ague), intercostal neuralgia, and sciatica. Other forms, such as those affecting the neck, arm, &c., are described, but they are of less frequent occurrence.

Facial neuralgia, or *tic douloureux*, is one of the most common forms of neuralgia, and one of the most severe. It affects the great nerve of sensation of the face (fifth nerve), and may occur in one or more of the three divisions in which the nerve is distributed. It is usually confined to one side. Females suffer, on the whole, more frequently than males, and adults or young persons more than children or the aged. Among the more prominent conditions associated with it may be mentioned a low state of health as a result of previous disease, any drain upon the system (such as excessive menstruation, over-lactation, &c.), and, very specially, over-exertion of body or mind and mental anxiety. It is occasionally associated with epilepsy (Trousseau). The attack is often precipitated by the irritation of a decayed tooth or by exposure to cold air. When the first or upper division of the nerve is involved, the pain is mostly felt in the forehead and side of the head. It is usually of an intensely sharp, cutting, or burning character, either constant or with exacerbations, and often periodic, returning at a certain hour each day while the attack continues. Occasionally the paroxysms are of extreme violence, and are brought on by the slightest provocation, such as a draught of cool air. The skin over the affected part is often red and swollen, and, even after the attack has abated, feels stiff and tender to the touch. In this, as in all forms of neuralgia, there are certain localities where the pain is more intense, these "painful points," as they are called, being for the most part in those places where the branches of the nerves emerge from bony canals or pierce the fascia to ramify in the skin. Hence, in this form, the greater severity of the pain above the eyebrow and along the side of the nose. There is also pain in the eyelid, redness of the eye, and flow of tears. When the second division of the nerve is affected the pain is chiefly in the cheek and upper jaw, the painful points being immediately below the lower eyelid, over the cheek bone, and about the upper lip. When the third division of the nerve suffers the pain affects the lower jaw, and the chief painful points are in front of the ear and about the chin. As a result of this malady important nutritive disturbances may appear in the affected area, such as thickening of the tissues, falling out or blanching of hair, &c., as well as various alterations of sensibility. Attacks of tic douloureux, extremely distressing as they are, may recur occasionally for years; and, although, by depriving the sufferer of sleep and interfering with the taking of food, they may in some measure impair the health, they rarely appear to lead to any serious results.

Hemicrania, *migraine*, *brow-ague*, and *sick headache* are various terms employed to describe what appears to be another form of neuralgia, notwithstanding the opinion of some that it is a different kind of disease. The causes giving rise to it appear to be similar to those which bring about any of the forms of neuralgia. In some instances it would seem to be hereditary. It most frequently affects females, and generally occurs in early life, tending to disappear as age advances. An attack may come on suddenly, but, in general, begins by a dull aching pain in the brow or temple, which steadily increases in severity and extent, but remains usually limited to one side of the head. It attains at times an extreme degree of violence, and is apt to be aggravated by movement, loud noises, or bright light. Accompanying the pain there is more or less of nausea, and when the attack reaches its height vomiting may occur, after which relief comes, especially if sleep supervene. An attack of this kind may last for a few hours or for a whole day, and after it is over the patient feels comparatively well. It may recur periodically, or, as is more common, at irregular intervals. During the paroxysms, or even preceding them, certain sensory disturbances may be experienced, more especially affections of vision, such as ocular spectra, hemiopia, diplopia, &c.; and there is also apt to be considerable mental depression.

Intercostal neuralgia is pain affecting the nerves which emerge from the spinal cord and run along the spaces between the ribs to the front of the body. This form of neuralgia affects the left side more than the right, is much more common in women than in men, and occurs generally in enfeebled states of health. It might be mistaken for pleurisy or some inflammatory affection of the lungs; but the absence of any chest symptoms, its occurrence independently of the acts of respiration, and other considerations well establish the distinction. The specially painful points are chiefly at the commencement of the nerve as it issues from the spinal canal, and at the extremities towards the front of the body, where it breaks up into filaments which ramify in the skin. This form of neuralgia is occasionally the precursor of an attack of shingles (*Herpes zoster*) as well as a result of it.

Sciatica is another of the more common forms of neuralgia. It affects the great sciatic nerve which emerges from the pelvis and runs down the leg to the foot. It is in most instances traceable to exposure to cold or damp, to overuse of the limbs in walking, &c.; but there are many other possible causes. Any source of pressure upon the nerve within the pelvis, such as may be produced by a tumour or even by constipation of the bowels, may excite an attack of sciatica. It is often connected with a rheumatic or gouty constitution. In general the nerve of one side only is affected. The pain which is felt at first a little behind the hip-joint steadily increases in severity and extends along the course of the nerve and its branches in many instances as far as the toes. The specially painful points are about the knee and ankle joints; besides which a feeling of numbness is experienced throughout the whole limb. In severe cases all movement of the limb aggravates the pain, and the patient is obliged to remain in bed. In prolonged attacks the limb may waste and be drawn up and fixed in one position. Attacks of sciatica are often attended with great suffering, and are apt to be very intractable to treatment.

In the treatment of all forms of neuralgia it is of first importance to ascertain if possible whether any constitutional morbid condition is associated with the malady, for otherwise the most powerful and approved remedies will often fail. Thus, if evidence of rheumatism, gout, anæmia, &c., be present, treatment appropriate to these conditions must be employed.

Of means available for the relief of the pain the number is so great that any detailed statement would be impossible in a general notice like the present. Only the more approved and potent remedial measures can be alluded to. The internal administration of narcotics and sedatives often succeeds in quelling the attack and procuring sleep. Among these the various preparations of opium, belladonna, henbane, chloral, croton-chloral, bromide of potassium, the bromide and chloride of ammonium, aconite, gelsemium, &c., are most commonly employed; but to many of them, such as opium and chloral, there exists the serious objection of the risk of the acquisition of the habit of indulgence in them.

When the attack is periodic the administration of a large dose of quinine two or three hours previous to the usual time of the seizure will often mitigate, and may even prevent, the paroxysm. In migraine, caffein and its preparations are recommended. Many topical applications are of great efficacy. The various liniments or ointments containing the preparations of opium, belladonna, or aconite rubbed into the affected part will often soothe the most severe local pain. An excellent sedative application is a lotion composed of equal parts of camphor and chloral painted or gently rubbed over the painful area. In many cases relief may be obtained by the hypodermic injection of morphia or atropia, by acupuncture, by blisters, or by counter-irritation with the button cautery.

The plan at one time resorted to of dividing or excising a portion of the affected nerve is now seldom employed, but the operation of nerve-stretching has been recently introduced, and in some forms of neuralgia, notably sciatica, is sometimes successful. It consists in cutting down upon and exposing the nerve, and in seizing hold and drawing upon it so as to stretch it. Such an operation is obviously justifiable only in cases where other less severe measures have failed to give relief. The employment of electricity, either in the form of faradization or galvanism, has much to recommend it, and in long continued and intractable forms of neuralgia proves in many instances eminently serviceable. (J. O. A.)

NEUROPTERA. See Insects, vol. xiii. p. 151.

NEU-RUPPIN, the chief town of a circle in the district of Potsdam and province of Brandenburg, Prussia, lies on the west bank of a small lake (the Ruppiner See), 37 miles to the north-west of Berlin. The town, which was rebuilt after a destructive fire in 1787, contains three Protestant churches, a small Roman Catholic church, and various educational and benevolent institutions. Its inhabitants are employed in the manufacture of cloth, starch, and machinery, iron-founding, and lithography. In 1880 they numbered 13,985. Important cattle and horse fairs are held here. The small town of Alt-Ruppin lies at the north end of the lake, and about 10 miles to the north is the chateau of Rheinsberg, where Frederick the Great spent his youth.

NEU-SANDEC, or Neu-Sandez (Polish, *Novi Sács*), the chief town of a district in western Galicia, lies on the river Dunajec, about 45 miles to the south-east of Cracow. It contains a mediæval chateau, a Gothic church of 1448, a Protestant church, a gymnasium, and several benevolent institutions. In Alt-Sandec, a little to the south, at the confluence of the Poprad and Dunajec, is an old convent of Clarissine nuns, formerly one of the wealthiest in Poland. Sandec was founded by Wenzel, king of Poland and Bohemia, in 1294. It contains (1880) 11,185 inhabitants, most of whom are Protestants.

NEUSATZ (Hungarian, *Uj Vidék*; Servian, *Novisad*), a royal free town of Hungary, in the province of Bács, and the seat of a Greek non-united bishop, lies on the left bank of the Danube, opposite Peterwardein, with which it is connected by a bridge of boats. It is about 150 miles to the south of Pesth and 50 miles above Belgrade. The town is well built, and contains ten churches (Greek, Roman Catholic, and Protestant), a synagogue, a gymnasium, and a real-school. It is a steamboat station, and carries on a brisk trade in grain and fruit with Germany and Turkey. Nearly one half of its 21,325 inhabitants (1880) are Serbs, the other half being made up of Magyars, Germans, and Jews; and it has recently become a sort of religious and literary centre for the Serbs of Hungary. Neusatz was founded in the middle of the 18th century, and was almost totally destroyed in 1849, when the insurgents made an ineffectual resistance here to the imperial troops under Jellachich. In the vicinity are the remains of an extensive Roman entrenchment.

NEUSOHL (Hungarian, *Besztercze-Bánya*; Slavonic, *Banska Bystrica*), an ancient mining town of Hungary, the capital and see of the district of Sohl, is prettily situated at the confluence of the Gran and the Bistritz, in a fertile valley enclosed by lofty hills, 85 miles to the north of Pesth. It is a well-built town, with five suburbs, and contains a Roman Catholic cathedral, an imposing Protestant church, an old castle, two gymnasia, an episcopal seminary, a normal school, and several charitable institutions. The offices of the mining and other authorities of the district are large and handsome buildings. In 1880 Neusohl contained 7160 inhabitants, of mixed Magyar, Slavonic, and German descent. They are employed chiefly in the copper, lead, and silver mines of the vicinity, and in the various metallurgical occupations to which these give rise; but they also manufacture cloth, dye-stuffs, paper, beetroot sugar, &c. Mining has been carried on here since the 8th century, and has been prosecuted with especial energy since the immigration of German miners in the 11th and 13th centuries. Neusohl was made a royal free town in 1255.

NEUSS, a busy manufacturing town of Rhenish Prussia, lies 4 miles to the west of Düsseldorf and 1½ miles from the west bank of the Rhine, with which it is connected by the Erft canal, uniting the Rhine and the Meuse. The chief building in the town is the church of St Quirinus, a remarkably fine example of the transition from the Round to the Pointed style; and there are four other Roman Catholic churches, a Protestant church, a gymnasium (containing a collection of Roman antiquities), and two lunatic asylums established in old convents. The site formerly occupied by fortifications is now laid out as a promenade encircling the town. Neuss is the chief place in the Rhenish province for the production of oil and meal, and it also carries on the manufacture of woollen stuffs, white goods, and paper, brick-making, iron-founding, and other industries too numerous to specify. Its markets for cereals are among the most important in Prussia, and it is also the centre of a brisk trade in cattle, coals, building materials, and the products of its various manufactories. In 1880 it contained 17,495 inhabitants, of whom 16,077 were Roman Catholics.

Neuss, the *Novesium* of the Romans, frequently mentioned by Tacitus, formerly lay close to the Rhine, and was the natural centre of the district of which Düsseldorf has become the chief town. Drusus, brother of the emperor Tiberius, threw a bridge across the Rhine here, and his name is preserved in the Drususthor, the lower half of which is of Roman masonry. In 1474–75 Charles the Bold of Burgundy besieged the town in vain for eleven weeks, during which he lost 10,000 men; but it was taken and sacked by Alexander Farnese in 1586.

NEUSTADT (Polish, *Prudnik*), a manufacturing town of Prussian Silesia, in the district of Oppeln, is situated on the river Prudnik or Prudnitz, 60 miles to the south-east of Breslau. It contains three Roman Catholic churches, a Protestant church, and a gymnasium. The chief industries are tanning, dyeing, and the manufacture of damask, table-linen, ticking, and woollen stuffs. In 1880 the population was 14,292, including 12,300 Roman Catholics. In 1745, 1760, and 1779 engagements between the Austrians and Prussians took place near Neustadt, which on the last occasion was bombarded and set on fire.

NEUSTADT, or WIENER-NEUSTADT, an important manufacturing town in Lower Austria, is situated between the Fischa and the Leitha, close to the Hungarian frontier, and 25 miles to the south of Vienna. It was almost entirely rebuilt after a destructive fire in 1834, and ranks among the handsomest provincial towns in Austria. Its ancient gates, walls, and towers have disappeared, but it still possesses a few mediæval edifices, the most important of which is the old castle of the dukes of Babenberg, founded in the 12th century, and converted by Maria Theresa into a military academy (400 to 500 pupils). The Gothic chapel contains the remains of the emperor Maximilian I., who was born here in 1459. The parish church, with its two lofty towers, is substantially a Romanesque building of the 13th century, but the choir and transepts are Gothic additions of a later date. The late Gothic church of the old Cistercian abbey contains a handsome monument in memory of Eleonora of Portugal (d. 1467), consort of the emperor Frederick IV. The town-house is also a noteworthy building. The educational and charitable institutions include a gymnasium, a real-school, a normal seminary, industrial, commercial, and musical schools, and three hospitals. The chief industrial establishment is an engine-factory, employing 2500 hands, and turning out 150 to 200 locomotives annually; but manufactures of cotton, silk, velvet, pottery, and paper, sugar-refining, and tanning are also extensively carried on. Trade is also brisk, and is facilitated by a canal connecting the town with Vienna, and used chiefly for the transport of coal and timber. The population in 1880 was 23,468, nearly all Roman Catholics.

Neustadt was founded in 1192, and was a favourite residence of numerous Austrian sovereigns, acquiring the title of the "ever-faithful town" (*die allezeit getreue Stadt*) from its unfailing loyalty. In 1246 it was the scene of a victory of the Hungarians over the Austrians; and in 1486 it was taken by Matthew Corvinus, king of Hungary, who, however, restored it to Maximilian I. four years later. In 1529 and 1683 it was besieged by the Turks. It was at Neustadt that the emperor Rudolf II. granted to the Bohemian Protestants, in 1609, the "Majestätsbrief," or patent of equal rights, the revocation of which helped to precipitate the Thirty Years' War. Compare Böheim, *Chronik von Wiener-Neustadt*.

NEUSTADT-AN-DER-HAARDT, a small manufacturing town in the Bavarian Palatinate, is picturesquely situated at the base of the Haardt mountains and the mouth of the valley of the Speyerbach, 14 miles to the east of Spires and the Rhine. The Protestant abbey-church, a fine Gothic edifice of 1354–1489, contains the tombs of several Counts Palatine. The other noteworthy buildings are the handsome Roman Catholic church, a modern Gothic structure; the Saalbau, a large edifice for balls and concerts; the town-house, formerly a Jesuit college; the old Latin school; the real-school; and the hospital. The chief industries are paper-making, straw-plaiting, distilling, and the manufacture of cloth, gold and silver plate, furniture, starch, and hats. A brisk trade is carried on in wood, grain, fruits, and wine, all of which are produced extensively in the vicinity. Neustadt, which received its municipal charter in 1275, now contains (1880) 11,411 inhabitants, of whom 6987 are Protestants and 4028 Roman Catholics. It is one of the centres of the Rhenish "grape-cure," which attracts numerous visitors.

NEUSTADT-EBERSWALDE, now officially named EBERSWALDE simply, is a manufacturing town of Prussia, province of Brandenburg, situated 28 miles to the north-west of Berlin, on a canal connecting the Oder and the Havel. It possesses a mineral spring, which has lately attracted numerous summer visitors, but its chief importance arises from its various industries, which include iron-founding and the making of horse-shoe nails, roofing material (*Dachpappe*, a kind of thick pasteboard), and bricks. A considerable trade is carried on in grain, wood, and coals. In the immediate vicinity are one of the chief brass-foundries in Germany and an extensive Government paper-mill, in which the paper for the notes of the national bank (*Reichsbank*) is manufactured. The town contains no noteworthy buildings except the large lunatic asylum for the province, and the school of forestry, which is attended by students from all parts of Germany. There are two Protestant churches, a Roman Catholic church, and a synagogue. In 1880 the population was 11,524, including 436 Roman Catholics and 171 Jews.

Neustadt-Eberswalde received its municipal charter in 1237, and was taken and sacked during the Thirty Years' War. In 1747 Frederick the Great brought a colony of Thuringian cutlers to the town, but this branch of industry has entirely died out. About 4 miles to the north lies the old Cistercian monastery of Chorin, the fine Gothic church of which contains the tombs of several margraves of Brandenburg.

NEU-STETTIN, a manufacturing town of Prussia, in the province of Pomerania and district of Köslin, lies on the small Streitzig lake, 90 miles to the north-east of Stettin. Its industries are iron-founding, dyeing, brewing, and the manufacture of machinery and matches. The inhabitants also practise cattle-rearing and agriculture, and carry on a trade in grain, timber, and spirits. Neu-Stettin was founded in 1312, and contains (1880) 8604 inhabitants, the bulk of whom are Lutherans and Irvingites. It is the seat of a gymnasium.

NEU-STRELITZ, the capital of the grand-duchy of Mecklenburg-Strelitz, is charmingly situated between two small lakes, 60 miles to the north of Berlin. It is well and regularly built in the form of a star, the eight rays of which converge on a spacious market-place, adorned with a statue of Duke George (d. 1860). The ducal residence is a handsome edifice in a pseudo-Classical style, with a library of 70,000 volumes, and collections of coins and antiquities. Attached to it are a fine garden and park. The other chief buildings are the three churches, the Carolinum (a large hospital), the town-house, the barracks, the gymnasium, and the real-school. In 1880 the town contained 9407 inhabitants, chiefly Protestants. They are supported partly by ministering to the wants of the court, and partly by the manufacture of iron wares, machinery, cloth, pottery, oil, and mineral waters. Its trade, chiefly in corn, meal, and timber, is facilitated by a canal connecting the town with the Havel and the Elbe.

About 1½ miles to the south lies Alt-Strelitz, the old capital of the duchy, a small town with (1880) 3336 inhabitants, employed in the manufacture of tobacco, leather, wax candles, and wadding. Neu-Strelitz was not founded till 1733. In the vicinity is the chateau of Hohen-Zieritz, where Queen Louise of Prussia died in 1810.

NEUSTRIA. See FRANCE, vol. ix. p. 530.

NEU-TITSCHEIN (Czech, *Novy Jicin*), a small but thriving town of Moravia, is picturesquely situated on an outlying spur of the Carpathians, on the Titsch, an affluent of the Oder, about 70 miles to the north-east of Brünn. It is the chief place in the Kuhländchen, a fertile valley peopled by German settlers, who rear cattle and cultivate flax. At Neu-Titschein manufactures of woollen cloth, flannel, hats, carriages, and tobacco are carried on; and it is also the centre of a brisk trade. The town was founded in 1311. It contains (1880) 10,274 inhabitants, almost entirely of German descent.

NEUTRA (Hungarian, *Nyitra*), the chief town of a district and bishopric of the same name in Hungary, is situated on the river Neutra, 90 miles to the east of Vienna. It lies partly on the slope of a hill, which is strongly fortified, and crowned with the episcopal chateau and the ancient and modern cathedrals. The town also contains three convents, a theological seminary, a gymnasium, and two hospitals, and carries on manufactures of vinegar, spirits, and liqueurs. Its grain-markets are important. Neutra has lagged far behind most Hungarian towns in the march of improvement, and a recent visitor describes its internal economy as on a par with that of Bokhara and other towns in Central Asia. The population in 1880 was 8650.

Neutra is one of the oldest towns in Hungary, and is said to have been the seat of a bishop in the 4th century, when in possession of the Marcomanni. The present and historically authenticated line of bishops dates from 1130.

NEUTRALITY. See INTERNATIONAL LAW, vol. xiii. p. 195, and SEA LAWS.

NEUWIED, the chief town of a circle in the district of Coblentz, Rhenish Prussia, and the capital of the mediatized countship of Wied, is pleasantly situated on the right bank of the Rhine, 8 miles below Coblentz. The principal edifice in the well-built town is the handsome chateau of the princes of Wied, containing a collection of Roman antiquities, most of which were found in the neighbourhood. The inhabitants—including Lutherans, Roman Catholics, Moravian Brethren, Baptists, and Jews—are noted for their industry. The chief products are starch and sugar made from potatoes, tobacco and cigars, chicory, and enamelled-tin wares. A brisk trade is carried on both by rail and river. In the vicinity are several large iron-foundries. Population in 1880, 9656. The schools of Neuwied enjoy a high reputation, and attract numerous pupils from England.

Neuwied was founded by Count Frederick of Wied in 1653, on the site of a village destroyed during the Thirty Years' War, and rapidly increased owing to the toleration accorded to all religious sects without distinction. Among those who sought refuge here was a colony of MORAVIAN BRETHREN (*q.v.*), who now number 500 to 600 souls, and occupy a separate quarter of the town, where they carry on manufactures of porcelain stoves and deerskin gloves. Near Neuwied one of the largest Roman castles on the Rhine has been excavated, yielding numerous interesting antiquities. In 1797 the French, under General Hoche, defeated the Austrians near Neuwied,—their first decisive success in the revolutionary wars.

NEVA, a river of Russia which carries off into the Gulf of Finland the waters of Lakes Ladoga, Onega, and Ilmen and many smaller basins. It issues from the south-west corner of Lake Ladoga in two channels which form the island of Oriekhoff, and are obstructed by sandstone reefs, so that the better of the two has a depth of only from 7 to 16 feet in its fairway. A little farther down it becomes completely navigable, and in the neighbourhood of the island of St Nicholas it attains a breadth of 4200 feet; but between the village of Ostrovkoff and that of Ust-Tosnui (Tosna-mouth) it passes over a limestone bed which, lying only from 2 to 12 feet below the surface, produces a series of rapids, and reduces the width of the river to from 1050 to 840 and that of the navigable passage to from 350 to 175 feet. From Ust-Tosnui downwards there is no further obstacle. Nine or ten miles from its outfall the river enters St Petersburg, and then 5 or 6 miles lower down

breaks up into the Great Neva (850 to 1700 feet wide), the Little Neva (945 to 1365), and the Great Nevka (280 to 1205), this last, two miles farther on, sending off the Little Nevka (370 to 1129). In front of the delta are sandbanks and rocks which prevent the passage of vessels except by five narrow channels, of which the best has a depth of 7 to 20 feet. The most of its alluvial burden being deposited in the lakes, the Neva takes a long time to alter its channels or extend its delta: an accession of 1570 acres was all that was registered between 1718 and 1834. According to Destrem the current above the delta is 114,659,529 cubic feet per minute, a mass of water greater than that of the Rhone or the Rhine. The ordinary rise and fall of the river is comparatively slight, but when the west wind blows steadily for a long time, or when Lake Ladoga sends down its vast accumulations of block-ice, inundations of a dangerous kind occur. In 1824 and 1879 the former cause produced a rise of more than 12 feet. According to observations extending from 1703 to 1879, the mean day of the freezing of the Neva is November 25, the earliest October 28 (1805), the latest (not quite certain) January 9 (1711), and the next latest December 26 (1826). The mean day of opening is April 21, the earliest March 18 (1822), and the latest May 12 (1810). The mean number of days open is 218, the least 172 (1852), the greatest 279 (1822).

NEVADA, one of the most western of the States of the American Union, was formed from a portion of the territory acquired by the United States from Mexico by the treaty of Guadalupe Hidalgo. The boundary line commences in the centre of the Colorado river, where the 35th parallel of north latitude crosses that stream (near Fort Mojave); thence it runs in a direct north-westerly line to the point where the 39th parallel of north latitude intersects the 120th degree of longitude west from Greenwich (near the centre of Lake Tahoe), thence north on that meridian to the 42d parallel of latitude, thence east on that parallel to the 37th meridian west of Washington, thence south on that meridian to the Colorado river and down that stream to the place of beginning, enclosing an area of 110,700 square miles. The State is bounded on the S. and W. by California, N. by Oregon and Idaho, and E. by Utah and Arizona. At the time of the discovery of the silver mines (1858–59) what is now the State of Nevada was a part of Utah. By Act of Congress of March 2, 1861, Nevada became a Territory; and, with a modification of its boundaries, it was admitted as a State on October 31, 1864.

By the upheaval in past ages of the Rocky Mountains and the Sierra Nevada, there was enclosed an ancient sea, several hundred thousand square miles in extent. The draining off and evaporation of the waters so enclosed left an immense plateau, having a general elevation of 4000 to 6000 feet above the present sea-level. Although this table-land is spoken of as a "basin," yet throughout its whole extent it is traversed by ranges of mountains rising from 1000 to 8000 feet above the general surface, and having the same northward and southward trend as the Sierra Nevada and the Rocky Mountains. The surface of the country as a whole presents a very barren, rocky, and mountainous appearance, yet between the parallel ranges are valleys from 5 to 20 miles in width, all having about the same altitude above the sea. Where traversed by rivers or creeks these contain considerable areas of arable land, the amounts usually being proportionate to the size of the streams. They are timberless, except for a few cotton-wood trees found along the rivers. Upon the mountains the quantity of timber depends upon the altitude. The lower ranges are bare, or contain only a scanty growth of piñon, cedar, or mountain mahogany, of very little economic importance. Several of the higher ranges contain small bodies of valuable timber, while the eastern slope of the Sierra Nevada is well-clothed with forests of conifers, which have proved of inestimable value to the people of the State.

The river system is peculiar, only two of the streams of the State finding their way to the sea: the Owyhee, which rises in the northern part, empties into the Snake, and thence passes through the Columbia river to the Pacific Ocean; and the Colorado river, on the southern boundary, flows into the Gulf of California. All the other streams either sink in the sand of the interior valleys or terminate in lakes that have no outlet. The Humboldt river, about 300 miles long, empties into Humboldt Lake or "Sink"; Truckee river, which drains Lakes Tahoe and Donner (in the Sierra Nevada), after a course of 125 miles, falls into Pyramid and Winnemucca Lakes. Walker river, 100 miles long, rises in the Sierra and discharges into Walker Lake; Carson river, 180 miles long, also rises in the Sierra Nevada, and empties into the "Sink of the Carson" or Carson Lake. Reese river rises in the Toyabe Range (within the basin region), and after a course of about 150 miles disappears in the sand; Quinn river, in the northern part of the State, after a course of 80 miles, similarly disappears in the soil; the Amargosa (bitter) river, in the southern part of the State, is 150 miles long, and, after sinking and rising several times, finally loses itself in the sands of Death Valley just over the line in California. Such of the creeks as are not tributaries of the rivers either sink in the sandy plains or end in small pools. Most of the lakes are merely sinks for the scanty streams. Of these, as already mentioned, are Humboldt, Pyramid, Winnemucca, Walker, and Carson Lakes, which, with the beautiful Lake Tahoe in the Sierra Nevada, complete the enumeration of the bodies of water of any considerable magnitude in the State. In many places on the sides of the mountain ranges are to be seen well-defined water-lines of the ancient sea or of extinct lakes, indicating a far greater extension of water surface and a much moister climate than at present. Hot springs, many of which have medicinal virtues, are found in all parts of Nevada. The most noted are the Steamboat Springs, in Washoe Valley, on the line of the Virginia and Truckee Railroad.

The climate of Nevada is characterized primarily by its extreme aridity. The air currents from the Pacific are thoroughly drained of their moisture before reaching the borders of the Great Basin, and pass over it as dry winds. In the southern part of the State, where the elevation above sea is least and the temperature highest, the rainfall averages not more than 5 inches per annum, while evaporation is extremely rapid. In the northern part the rainfall is greater, averaging not far from 15 inches in many localities. Nowhere, however, is it sufficient for the needs of agriculture, and consequently irrigation has to be universally resorted to. The mean annual temperature in the habitable portions of the State ranges from 70° Fahr. in the south to 45° in the north. This, however, expresses but a part of the conditions of temperature. The range between summer and winter, and between day and night, is very great. At several meteorological stations in the State the maximum temperature is quoted at from 100° to 111° Fahr., while the minimum temperature ranges as low as − 23° Fahr. The temperature varies greatly according to altitude. In the lower valleys snow seldom lies more than a day or two in winter. The weather in winter as a rule is dry, bright, and pleasant. In summer the nights are everywhere delightfully cool.

The fauna of the State is poor, and illustrates, with the flora, the aridity of the climate. Coyotes, badgers, and rabbits are perhaps the most abundant animals, as they certainly are the most characteristic. In the more northern valleys are to be found, in the winter, herds of antelope, and occasionally a few deer and elk. In the Sierra, except where driven away by the encroachments of civilization, large game, consisting of elk, deer, and black and grizzly bears, are still to be found in greater or less abundance. The flora is also scanty, and is characterized by *Artemisia*, so that Nevada is often nicknamed the "Sage-brush" State. In the southern valleys even this fails, and the sterility is relieved by little save *Yucca* and various species of *Cactus*. In the northern valleys, and particularly upon the lower mountains and hills, the bunch grasses replace *Artemisia* to a considerable extent, although not sufficiently to give the interest of meat-production great prominence in the State.

Nevada offers an attractive field of study for the geologist, not only on account of its great wealth of precious metals, but because of the great complexity of geological phenomena there presented. The valleys are everywhere covered to a great depth with most recent deposits, out of which rise the ranges, as long, narrow islands from the sea. These ranges bring to the surface rocks of all the geologic ages, even to the Azoic, while here and there are intrusions of volcanic rock. In the north-western part of the State the great lava field of southern Oregon has overflowed the State boundary, and extends over a considerable area.

The State is rich in mineral productions of all kinds. Silver is, however, the leading mineral product, and the mines of the Comstock at Virginia City and Gold Hill have been among the richest in the world. Since the discovery in 1859 these mines have yielded over $200,000,000 in silver and gold, and the product of the whole State hitherto has been about $300,000,000. Two mines alone on the Comstock, the California and the Consolidated Virginia (known as the bonanza mines), have yielded over $130,000,000 in silver and gold,—the bullion of the Comstock being about one-third gold and two-thirds silver. The rich deposits of the vein, known as "bonanzas," have, however, now been exhausted as far as discovered, and since 1880 the yield from the Comstock lode has been light. Explorations, however, are actively continued. In the Yellow Jack and Belcher mines the workings have reached a depth of 3000 feet, and in the Ophir and Mexican mines they are drifting at a point 3100 feet below the surface, the greatest depth to which mining operations have been carried anywhere on the American continent. At these great depths the lode is found to diminish neither in width nor strength of formation. The heat of the rock is intense in these levels, and it is possible for men to work only for very short periods, requiring frequent shifts. The Sutro tunnel, over 20,000 feet in length, drains all the leading mines of the lode to a depth of 1600 feet, thus saving much pumping. There are millions of tons of low-grade ore in the many mines of the Comstock which will be mined at no distant day, but which cannot be profitably worked at the present high rates of wages (miners get $4 per day) and great cost of transportation and reduction. In the eastern part of the State, at Eureka and several other points, are mines which produce smelting ores containing too much lead to be worked by mill process, as are the free chloride and sulphuret ores of the Comstock. Many of these "base metal veins," as they are called by the miners, are very rich in silver, have been profitably worked for several years, and are still yielding well. The mineral production of Nevada for the year 1882 was reported by Wells, Fargo, & Co. to be:—gold dust and bullion, $752,506; silver bullion, $6,588,023; ores and base bullion, $3,022,847—making a total of $10,363,376. All the interior ranges of mountains in the State contain veins producing gold, silver, copper, lead, and antimony in paying quantities, but as yet little mining has been done except for gold and silver. The many rich mines of copper have scarcely been touched. Besides the metals mentioned, there are found within the borders of Nevada iron, platinum, zinc, nickel, cobalt, quicksilver, lignite, gypsum, kaolin, beds of pure sulphur, and in the plains and marshes deposits of pure salt, carbonate of soda, borax, nitrate of potash, and other minerals of a similar nature.

While Nevada is not a country to attract the farmer, there is still a considerable amount of arable land within its borders. At present there are under cultivation only about 344,423 acres. Wherever water for irrigation can be procured good crops of most kinds of grain, hay, and vegetables may be grown. It has been estimated that by a full utilization of the streams for irrigation possibly 3 per cent. of the area of the State can be brought into cultivation; of this (some 2,000,000 acres) only about one-sixth has as yet been reduced to the service of man. It is not probable, however, that Nevada will ever attain to a high rank as an agricultural State. The principal products during the census year 1880 were—barley, 513,470 bushels; oats, 186,860 bushels; wheat, 69,298 bushels; wool, 655,012 lb; hay, 95,853 tons; and potatoes, 302,143 bushels. The grazing interest is not, and probably never will be, a very extensive one. The following figures give the amount of live stock in the State:—horses, 32,087; cattle, 172,212; sheep, 133,695.

The manufacturing interests of Nevada are not extensive, and are confined mainly to the smelting and reduction of ores.

There are several railroads. The Central Pacific crosses the whole State, and has within its limits a length of 452 miles; the Virginia and Truckee runs from Reno, on the Central Pacific, through Carson to Virginia City, and is 52 miles long; the Carson and Colorado leaves the Virginia and Truckee near Virginia City, and running southward through the State taps a rich and extensive mineral and agricultural region. This road is now completed to Benton, California, 193 miles, and will eventually connect with the Southern Pacific at Mojave, California. The Nevada Central, 93 miles in length, connects the towns of Austin and Battle Mountain; and the Eureka and Palisade, 20 miles long, connects the places named. There are several shorter lines completed, and a considerable number projected.

There are in the State 185 common schools, 12 high schools, and a State university at the town of Elko. In all the large towns are churches of the leading religious denominations, and many of the church edifices are fine and costly structures. Thirty-seven newspapers are published, the majority being dailies.

The returns of the tenth census place the assessed valuation of the real estate of Nevada at $17,941,030, and the personal property at $11,350,429, a total of $29,291,459. The true valuation is estimated at $69,000,000 in 1880.

The State government is similar to that of the majority of the western States. Nevada has two representatives in the United States senate and one in the house of representatives.

The first settlement in Nevada was made at Genoa, at the foot of the Sierra Nevada, in 1850, though as early as 1848 the Mormons, travelling between Salt Lake and California, had established a temporary camp at that place. The Mormons made two or three small settlements in the valleys along the base of the Sierra, and until 1859, when the silver mines of the Comstock were discovered, they were the principal white inhabitants. The discovery of silver caused great crowds of miners of all nationalities to pour over the Sierra Nevada from California, and in that year and 1860 several towns were laid out and rapidly built up. In a few years new mineral belts were discovered to the eastward, and soon there were founded many interior towns and camps.

In 1870 the population was 42,491. In 1880 it had increased to 62,266 (1 to 1¾ square miles), a gain of 46·5 per cent. In 1883 it had not greatly increased over the number in 1880. The population shows a great disproportion of males, as is everywhere the case on the frontier, especially in a mining region. Of the total number 42,019 were males and 20,247 females. There was also a disproportionately large number of the foreign born, 36,613 being natives and 25,653 foreigners. With the Pacific coast States, Nevada has received a comparatively large accession of Chinese, these numbering 5416, or more than one-eighth of the whole population of the State. The main body of the population is congregated in the extreme western portion of the State, in Storey and the adjacent counties. A second but much smaller body of population is about Eureka. The balance is dispersed very sparsely. The population of the principal towns in 1880 was as follows:—Carson City, the capital of the State, 4229; Eureka, 4207; Virginia City, 10,917; Gold Hill, 4531; Reno, 1302. The population is now (1883) about the same for all these towns except Reno, which has probably 3000 inhabitants. There are several other towns and camps containing from 300 to 1000 inhabitants. There are comparatively few Indians in the State, and these, known as Pah Utes or Diggers and Shoshones, are theoretically upon reservations in the western part. Their number is estimated by the Indian office at 3377. They are, as a class, both mentally and physically below the average of the North American tribes. (W. WR.)

NEVERS, a city of France, chief town of the department of Nièvre, and formerly capital of the countship of Nevers or Nivernais, is picturesquely situated at a height of 656 feet above the sea, on a hill commanding the right bank of the Loire at the confluence of the Nièvre, 158 miles south-south-east of Paris by the railway to Nîmes. It is the see of a bishop, and has a fine cathedral, which, dating from the 12th and 14th centuries, but at present (1883) undergoing a complete restoration, is mainly notable for the fact that there is an apse above the crypt and another at the opposite end of the building. To the north of the nave rises a massive but highly-decorated tower. Of higher architectural interest as a remarkable specimen of the Romanesque style of Auvergne is the church of St Étienne, consecrated at the close of the 11th century, and belonging to an abbey affiliated to Cluny. The ducal palace at Nevers (now occupied by the courts of justice and a ceramic museum) was built in 1475 by J. de Clamecy, count of Nevers, and is one of the principal feudal edifices in central France. A middle tower, containing the great staircase, has its windows adorned by sculptures relating to the history of the house of Cleves. In front of the palace lies a wide open space with a fine view over the valley of the Loire. The Porte de Croux, dating from the end of the 14th century, is the only remnant of the old fortifications; it now contains a collection of sculptured stones and some Roman antiquities. The modern triumphal arch (18th century), the town-house and library, the almshouses, and the mother-house of the Nevers sisters of charity may also be mentioned. The Loire is crossed by a fine stone bridge of fifteen arches, and a cast-iron railway bridge. Up to 1880 there was at Nevers a navy cannon foundry which, furnished with eight blast-furnaces capable of melting 40 tons at once, used to turn out 250 pieces per annum. It has now been combined with the foundry at Ruelle (Charente); and the works are transformed into a practical school for such branches as boiler-making and engine-fitting. The town also contains private engineering establishments, potteries and porcelain works, chemical works, pit-cable factories, file-works, oil-works, tanneries, and wool-spinning mills. Commercially it has the advantage of being a large railway junction, communicating with Paris and Orleans by Gien, with Bourges, Moulins, and Dijon by Chagny, and with Auxerre by Clamecy. Population in 1881, 23,846.

Noviodunum, or (later) Nevirnum, derived its name from two Celtic words *nov*, a river, and *dun*, a hill. The quantities of medals and other Roman antiquities found on the site indicate the importance of the place at the time when Cæsar chose it as a military depôt for corn, money, and hostages. It had counts of its own as early as 987, and obtained a charter in 1194. Subject for a time to the dukes of Burgundy, it next passed to the German house of Cleves. In 1538 Francis I. erected the Nivernais into a ducal peerage, which, becoming in 1565 the property of the Gonzaga of Mantua, was purchased from them by Cardinal Mazarin, and remained in his family till the Revolution. For a short time in the 14th century the town was the seat of a university, afterwards transferred to Orleans.

NEVIANSK (NEVIANSKIY, or NEIVINSKIY ZAVOD), a town of Russia, in the government of Perm, 62 miles to the north-north-west of Ekaterinburg, is situated on the eastern slope of the Ural mountains, in the populous valley of the Neiva, surrounded by mountains composed of talc and chlorite schists and granites, in a district very rich in iron and also in auriferous sands. The population in 1881 numbered 13,980 (17,950 with its suburb, the Byngovskiy iron-work), all Great-Russians, and mostly Nonconformists (*edinovyertsy*), of whom about 3000 are employed at the iron-works, while the others carry on various small trades, such as the manufacture of boxes widely sold in Siberia, small iron-wares, and boots, or engage in agriculture. The merchants of the town carry on an active trade, and its fairs are very animated. The iron industry produced in 1879 96,000 cwts. of cast iron and 45,000 cwts. of wrought iron, and the average yearly yield of gold is about 400 ℔.

The iron-work at Neviansk is the oldest on the Ural, having been founded in 1699. In 1702 Peter I. presented it to Demidoff, with 3,900,000 acres of land around it, of which 522,000 acres, besides 60,000 acres of forest, still belong to the present proprietors of the works, the merchants Yakovleffs. Five iron-mines, seven gold-washings, and two iron-works are its dependencies. Several other important iron-works are situated within short distances of Neviansk, on the Neiva river, and are usually comprised under the same name of Neivinsk iron-works, the chief being Verkhne-Neivinsk (Upper Neivinsk), situated 14 miles to the south (3960 inhabitants); Neivo-Rudyansk, 8 miles to the south (4020); Petrokamensk, 32 miles to the north-east (2200); Neivo-Shaytansk, 8 miles lower down the Neiva (3000); and Neivo-Alapaevsk (6000).

NEVIS, an island in the Federated Leeward group, British West Indies, in 17° 14′ N. lat. and 62° 33′ W. long., separated from St Christopher by a shallow strait 2 miles broad at the narrowest. It is a mountain rising gradually to a height of 3200 feet, the lower portion being cultivable; the total area is about 32,000 acres. The climate is healthy, the average height of the thermometer being 82° Fahr. Discovered by Columbus in 1498, and colonized by the English in 1628, it now forms one presidency with St Christopher, with one legislative council (meeting in St Kitts) of ten official and ten unofficial members, all nominated by the crown, Nevis sending three of the unofficial members. The revenue in 1882 was £9285, and the expenditure £8465. Its exports of sugar in the four years from 1879 to 1882 respectively were 3500, 1600, 1700, and 4000 tons,—the total exports in 1881 being £38,672, and in 1882 £75,000. The population is 11,864; the capital is Charlestown, on the shore of a wide bay on the south-west side of the island.

NEW ALBANY, a flourishing manufacturing city of the United States, in Floyd county, Indiana, occupies a good position on the left bank of the Ohio, nearly opposite the west end of Louisville, 156 miles below Cincinnati. It is handsomely built, with wide and well-shaded streets, and among its public edifices are a city-hall, a court-house, an opera-house capable of containing 2500 persons, a masonic hall, and an oddfellows' hall. Abundant water-power is obtained from the falls about two miles up the river. Besides the glass-works, which rank as the largest in the United States, the industrial establishments comprise foundries, pork-packing factories, boatbuilding yards, rolling mills, cotton and woollen mills, and hosiery mills. Laid out in 1813, and incorporated as a city in 1839, New Albany increased its population from 4226 in 1840 to 16,423 in 1880, and is still rapidly growing.

NEWARK (or in full NEWARK-UPON-TRENT), a municipal and parliamentary borough and market-town of Nottinghamshire, England, is situated in the midst of a flat but highly cultivated country, near the Trent, on the river Devon, and on the Great Northern and Nottingham and Lincoln Railways, 120 miles north of London, and 19 east of Nottingham. By means of a canal 1½ miles in length it is connected with the Trent navigation. The town is well built, with wide but irregular streets, which diverge from the market-place. The church of St Mary Magdalene, one of the largest and finest parish churches of England, is specially notable for the beauty of the tower and of the octagonal spire (223 feet high) by which it is surmounted. The central piers of the old church, dating from the 11th or 12th century, still remain, and the lower part of the tower is a fine example of Early English when at its best. The upper parts of the tower and spire were completed about 1350, the nave between 1384 and 1393, and the chancel in 1489. The sanctuary is bounded on the south and north by two chauntry chapels, the former of which has on one of its panels a remarkable painting from the Dance of Death. There are a few old monuments, and an exceedingly fine brass of the 14th century. The castle, supposed to have been founded by Egbert, king of the West Saxons, was partly rebuilt and greatly extended by Alexander, consecrated bishop of Lincoln in 1123, who established at it a mint. The castle from its position and its great strength was for a long time known as the "key of the North." Of the original Norman stronghold the most important remains are the gate-house and the lofty rectangular tower at the south-west angle. The building seems to have been reconstructed in the early part of the 13th century. In the reign of Edward III. it was used as a state prison. During the civil war it was garrisoned for the king, and endured three sieges. Its dismantling was commenced 11th May 1646. There is a very beautiful and interesting cross (the "Beaumond" cross) of the latter part of the 15th century in good preservation in the town. A grammar and song school was founded in the reign of Henry VIII., and endowed by Archdeacon Magnus. The other principal public buildings are the town-hall in the Grecian style (erected in 1774), the corn exchange (1848), the Stock library and Middleton newsroom (1828), the mechanics' institution (1836), the new hospital (1881, a very fine building). Two elegant buildings—a coffee palace and a free library—were given to the town in 1882. By means of the Trent navigation Newark carries on a large trade in coal, corn, and cattle. The manufacture of malt is by far the chief source of wealth in the town. There are iron and brass foundries, boiler-works, agricultural implement manufactories, and breweries. Gypsum and limestone are obtained in the neighbourhood, and plaster of Paris is extensively manufactured. The population of the municipal and parliamentary borough (area 1933 acres) in 1871 was 12,195, which in 1881 had increased to 14,018.

From the large number of Roman remains found in the neighbourhood, from traces of ditches, and from supposed portions of Roman buildings that still exist, some antiquarians suppose that Newark was an important Roman station built to protect the navigation of the Trent, and identify it with the British Ael Tavum, the Roman Eltavona, and the Saxon Sidnacester, which was an episcopal see of Mercia. The balance of probability seems, however, to favour the opinion that Sidnacester was situated in Lincolnshire. The first authentic notice of Newark is during the Saxon heptarchy. The town was partly destroyed by the Danes, but during the reign of Edward the Confessor it was rebuilt. By Leofric, earl of Mercia, the manor of Newark was bestowed upon the monastery of Stow, near Lincoln. The castle and manor were conveyed to the crown by Henry Holbeach, bishop of Lincoln, in the reign of Edward VI., by whom the town was incorporated in 1549. It was created a mayoralty by Charles II. in 1625. It is supposed to have sent members to parliament in the reign of Edward VI., but it is not known how long the privilege had been in abeyance when it was restorod by Charles II. in 1625, from which time it has returned two members. Newark is the birthplace of Bishop Warburton; David Hartley taught in its grammar school; and the first volume of Lord Byron's poems was printed by Ridge, a Newark bookseller.

Of the various histories of Newark the most recent is the beautiful and elaborate volume by Cornelius Brown, *Annals of Newark-upon-Trent*, 1879.

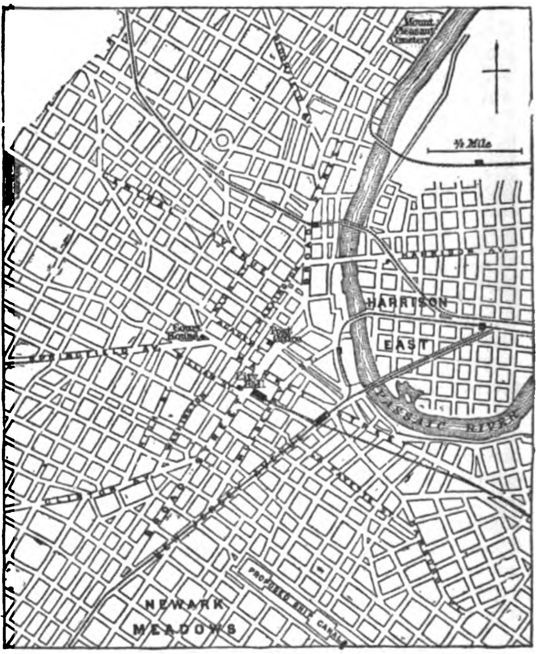
NEWARK, the principal city of the State of New Jersey, United States, is situated in Essex county, on the west bank of the Passaic river, 4 miles above Newark Bay, and covers an area of about 18 square miles. The original site was a crescent-shaped ridge, or double chain of low hills, extending from north-east to south-west, now much changed by levelling and cutting. The main part of the city is on the lower ground which stretches east and south towards the Newark and Hackensack Meadows (salt marshes). The surface is, in general, well adapted for drainage and sewage. The climate is mild, tempered by the proximity of Newark Bay and the Atlantic (12 miles distant), and the place bears a good reputation for healthfulness. The water-supply comes from the Passaic. There are about 130 miles of streets, generally wide and well-shaded, one-fifth of which are paved. The principal thoroughfare, Broad Street (120 feet wide), is lined throughout a good part of its length with fine old elms, and where not occupied by business premises is fronted by numerous handsome residences. There are several small parks, the principal of which are Military and Washington Parks, bordering on Broad Street. The public buildings are for the most part unsightly and unsuitable; on the other hand, the city is not overburdened by debt or by heavy taxation.

Notwithstanding that the central portion of Newark is but 9 miles distant from the general post-office in New York city,—being considerably nearer that point than are the northern portions of New York city proper—Newark has more the character of an independent city than a suburb. This it owes in part to its situation within another State, but still more to its independent and distinctive manufacturing interests. Even prior to 1872 it was called "the Birmingham of America." In that year a very successful exhibition, consisting of the manufactures of Newark, greatly stimulated the investment of capital.

The United States census of 1880 gives the following statistics of manufactures for Newark:—

No. of Industries.	Capital Invested.	Wages Paid Annually.	Total Value of Products.	Persons Employed.		
				Males.	Females.	Children.
1,319	$25,679,885	$12,171,339	$69,252,705	23,151	5,946	2,649

The principal industries are—jewellery, tanning and currying, celluloid (a substitute for ivory, coral, &c.) and celluloid goods, hat-making, boot and shoe making, trunk and valise making, saddlery hardware, harness-making, breweries (mostly lager beer) and malt-houses, building, carriage and waggon making, clothing, chemical works, cigar and tobacco factories, edge tools, hammers, &c., cabinetmaking, and iron and steel works. There are also large cotton, woollen, and silk-thread factories, and an extensive sewing-machine factory, together employing about 3000 hands.



Plan of Newark.

The shipping facilities of Newark are abundant, and four great trunk lines of railroad—the Pennsylvania, the New York, Lake Erie, and Western, the Delaware, Lackawanna, and Western, and the Central Railroad of New Jersey (Reading Railroad)—give ready communication with all parts of the United States, and with the steamship lines at Jersey City and in New York. Newark is intersected by the Morris Canal, and has considerable coasting trade by way of the Passaic river. The city has 112 churches and missions:—Presbyterian, 23; Reformed Presbyterian, 1; United Presbyterian, 1; Congregational, 2; Reformed Dutch, 9; Baptist, 13; Episcopal, 12; Episcopal Reformed, 1; Methodist, 22; Lutheran, 4; Roman Catholic, 11; Jewish synagogues, 3; besides Bethel, Universalist, Unitarian, Independent Catholic, and other independent churches. It has an admirable free public school system. There are three well-appointed hospitals. The city has six daily newspapers, four English and two German, besides two Sunday morning newspapers and a weekly German paper.

In 1810 the population of Newark was 6000; in 1836, when the town became a city, it was 19,732; in 1840 it was 17,290, shortly after which began a stream of immigration which has continued almost uninterruptedly since. In 1850 the population had more than doubled, reaching 38,894; in 1860 it was 71,941, having again almost doubled; during the next decade, including the period of the civil war, it increased to 105,059, and it has since grown in like ratio, being 136,508 in 1880. This had risen to 145,000 (estimated) in 1883. In 1880 there were 17,628 persons of German, 13,451 of Irish, 4478 of English, and 1090 of Scotch birth, together with Italians, French, Swedes, Swiss, and other nationalities in numbers which bring the total of foreign-born population up to 40,830. Those of German and Irish birth, together with their children (minors) born within the United States, constitute fully three-fifths of the entire population.

History.—On or about May 17, 1666—the exact date cannot be determined—there anchored in the Passaic river, opposite what is now Newark, a small vessel from Milford, Connecticut, having on board a company of thirty persons, Puritans, who had come to form a new settlement in the New Jersey wilderness. Before the landing was completed, the Hackensack Indians demanded compensation from the new comers, which they finally received. The price then paid for the land upon which Newark and the adjacent towns and villages of Essex county are built being "fifty double hands of powder, one hundred bars of lead, twenty axes, twenty coats, ten guns, twenty pistols, ten kettles, ten swords, four blankets, four barrels of beer, ten pairs of breeches, fifty knives, twenty horses, eighteen hundred and fifty fathoms of wampum, two ankers of liquor (or something equivalent), and three troopers' coats." Subsequently another vessel arrived from Connecticut containing a somewhat larger party, but both together numbered, all told, less than seventy persons. Their chief desire was to establish a community whose spiritual and temporal affairs would be controlled and directed "according to God and a godly government." Their pastor was Abraham Pierson, originally from Newark-on-Trent, in whose honour the name of the settlement was changed from Milford to Newark. The town was laid out in lots, and everything was ordered and governed mainly according to Mosaic law. The foremost among the settlers was Captain Robert Treat, a brave, resolute, wise, and kindly man, who, after remaining long enough to see the new settlement fairly established, returned to Connecticut, and became governor of the colony. He had previously been deputy-governor for thirty-two years. The dream of Pierson and his Puritan followers was not realized. Before many years the Mosaic bars had to be removed one by one, and gradually the townspeople broadened their ideas of government. But even to this day, despite the cosmopolitan character of the population, the old Puritan leaven is still at work, largely leavening the whole lump.

The first occurrence of special interest in the history of the town after its settlement was a schism in the old church. Colonel Josiah Ogden, a rich and influential member, and a man of strong individuality, saved his wheat one dry Sunday, in a wet season. He maintained that it was a work of necessity; the church declared it to be a violation of God's law. The immediate result was the withdrawal of Ogden and his followers, and the founding of the first Episcopal or Church of England Society in Newark,—Trinity Church. The affair led also to an exacerbating controversy which lasted from 1734 until long after the Revolutionary war which closed in 1783. Newark was, from 1748 to 1756, the seat of the college of New Jersey, thereafter permanently established at Princeton, founded by the Rev. Aaron Burr, father of the more celebrated American of the same name; the latter was born in Newark. During the war of independence, the great majority of the thousand inhabitants of Newark sided with the Americans; the town suffered severely from the ravages of the British and marauding parties of American loyalists; on the other hand the American revolutionists drove out all loyalists, and confiscated their property. After the war, manufactures began to prosper, and have continued to do so ever since. At one time chair-making was carried on extensively, and it is stated that among those who worked at it in Newark was the famous Talleyrand.

NEWARK, a city of the United States, capital of Licking county, Ohio, is situated on the Licking river and on the Ohio and Erie Canal, and is 33 miles from Columbus by the railway to Pittsburg. It is a flourishing agricultural and industrial centre, with extensive railway shops, foundries, and manufactories of glass, paper, steam-engines, and agricultural implements; and sandstone quarries and coal-mines are worked in the neighbourhood. Some of the most extensive and interesting of the earth-work remains of the prehistoric inhabitants of North America are found here. The population was 3654 in 1850, 6698 in 1870 and 9602 in 1880.

NEWARK, DAVID LESLIE, LORD (1601–1682), a celebrated Scottish military character during the civil war, was born in 1601, the fifth son of Patrick Leslie of Pitcairley, commendator of Lindores, and Lady Jane Stuart, daughter of the first earl of Orkney. In his early life he served in the armies of Gustavus Adolphus, where he rose to the rank of colonel of horse. On his return he was appointed major-general in the army that was sent into England under the earl of Leven to assist the Parliament. This army engaged the Royalists under Prince Rupert at Marston Moor, and totally defeated them, in July 1644. When Scotland after the battle of Kilsyth was at the mercy of Montrose and his army, Leslie was recalled from England in 1645, and made lieutenant-general of horse. In September he defeated Montrose at Philiphaugh near Selkirk, with great loss, and was rewarded by the committee of estates for this service with a present of 50,000 merks and a gold chain. He completely suppressed the civil war in Scotland in 1647, was declared lieutenant-general of the forces, and, in addition to his pay as colonel, had a pension of £1000 a month settled on him. Leslie then returned to England, and was present at the siege of Newark. On his return to Scotland he reduced several of the Highland clans that supported the cause of the king. In 1649 he purchased the lands of Abercrombie and St Monance, Fifeshire. In 1650 he was sent against Montrose, whom he made prisoner; and on the resignation of the earl of Leven he was appointed to the chief command of the army raised on behalf of Charles II. He baffled the forces of Cromwell, who was then invading Scotland, by shutting him up in Dunbar, and would have cut off his whole army, but, yielding to the advice of the church and state committee, he rashly left his commanding position on the Doon Hill, and was signally defeated on the 3d September 1650. After various skirmishes Leslie afterwards accompanied Charles to Worcester, where he was lieutenant-general under the king, who commanded in person. On the defeat of the royal army, Leslie, intercepted in his retreat through Yorkshire, was committed to the Tower, where he remained till the Restoration in 1660. He was fined £4000 by Cromwell's "Act of Grace" in 1654. He was in 1661 created Lord Newark, and received a pension of £500 per annum. He died in 1682. The title became extinct in 1790.

NEW BEDFORD, a city and port of entry of the United States, one of the capitals of Bristol county, Massachusetts, stretches for several miles along the west side of the estuary of the Acushnet river, which opens into Buzzard Bay, and forms an excellent harbour. It is 56 miles almost due south of Boston by the Old Colony Railroad. Of the fact that it has been for a long time one of the wealthiest cities in the State New Bedford affords abundant indications in the character both of its private residences and of its public enterprises and numerous charitable institutions. Among the more conspicuous buildings are the city-hall, constructed of granite in 1839, the custom-house (1836) also of granite, the almshouse (1846), and the public library. This last was erected in 1857 at a cost of $45,000, the city having taken over the "Social Library," founded in 1803; in 1863 the development of the institution and the cause of liberal education generally were stimulated by a bequest of $100,000 from Miss Sylvia A. Howland. The same lady left a similar sum for the construction of water-works; and in 1867–69 a total of about $1,000,000 was spent in connecting the city with a reservoir for 300,000,000 gallons supplied by the upper part of the Acushnet river. French Avenue, the favourite promenade, was laid out by the municipality in 1853; it runs 4 miles round the shore of Clark's Point at the mouth of the river, where the United States erected a granite fort in 1860–64. Since the decline of Nantucket New Bedford has been the great seat of the United States whale fishery; in 1854, when this enterprise was at its best, the New Bedford district possessed 410 whalers with a burden of 132,966 tons, but owing to the civil war and other influences (especially the immense production of petroleum) the number was by 1883 reduced to 95. The manufactories of the city, which on the other hand have been increasing in importance, produce cotton goods (460,000 spindles), woollen goods, silver-plated and iron wares, drills for metalworkers, copper sheathings, Prussian blue, paraffin and other candles, glass, cordage, shoes, &c., the total value in 1880 being $8,880,384. The population was 21,320 in 1870, and 26,845 in 1880.

New Bedford (Acushnet of the Indians) was settled by Quakers in 1664, but it did not receive its present name till about 1765. Previous to 1787 it formed part of the "town" of Dartmouth. The city charter dates from 1847. In 1778, in revenge for the use of its harbour as a rendezvous of privateers who had been driven from other ports, the shipping and wharves of New Bedford were burned by the British. Not many of the privateers, however, belonged to the town, most of the inhabitants at that time being Quakers.

NEW BERNE, or NEWBERN, a city of the United States, the capital of Craven county, North Carolina, and the port of entry of the district of Pamlico, is situated at the meeting of the Neuse and the Trent, on the Atlantic and North Carolina Railroad, 107 miles south-east of Raleigh. Vessels drawing 8½ feet can reach the wharves at mean water-level, and steamers run regularly to New York, Baltimore, and Norfolk. Cotton, lumber, naval stores, fish, rice, corn, and early vegetables for the northern markets are the chief articles of trade. Tobacco factories, turpentine distilleries, candy factories, lumber mills, a wooden-plate factory, a cotton-seed-oil factory, a rice mill, and a cigar factory are the most noteworthy of the industrial establishments in the city. The population was 5849 in 1850, and 6443 in 1880. Founded by Swiss settlers in 1701, New Berne continued to be the capital of the province of North Carolina till 1793. It was captured by Burnside in 1862, and suffered from fire.

NEW BRIGHTON, a post-village of the United States, in Richmond county, New York, is situated at the north-eastern corner of Staten Island, 6 miles south-west of New York, with which it is connected by ferry. Best known as the seat of the Sailors' Snug Harbour, a fine building fronting the Kill von Kull, which was founded in 1831 for aged and disabled seamen of the port of New York, New Brighton also contains an asylum for destitute children of seamen, one of the largest dyeing and printing establishments in the United States, a silk-printing factory, a paper-hanging factory, &c., as well as many residences belonging to New York men of business. The population in 1880 was 12,679.

NEW BRITAIN, a city of the United States, in Hartford county, Connecticut, 10 miles south-west of Hartford by the New York and New England Railroad. It is the seat of the State normal school (the new building erected in 1881 cost $90,000), and has a public park of 74 acres, a public library, and a good water-supply from a reservoir 200 feet above the level of the streets. The principal manufactures are bronze goods, locks, builders' hardware, cutlery, knit woollen goods, carpenters' tools, and jewellery. In 1870 the population was 9480; in 1880, 13,979. Elihu Burritt was born at New Britain in 1811.

NEW BRITAIN (BIRARA) AND **NEW IRELAND**, two Polynesian islands, about 340 miles by 23, and 240 by 22 respectively, are separated from the south-east extremity of New Guinea by a strait, first ascertained to be such by Dampier, 52 miles wide (see Plate VI.). They form together a sort of horse-shoe, divided in the middle by St George's Channel, some 20 miles wide, which in 1878 was half choked, temporarily, by pumice from a neighbouring volcano. In this channel lies the Duke of York group, fourteen small, well-wooded, fertile islands, with steep cliffs and narrow fringing reefs. A Wesleyan mission and some German and other traders are settled here and on the adjacent part of New Britain. The coasts of New Britain are in some parts precipitous; in others the mountains lie farther inland, and the coast is flat and bordered by fringing reefs. The west coast of New Ireland is generally precipitous, and crowned by a table-land which falls away towards the east. The north coasts of New Britain and the adjacent islands are studded with active volcanoes rising to 4000 feet, and at both ends of the island these are on a very grand scale. The scenery and vegetation are varied and luxuriant, with abundant wood and water. In New Ireland images, apparently representing deceased relations, like the karwars of New Guinea, are made of a rock indistinguishable from pure chalk, which is said to exist nowhere else in the Pacific. These are deposited in buildings set apart for them. There are also peculiar wooden masks, worn at stated inter-tribal meetings and dances, and composite wooden images in which the human figure, male or female, is surrounded by those of the snake, fish, owl, tern, &c.

The people of New Britain, especially towards the west, resemble those of eastern New Guinea, height about 5 feet 6 inches, with matted curly hair; the women appear stunted and oppressed. They are a finer race than those farther east in Duke of York and New Ireland, who, excepting an evidently Polynesian colony on the south coast of New Ireland, rather resemble the Solomon Islanders. Both are thorough cannibals. Their weapons are clubs (stone-headed in New Britain), spears, tomahawks, and slings. They perform complicated surgical operations with an obsidian knife or a shark's tooth. They construct ingenious fishing weirs. The villages are clean and well-kept, the houses varying from miserable huts 8 by 5 feet without furniture to neat well-built semicircular houses, the roof extending to the ground behind, with front of wicker work, leaving a space for the door. The common dead are buried or exposed to sharks on the reefs; bodies of chiefs are exposed in the fork of a tree. Girls for some time before puberty are confined in cages of pandanus leaves about 4 feet diameter, possibly to fatten them, an old Polynesian custom. Justice is executed, and tabus, feasts, taxes, &c., arranged, by a mysterious disguised figure, the "duk-duk." Only the chief and those who have been initiated on payment of a heavy fee know who or what he is. Women and children are forbidden to look on him. The custom, perhaps, points to a time when there was a priesthood, aiding the chief to rule the people. The population is divided into two exogamous classes. The children belong to the class of the mother, and when the father dies go to her village for support, the land and fruit trees in each district being divided between the two classes. Compare the Polynesian custom "tamaha" (the Fijian "vasu"), which gives certain privileges to a sister's children. There are several dialects, the construction resembling Fijian, as in the pronominal suffixes in singular, triad, and plural; the numerals, however, are Polynesian in character

See Wilfrid Powell, *Wanderings in a Wild Country*, and paper in *Roy. Geog. Soc. Proceedings*, 1881; Rev. G. Brown in *Roy. Geog. Soc. Journal*, 1877, and *Proceedings*, 1881; *Verhandlungen der Ges. f. Erdkunde zu Berlin*, x., Nos. 5 and 6.

NEW BRUNSWICK, a province of Canada, in British North America, lying between 45° 5′ and 48° 40′ N. lat. and 63° 50′ and 68° W. long. It is bounded on the N.W. by Quebec; N. by the Bay of Chaleur; E. by the Gulf of St Lawrence and Northumberland Strait, which separates it from Prince Edward Island; S. by a portion of Nova Scotia, Chignecto Bay, and the Bay of Fundy; and on the W. by the State of Maine. Its length from north to south is 230 miles, its greatest breadth 190 miles, and it has a seaboard of some 545 miles, interrupted only by the isthmus of Chignecto, which joins the province to Nova Scotia. In shape it is very compact, resembling an irregular quadrangle. Its area is 27,177 square miles.

Physical Features.—The surface is generally undulating, but in the northern and north-western sections there are many ranges of hills which rise to a height of from 1200 to 2000 feet, while individual peaks are to be found of even greater altitude. These elevations are an extension of the Appalachian Mountains, and traverse the province from the State of Maine. The scenery is most picturesque and varied, and vast forests abound all through this section of country. The southern region embraces the district along the Bay of Fundy. Its coast is rocky and bold, and interrupted by great ravines. West of the river St John the soil is fertile and rich, and, though towards the east it is not so deep, there is still a good agricultural country, with many beautiful valleys, grain fields, and forests. Along the shores on the east coast, and for 20 miles inland, the country is flat, and composed of mosses and marshes, but beyond that distance it rises into gently sloping hills, which extend as far as St John.

The whole of New Brunswick is well watered. Rivers, bays, and lakes are numerous, and several are navigable for vessels of large tonnage. The principal rivers are the St John, Miramichi, Restigouche, Saint Croix, Petitcodiac, Richibucto, and Nepisiguit. The St John, which is famous for its scenery, rises in the State of Maine, and is over 450 miles in length. It is navigable for vessels of moderate tonnage from St John on the Bay of Fundy to Fredericton, a distance of about 88 miles, but steamers of light draught ply as far as Woodstock, 65 miles farther, and during the rainy season boats may proceed to Grand Falls, a cataract 70 or 80 feet high, 225 miles from the sea. Above the falls the St John has been navigated by a steamer to the mouth of the Madawaska, 40 miles. The river is an important highway, especially of the lumber traffic. About 9,000,000 acres of New Brunswick, 2,000,000 acres of Quebec, and 6,000,000 acres of Maine lands are drained by it. Among the many lakes communicating with the St John is Grand Lake, 30 miles long, and varying from 3 to 9 miles in breadth. The Miramichi rises in the county of Carleton, and flows in a north-easterly direction into a bay of the same name. It is 225 miles long, 7 miles wide at its mouth, and navigable for large vessels as far as Nelson (46 miles). In the spring and autumn, when full freshets prevail, small steamers and tow-boats can ply a much greater distance. The branches of the Miramichi drain a fourth of the entire province. An extensive lumber trade is done in this district, and many sawmills are driven by the river. Its fisheries are specially valuable. including salmon, trout, bass, smelt, and lobster. The Restigouche forms the north-east boundary of the province, is 100 miles in length, and discharges into the Bay of Chaleur. It is composed of five main branches, from which fact it derives its name, signifying in Indian "the river which divides like the hand." It is a considerable waterway, 3 miles in width at its mouth, and 9 fathoms in depth. Large vessels may safely navigate it 18 miles from the bay. The main river and its tributaries drain over 4000 square miles of fertile and well-wooded country. A good deal of lumber is carried on it, and the harbour is secure and safe for ships of ordinary tonnage. The St Croix separates the State of Maine from New Brunswick at its south-west part. Its source is a chain of lakes called the Chiputneticook. The Petitcodiac is navigable for 25 miles for ships, and schooners of 80 tons burden may proceed to the head of the tide, 12 miles farther; it empties into Shepody Bay. The Richibucto discharges into the Gulf of St Lawrence. The Nepisiguit and Tobique (a tributary of the St John) in the north are in much repute among anglers.

The coast-line of New Brunswick is indented with numerous fine bays and harbours. There are few islands. The Bay of Fundy is a huge arm of the sea extending into the land between New Brunswick and Nova Scotia, and terminating in two smaller bays, Chignecto Bay and the Basin of Minas. Its length up to Chignecto Bay is 140 miles, and its extreme breadth 45 miles. It is noted for its high tides, which are influenced by the Gulf Stream, and rise about 30 feet at St John and 60 feet at the head of Chignecto Bay, rushing into the latter with remarkable force. At Bay Verte, 14 miles distant, the tide rises little more than 4 or 5 feet. The Bay of Chaleur, which presents no impediment to navigation, and has several excellent harbours, is over 90 miles in length, and from 20 to 25 miles in breadth. On its southern side the shores are low, and on the northern bold and precipitous. The other inlets of consequence on the east coast are Miramichi, Richibucto, Buctouche, Cocagne, and Shediac Bays; on the south coast are Passamaquoddy Bay, St John Harbour, and Chignecto Bay.

Geology.—The northern divisions of the province are occupied by metamorphic slates and rocks of Silurian age. The area of the Carboniferous system includes the greater part of the counties of Westmoreland, Queen's, Sunbury, and Gloucester, a considerable portion of York and Northumberland, and the whole of the county of Kent. The Lower Carboniferous and Devonian systems prevail in the western portion about the head of the Grand Lake and on the river Canaan. Grey sandstone, shales, and conglomerates predominate. Along the southern coast, from the head of the Bay of Fundy to the State of Maine, there is a belt comprising Laurentian, Huronian, Cambrian, and Silurian rocks. Dr J. W. Dawson says, "the Carboniferous plain of New Brunswick corresponds to and at its eastern extremity is connected with that of Nova Scotia; and its hilly ranges of altered and igneous rocks form, with those of Nova Scotia, outlying ridges rudely parallel to the great Appalachian breastbone of America, and, like it, descending under the level of newer deposits and of the sea at their north-eastern extremities." The Newer Red Sandstone and Middle Cambrian formations are also to be found in New Brunswick, with trap, limestones, porphyry, granite, syenite, felsites, and gneiss. Many of the strata are rich in fossil remains. The coal-fields of the province occupy an area of over 11,000 square miles. Iron and plumbago or graphite occur in workable quantities, the deposits of the former being extensive and valuable. Manganese abounds and forms an article of export. Gold, in small quantities, is found on the banks of the Shiktehawk, a tributary of the St John. Professor Bailey has discovered drift gold on the headwaters of the Tobique and the Miramichi, and at the Grand Falls of the St John. At St Stephen, in Charlotte county, it occurs in quartz veins in micaceous schist, and in the same neighbourhood in a black plumbaginous slate. Copper, lead, nickel, and zinc, with important deposits of antimony, complete the list of minerals.

Climate.—The climate of New Brunswick is somewhat similar to that of the more southern parts of Quebec. It is subject to pronounced extremes of heat and cold, but is considered healthy, and epidemics are rare. In the interior the thermometer sometimes registers 95° Fahr. in the summer while in the winter, which begins early in December and lasts until the end of March, the mercury frequently drops as low as 35° below zero. At Fredericton, the capital, the temperature ranges from - 35° to 100°, the mean being about 42°. The winters are severe, and snow falls to a great depth, especially in the north, where also wild and cold winds prevail. In the south the winters are milder and more broken. The most charming season is autumn, and particularly that part of it known as the Indian summer, which lasts about six weeks.

Agriculture, &c.—Vegetation is rapid. A very large portion of the country is well adapted for agriculture, the soil being exceedingly fertile. On the "intervales" or low lands enormous quantities of hay are grown, while the yield on the high lands varies from one to three tons per acre. Wheat, oats, buckwheat, rye, barley, hemp, and flax yield good crops, and potatoes, turnips, beets, celery, carrots, parsnips, and pease and beans grow well. The principal fruits are apples, plums, cherries, gooseberries, currants, strawberries, and raspberries. A large export trade of recent years has sprung up in the latter fruits. Hay has always been exported from the province to the United States, where it commands good prices. Farming is not prosecuted in New Brunswick to the extent it should be, and the inhabitants fail to raise enough produce to meet their own wants.

The amount of land under crop in 1871 was 778,461 acres, and in pasture 385,105 acres. In 1881 these figures were increased to 849,678 acres under crop and 392,169 in pasture. The crops raised during the latter year were 521,956 bushels of wheat, 84,188 of barley, 3,297,534 of oats, 1,587,228 of buckwheat, 18,157 of corn, 43,121 of pulse, 990,336 of turnips, 6,961,016 of potatoes, 159,043 of other roots, 414,046 tons of hay. The number of horses in 1881 was 52,975; of working oxen, 8812; of horned cattle, 203,748; of sheep, 221,163; and of swine, 53,087. In 1882 760,531 ℔ of wool and 78,203 ℔ of bees' honey were raised.

Commerce.—New Brunswick ranks as one of the most amply wooded countries in the world. Great forests of trees cover an extensive portion of its surface, and lumbering forms one of its chief industries. The principal trees are pine, hackmatac, spruce, cedar, beech, maple, hemlock, birch, fir, elm, oak, larch, butternut, ash, poplar, chestnut, and sumach. Though lumbering and fishing form the main occupations of the people, many are engaged in the mining and manufacturing industries. The total value of the produce of the forest exported in 1881–82 was $4,724,422; of the fisheries, $753,251; of the mines, $140,908; of animals and their produce, $321,426; of agricultural produce, $256,994; of manufactures, $365,748. The total value of the exports was $7,474,407, and of the imports $6,707,244. The chief articles of export are fish, timber and lumber, iron, coal, gypsum, manganese, hay, &c. The imports embrace wheat and other grain, flour and corn-meal, salted meats, coffee, tea, sugar, molasses, tobacco, woollen, cotton, and silk goods, fruits, &c.

Industries.—Shipbuilding, which was prosecuted on an extensive scale some twelve or fifteen years ago, has fallen off considerably of late, owing principally to the fact that iron ships and steamers have taken the place of the wooden craft in the carrying trade. During the year 1882 the number of vessels built in New Brunswick was 66, tonnage 16,820. On the 31st December 1882 the vessels registered in the province and remaining on the registry books of the several ports amounted to 1064, tonnage 308,961. In that year there were engaged in the coasting trade, including steamers and sailing vessels, 4435 craft, representing a tonnage of 415,029. The number of saw-mills in the province is 478, employing 7175 hands. There are also 166 flour and grist mills, and 83 tanneries. Other industries are lime-burning, shingle-making, manufacture of woollen cloth and cotton warps, cheese and butter making, sash, door, and blind factories, iron working, and brick-making. In 1871 the amount of capital invested in industries was $5,976,176; in 1881 it reached $8,425,282,—19,922 hands being employed in manufacturing, $3,866,011 paid in wages, and $11,060,842 worth of raw materials consumed. The total value of the articles produced was $18,512,658.

Fisheries.—The chief seats of the fisheries are in the Harbour of St John, on the islands at the mouth of the Bay of Fundy, and on the north shore. Cod, haddock, salmon, trout, sturgeon, holibut white fish, herring, shad, gaspereaux, smelt, bass, mackerel, and eels comprise the principal varieties taken. Of recent years the fishing business has been most industriously pursued, and several firms have gone extensively into the canning of salmon, oysters, and lobsters for export. Fish-breeding establishments are in operation, maintained by the Government of the Dominion. In 1881 there were 205 larger vessels and 4284 boats engaged in the fisheries.

Game, &c.—Game is abundant,—wild ducks, teal, wild geese, partridges, woodcocks, pigeons, plover, snipe, &c., occurring in great quantity. No fewer than 270 varieties of birds have been already discovered, and ornithologists state that that number can be increased. Of wild animals the principal are the bear, wolf, deer, moose, caribou, lynx, fox, musk-rat, mink, marten, ermine, hare, squirrel, and beaver.

Communication.—Good waggon roads intersect the province wherever there is a settlement. Telegraphic lines are established throughout the country, and the means of railway communication are excellent. The Inter-Colonial, which is the principal line, runs from St John to Moncton and thence to Halifax, N.S. At Moncton a branch line extends to Shediac, while the main division proceeds in a northerly direction through the counties of Westmoreland, Kent, Northumberland, Gloucester, and Restigouche, crossing the Restigouche river at the valley of the Metapedia, where the scenery is varied and beautiful, and thence to Point Levis opposite the ancient city of Quebec. The head offices are at Moncton. The St John and Maine Railway runs from St John westward to the State of Maine, connecting at Fredericton Junction with the Fredericton Branch Railway, at M'Adam with the New Brunswick and Canada Railway, and at Bangor (Maine) with all the great railway lines of the United States. The New Brunswick and Canada Railway runs from St Andrews to Woodstock, and has branches to St Stephen and Houlton (Maine). At Woodstock it connects with a branch of the New Brunswick Railway which runs between Fredericton and Woodstock and Edmundston in the new county of Madawaska. The Grand Southern Railway runs from St John to St Stephen, the Albert Railway from Salisbury to Hopewell, the Elgin from Petitcodiac to Elgin, and the St Martins and Upham Railway runs from Hampton to Quaco on the shore of the Bay of Fundy. The total length of the railways now (1883) is about 1002 miles.

Population.—The province is divided into fifteen counties, viz., Restigouche, Gloucester, Northumberland, Kent, Westmoreland, Albert, St John, Charlotte, King's, Queen's, Sunbury, York, Carleton, Victoria, and Madawaska. Up to the 31st October 1882 9,937,438 acres were granted by the Government and occupied, leaving 7,455,977 acres still vacant. The population of the province, 285,594 in 1871, was 321,233 (164,119 males, 157,114 females) in 1881. There are two Roman Catholic dioceses, one at St John and the other at Chatham, and one see of the Church of England at Fredericton. The following table shows the religious denominations and the number of their adherents:—

Church of England	46,768	Adventists	738
Church of Rome	109,091	Universalists	375
Presbyterians	42,888	Other denominations	2,966
Baptists	81,092	Of no religion	114
Methodists	34,514	No creed stated	1,260
Congregationalists	1,372	Jews	55

A large proportion of the population is composed of emigrants from Great Britain and their descendants. In the northern counties and in the valley of the Madawaska there are many settlements of French Acadians, and in the same localities and along the shores of the St John river there are Indians belonging to the Malicite, Micmac, and other tribes, numbering in all 1401. During the last forty years these have varied from 1200 to 1400. The tribes, though resembling each other in physique and appearance, differ very materially in origin and almost wholly in language. The extent of land granted to the Indian population by the Government of New Brunswick is 58,662 acres. Within the last six or seven years a most flourishing colony of Danes has been settled in the province.

Administration.—The affairs of the province are administered by a lieutenant-governor (salary $9000) and an executive council composed of six members with portfolios and three without offices or salary, assisted by a legislative assembly of 41 representatives and a legislative council of 18 members. The latter are appointed for life, and the former are elected by the people every four years. The lieutenant-governor is appointed by the governor-general of Canada in council. New Brunswick returns to the Canadian House of Commons 16 members, and 10 senators are appointed by the crown. The public revenue in 1882 was $643,710, and the expenditure $614,236. The principal source of income is the annual subsidy granted to the province, under the terms of the British North America Act of 1867, by the Dominion Government. This subsidy is computed on a fixed rate of 80 cents per head of population; $50,000 are allowed for government and $150,000 for export duty. In 1882 the amount paid on this basis to New Brunswick was $456,903·20. It will increase until the population reaches 400,000, when the 80 cents will be regularly calculated on that number. The remainder of the revenue is derived from the sales of crown lands, timber limits, mining licences, fishing licences, fees, and other miscellaneous receipts. The judiciary consists of a supreme court with chief and five puisne judges having law and equity jurisdiction, a court of marriage and divorce, a vice-admiralty court, a court for the trial and punishment of piracy and other offences on the high seas, a probate court, and six county courts. These officers are appointed for life by the federal authorities. The provincial legislature meets at Fredericton, where the Government offices are situated. The militia of the province consists of an active force of one regiment of cavalry (seven troops), two batteries of field artillery, seven batteries of garrison artillery, one company of engineers, and five battalions of infantry and rifles, in all 140 officers and 1570 non-commissioned officers and men.

Education.—The present school law was passed in 1871. Under its provisions school trustees of each district are compelled to provide school accommodation for all persons therein between the ages of five and twenty free of charge. In addition to the provincial grant a tax is levied in each county equal to 30 cents per head, and a large fund sufficient to carry out the law (including a poll-tax of $1 per head) is raised by the localities. The educational institutions aided by the Government are the university of New Brunswick (founded in 1828 under the title of King's College, and having its seat at Fredericton), a normal or training school for teachers, and a system of common schools ranging from the primary to the grammar or high school department. The common schools are non-sectarian and free to all. The province expended for this service in 1882 $166,733. In the summer term of 1881 the number of schools was 1386, of teachers 1453, and of pupils 51,921. During the winter course of 1882 there were 1317 schools at work, taught by 1371 teachers, and attended by 48,805 boys and girls. The total number of pupils in attendance at the schools within the year was 64,267. Besides the university at Fredericton there is the Mount Allison Wesleyan College at Sackville. The public charitable institutions receiving aid from the local Government are the Provincial Lunatic Asylum and the City Hospital, St John, and the deaf and dumb school at Fredericton; and the blind school and deaf and dumb asylum at Halifax, N.S., receive an annual grant from the province also. In consideration of this the latter admit pupils from New Brunswick. The lazaretto for lepers at Tracadie and the marine hospital at St John are maintained by the Dominion.

History.—New Brunswick was settled in the first place by the French in July 1604, and with Nova Scotia belonged to that part of New France called Acadia until 1713, when it passed into the hands of England. A dispute arose between the two powers concerning the precise limits of Acadia, and the question remained a vexed one until the treaty of Paris, 1763, when the whole domain was finally ceded to Great Britain. In 1764 a body of Scottish farmers and labourers arrived in the country and took up their homes in the Miramichi and other districts. The year 1783 is memorable as the date when the Loyalists landed from the United States and settled in the colony. In the following year Nova Scotia and New Brunswick separated, and they remained distinct provinces until 1867, when they were united with Quebec and Ontario to form the Dominion of Canada. The capital of New Brunswick is Fredericton (population 6218), and St John (26,127) is the chief commercial city. Portland (15,226), formerly a suburb of St John and latterly a town, was erected into a city in April 1883. Other towns are Moncton (5032), which contains the head offices of the Inter-Colonial Railway and a sugar refinery, Shediac (6227), Dorchester (6582), Chatham (5762), Sackville (4882), Richibucto (4079), St Stephen (2338), Bathurst (4806), St Andrews (2128), St George (3412), Woodstock (1994), Dalhousie (2353).

See Dawson, *Acadian Geology*, 3d edition, Montreal, 1878; Bailey, Ells, and Matthew, in *Reports of the Geol. Survey of Canada*, 1878–79–80; *Public Documents of New Brunswick and Canada*, 1882. (G. ST.)

NEW BRUNSWICK, a city of the United States, capital of Middlesex county, New Jersey, 31 miles by rail from New York, at the head of navigation of the Raritan river, and the eastern terminus of the Raritan and Delaware Canal. The older portion occupies the low land along the river, and has narrow irregular streets; but the newer districts have spread over the higher grounds behind, and are both well built and well laid out. Conspicuous among the public buildings are Rutgers College and the theological seminary of the Reformed (Dutch) Church. The college was founded in 1770 as Queen's College, and received its present name in honour of Colonel Henry Rutgers (1746–1830) only in 1825. It has a library of 12,000 volumes, and 16 professors and 115 students. The seminary, dating from 1784, consists of eight fine buildings—Hertzog Hall, Suydam Hall, the Gardiner Sage Library (36,000 volumes), and five professors' residences—and occupies a good position to the north of the college. India-rubber goods, hosiery, paperhangings, shoes, and machinery are manufactured on a large scale in the city. The population was 15,058 in 1870, and 17,166 in 1880. Settled in the close of the 17th century, New Brunswick was incorporated in 1736, and had become by 1748 a "pretty little town with four churches and a considerable trade with New York." A city charter was obtained in 1784.

NEWBURG, or NEWBURGH, a city of the United States, the capital of Orange county, New York, occupies a commanding position on the steep slopes of the west bank of the Hudson, about 60 miles north of New York. It has a large river trade, especially in coal and lumber, contains engine-factories, a cotton-mill, a bleachery, a lawn-mower factory, &c. Hasbrouck House, an old stone mansion which served as Washington's headquarters in 1782–83, has since 1850 been maintained by the State, and contains a considerable collection of historical relics. The population was 17,014 in 1870, and 18,049 in 1880.

The site of Newburg, then occupied by a clan of the Minsis (Delaware) tribe, was recognized by Hudson in 1607 as a "pleasant place to build a town on"; but it was not till 1709 that the Palatine Parish of Quassaic, as it was at first called, was settled by a number of Germans from the Palatinate of the Rhine. In 1752 the name of Newburgh or Newburg was adopted from the likeness which the place bore to Nowburgh on the Tay in Scotland. It was here that Washington rejected the proposal to make him king, thereby checking the incipient mutiny which the anonymous "Newburgh Letters" were designed to excite, and here the army was disbanded. A city charter was obtained in 1865.

NEWBURY, a municipal borough and market-town of Berkshire, England, near the Hampshire border, is situated on the river Kennet, the Kennet and Avon Canal, and the Great Western Railway, 53 miles west of London and 16 south-west of Reading. The church of St Nicholas, in the Late Perpendicular style, is said to have been mainly built at the expense of John Winchcombe (Jack of Newbury), who sent one hundred of his own weavers fully equipped to Flodden Field. The church was restored in 1867 at a cost of £15,000. It contains a brass of John Winchcombe and Alice his wife (1519). Among other public buildings are the corn exchange (1862), the literary and scientific institution, and the free grammar school. There are over one hundred almshouses, of which twenty-four are supported by the hospital of St Bartholomew, chartered by King John. Malting is carried on, and there is a considerable trade in corn and agricultural produce. Silk, ribbons, and paper are also manufactured. A large wool fair is held in February. The population of the municipal borough, 6602 in 1871, was 10,144 in 1881. In 1878 the area of the borough was extended from 1722 to 1813 acres.

Nowbury owes its origin to the Roman station *Spinæ*, now represented by the modern village of Speen. In contradistinction to this village it was named Nowbury, that is the new borough or town. By William the Conqueror it was bestowed on Ernulf de Hesdin, and it belonged to the Marshalls of Hampstead-Marshall before it came into the possession of the Cravens. The town was incorporated by Elizabeth in 1596, and the charter was renewed by James I. and Charles II. In the reign of Edward I. it sent two members to a parliament at Westminster; and, being a place of considerable trade, it also sent representatives to a great council in the time of Edward III. It then possessed large woollen manufactures, but the industry is now wholly discontinued. During the civil war two battles were fought near it in 1643 and 1644. In 1645 it was taken by the Parliamentarians, who held possession of it till the close of the war. A handsome memorial to Lords Falkland, Sutherland, and Carnarvon and other Royalists who fell at Newbury in 1643 has been erected on the battlefield (1878).

NEWBURYPORT, a city and port of entry of the United States, and one of the shire-towns of Essex county, Massachusetts, lies on the right-hand side of the estuary of the Merrimack, and 35 miles by rail north-north-east of Boston. At this point the river is crossed by several bridges, one of which, constructed in 1792, was the first suspension bridge in America. The ground on which the city is built rises gradually to a height of about 100 feet; along the top of the ridge, parallel with the river, runs for a distance of 3 miles High Street, the leading thoroughfare, lined with old-fashioned mansions (Caleb Cushing's, Lord Timothy Dexter's, &c.); and at the junction of High Street and State Street is a pond of 3½ acres enclosed by a terraced promenade. The streets in general are umbrageous even for an American city, a special endowment having been left for the maintenance of shade trees. Old South (Presbyterian) Church in Federal Street contains a whispering gallery of a very striking kind, and under its pulpit lie the remains of George Whitefield. The free library, founded by Josiah Little in 1854, and endowed by George Peabody, occupies the old Tracy mansion, and contains upwards of 21,000 volumes. Putnam Free School, dating from 1847, with an endowment of $50,000, and the high school for girls, are both institutions of wide reputation (the latter the first of its kind in the States), now consolidated with the high school for boys. The cotton manufacture, introduced in 1836, is the staple of the city, which also, however, contains shoe factories (one of them said to be the largest manufactory of women's shoes in the world), an iron foundry, a distillery, carriage works, hat factories, &c., and has long been the seat of extensive shipbuilding operations (tonnage 4000 in 1882). The harbour (formed by the northern end of Plum Island, which is united to the city by a causeway) is of somewhat difficult access owing to the shifting character of the bar, which becomes altogether impassable during storms from the east. The population of the city was 13,401 in 1860, 12,595 in 1870, and 13,538 in 1880.

Newbury was settled by Thomas Parker's company in 1635, but it was not till 1764 that Newburyport attained independent existence. It had reached a state of great prosperity when in 1811 about 11 acres of its most closely-built portion were destroyed by fire. In 1851 a city charter was obtained.

NEW CALEDONIA, the largest island in the Pacific after New Zealand, about 240 miles long, with an average breadth of 25 miles, lies at the southern extremity of MELANESIA (*q.v.*), between 20° 10′ and 22° 25′ S. lat. and between 164° and 167° E. long., and, like all the chief islands of that chain and the chain itself, runs north-west and south-east. It was discovered by Cook in 1774, and was appropriated by the French for a convict settlement in 1853. Their capital, Nouméa, with a fine harbour, is near the south end of the island. An almost unbroken barrier reef skirts the west shore at about 5 miles distance; on the east, which is more abrupt and precipitous, it is much interrupted. To the north the reefs continue, marking the former extension of the land, for about 160 miles, ending with the Huon Islands. Hunea, or Isle of Pines, so called from its araucarias, geologically a continuation of New Caledonia, lies 30 miles from its south-east extremity. It abounded formerly in sandalwood, and consists of a central plateau surrounded by a belt of cultivation. New Caledonia consists essentially of confused masses and ranges of mountains, rising at Mount Humboldt to 5380 feet, the plains being chiefly the deltas of rivers. The landscape is rich and beautiful, varied with grand rock scenery, the coast-line being broken by countless streams, often skilfully utilized by the natives for irrigation. The larger rivers in the wet season form impassable morasses. The framework of the island consists chiefly of argillaceous, serpentinous, and mica schists. There are no active volcanoes, but great magnesian eruptions, represented by serpentines, cover the greater part of the surface, especially in the south-east,—the extent of sedimentary formations, ranging from Upper Devonian (to which some Carboniferous rocks near Nouméa apparently belong) to Neocomian, being relatively insignificant. With the serpentines occur masses of red clay from the decomposed rock, and much chromate of iron, which forms the metalliferous black sands of the streams. The famous nickel mines lie in the Kanala district, and extend for some 60 miles along the east coast, the rocks being coated with the green ore ("garnierite," a hydrous magnesian silicate impregnated with nickel oxide), which also occurs in pockets, and is extensively worked. There are also mines of copper and cobalt. Gold has only been found in small quantities. In the low-lying districts to the south-east are several lakes and morasses of black mud, and blocks of ironstone so abundant as to affect the compass. In the north-west the rocks (in which quartz replaces the diorite) are not ferruginous, and are less contorted. The hottest and the wettest months are from December to March, but there is usually a fresh trade-wind blowing, and the climate is healthy. There is much less moisture, and the flora is of a less tropical character, than farther north; it has some Polynesian and New Zealand affinities, and on the west coast a partially Australian character; on the higher hills it is stunted; on the lower, however, there are fine grass lands, and a scattered growth of niaulis (*Melaleuca viridiflora*), useful for its timber, bark, and cajeput oil. There is a great variety of fine timber trees: those at present most used are the kaurie, houp, and other pines, tamanou (*Calophyllum montanum*), ironwood, acacias, milneas, *Cordia Sebestena*, cohu, bourao, azou. The bread-fruit, sago, banana, vanilla, ginger, arrowroot, and curcuma grow wild. The cocoa nut, maize, sugar-cane, coffee, cotton, rice, and tobacco (which last does not suffer like other crops from the locusts) do well. The orange, indigo, lucerne, and European vegetables are grown. There are probably no mammals except the rat and *Pteropus* and other bats. The commonest birds are pigeons (the large notou and other varieties), doves, parrots, kingfishers, and ducks. The kagu (*Rhinochetus jubatus*), a peculiar "wingless" bird, is found here only. Turtle abound on the coast, and fish, of which some kinds, as the tetrodons (globe-fish), are poisonous, especially at certain seasons.

The population is probably about 30,000, but has diminished greatly since the French occupation. There are two distinct types: one is sub-Papuan, probably aboriginal, dark brown, with black frizzly hair, rounded narrow retreating forehead, high cheek-bones, and flat nose depressed at the root below the prominent brows; the other, with all these features modified, better-developed physique, and lighter colour, strongly resembles the Polynesian, and is most numerous in the east and south, where most of the upper class belong to it; but the two types intermingle everywhere. The women, though hard worked, are less degraded than is usual among Papuans. Their marriage ceremonies end with a simulated flight and capture. The people are hospitable to strangers, and not quarrelsome among themselves, though fond of war with another tribe, which is declared by a masked messenger, who taking a spear and money with him thrusts the former among the challenged tribe, and then, throwing down the money in atonement of the injury his spear may have done, is allowed to return unharmed. Their weapons are clubs, slings, stone hatchets (resembling the Australian), and spears with a throwing cord. Rows of stones are found commemorating the numbers of enemies killed and eaten in former wars. The French have found them formidable antagonists on many occasions; the last "revolt" was put down after much trouble and bloodshed in 1881. There are various degrees of hereditary chiefships, distinguished by insignia on their houses. As in some other Pacific islands, when a son is born the chiefship passes to him, but the father continues to govern as regent. They have strict ideas of property—individual, village, and tribal. The people have to work on the chief's plantations and fisheries, and also work in parties for each other, breaking up new land, &c. This often ends in feasting and in dances (*pilu pilu*), which include allegorical representations of events or ideas.

Their huts are usually beehive-shaped, with a single apartment, low narrow door, and no chimney. The fire inside is their only defence against mosquitoes. The central pole is continued outside, usually by a rude figure surmounted by a long post elaborately decorated, especially in the chiefs' houses, which far overtop the others, and have a good deal of grotesque hand carving, something like but inferior to that seen in New Zealand.

The food is chiefly vegetable, so that there is considerable scarcity at certain seasons; but almost anything is eaten, including all sorts of insects, and a steatite earth which contains a little copper. The exception is the lizard and the gecko,[1] of which they have a superstitious dread.

They believe in the power of spirits to take up their abode in persons or inanimate objects, and employ the aid of the soothsayer in this and many other emergencies of life. The dead are supposed to go down into the sea at the west end of the island. Cocoa-nut trees, a valuable sacrifice, are cut down on the death of a chief. Like other cannibals, they have a certain knowledge of anatomy and surgery, and also of medicine. Their music is quite rudimentary, and consists of little else than beating or sounding in time. Their money is made of different sorts of shells, but other articles of value—axes, skins, mats, &c.—are used as mediums of exchange.

The languages of the different tribes are mutually unintelligible. They express abstract ideas imperfectly. Dr Patouillet says that there are several words for eating, each applied to a particular article of food. Their reckoning shows the same peculiarity. The numbers go up to five, and for living objects the word *bird* is added, for inanimate *yam*, for large objects *ship*.[2] There are other terms for bundles of sugar-canes, rows (planted) of yams, &c.; and sometimes things are counted by threes. Ten is two fives, 15 three fives, 20 is a "man" (ten fingers and ten toes), 100 is "five men," and so on.

The free white population, settlers and miners, numbers about 3000; officials and troops, 3000; transportés and déportés (ordinary and political convicts), with their families, 4000 and 6700 respectively. Some of the planters and graziers are fairly prosperous, but the material development of the country does not advance rapidly. There seems a general want of energy, a deficiency of banking facilities and of roads and means of transport. It is in fact found difficult to work the settlement both as a free and as a penal colony. The larger proprietors are free immigrants, but are being swamped by the more numerous small ones, who are "libérés," holding small concessions, and bound—theoretically at least—not to leave the country. The déportés and transportés are under separate regulations. The latter when well-behaved are hired out to the free settlers at 12 francs a month. The libérés either receive a very small allowance from Government, or are permitted to take service, receiving 30 to 50 francs a month, with their board. The sending out of the families of convicts, with the view to promote settlement, has not answered well. Free concessions are offered with the same object, especially to retired officials and others. Large concessions have also been made to agricultural colonies, which have mostly failed. The agricultural establishments worked by convicts have answered better, the lands belonging partly to colonists, and the convict labourers eventually obtaining a certain status, and permission to marry. Out of a total area of about 1,600,000 hectares, half is unfit for cultivation or pasture. Up to 1877, 130,965 hectares were taken up, and probably half the available land is now taken. The miners in New Caledonia are chiefly Australians, but out of several hundred concessions of mines, chiefly nickel, only a few have been worked. The intention of the French Government to send yearly to New Caledonia 5000 *recidivistes* or habitual criminals, to be released after three years' detention, causes serious uneasiness in Australia.

The trade was valued in 1874 at 13,471,000 francs, the imports being three times the value of the exports, and the greater part carried in foreign vessels.

Principal Authorities.—Ch. Lemire, *La Colonisation Française en Nouvelle Calédonie*; papers—(geological) by Jules Garnier in *Annales des Mines*, 1867, and by Herteau, *Ibid.*, 1876, and (anthropological) by Dr Bourgarel in *Mém. de la Soc. d'Anthropologie de Paris*, vol. i.; Dr J. Patouillet, *Trois ans en Nouvelle Calédonie*. (C. T.)

NEWCASTLE, or in full, for the sake of distinction, **Newcastle-upon-Tyne**, a city (with the constitution of a county), municipal and parliamentary borough, market-town, and seaport in the county of Northumberland, England, is situated on the north bank of the river Tyne, 8 miles above its mouth, and on the main line of the North-Eastern Railway, 275 miles north of London and 70 east of Carlisle. Some of the streets in the older portion of the town along the river side are narrow and steep, and still contain several of the quaint gable-fronted houses of the time of Elizabeth. The business portions of the town—principally erected from the plans of Richard Grainger—are characterized generally by spacious streets with imposing buildings and fine shops; and in the northern and western suburbs there are numerous terraces and villas inhabited by the wealthier classes. The important town of **Gateshead** (*q.v.*), on the south side of the river, is connected with Newcastle by three bridges—a high level bridge, an hydraulic swing bridge, and a suspension bridge. The high level bridge has been already described (see vol. iv. p. 337). The hydraulic swing bridge, on the low level a little farther down the river, was built to replace a stone structure erected in 1781 on the site of a bridge dating from 1250, and destroyed by a flood in 1771. The Roman bridge, the Pons Ælii, probably built by the emperor Hadrian, is said to have spanned the river at the same point. The hydraulic bridge was begun in 1868, and opened for traffic 15th June 1876, at a cost of about £200,000. It consists of one large centre pier, two mid-stream piers, and two abutments; and its foundations are iron cylinders resting on the solid rock, 60 feet below the bed of the river. Two spans, which open simultaneously by machines impelled by steam, allow 103 feet of waterway for vessels going up and down the river. About half a mile farther up the stream is the Redheugh bridge, commenced in 1867, and opened in 1871 at a cost of £40,000.

Newcastle is well supplied with public parks and recreation grounds. To the north of the city is the Leazes ornamental park of 35 acres, and beyond this the town moor and racecourse, an extensive common, the survival of the pasture land of the township. Eastward from the town moor is Brandling Park. The picturesque grounds of Armstrong Park to the north-east of the city extend to about 50 acres, the larger half of which was presented by Sir W. G. Armstrong, who also has presented the beautifully wooded grounds of Jesmond Dene. Elswick Park in the south-west of the city, extending to 8¾ acres, and including Elswick Hall, was purchased by the corporation and opened as a recreation ground in November 1878.

The earliest artificial method of water supply for Newcastle was by pipes of elmwood from Heworth and from springs about 3 miles north of the town. In 1845 a water company was formed to supply the town with water from Whittle Dene. The reservoirs of the company have been extended from time to time, and the water of various other streams utilized to meet the increasing necessities of the town. The gas supply is also in the hands of a company.

Of the old walls of the town, which, according to Leland, "for strength and magnificence far surpassed all the walls of the cities of England and of most of the towns of Europe," and the circuit of which was 2 miles 239 yards, there still remain some towers in good preservation, although the fortifications were allowed to go into disrepair after the union of Scotland and England. The castle, from which the town takes its name, stood on a slight elevation rising abruptly from the river, and was erected by Henry II. between 1172 and 1177 on the site of an older structure built in 1080 by Robert eldest son of the Conqueror. It was originally the strongest fortress in the north of England, and its keep is now one of the finest specimens of the Norman stronghold remaining in the country. While it was still incomplete, William the Lion was led within its walls after his capture at Alnwick; and within its great hall Baliol, on 26th December 1292, did homage for the crown of Scotland to Edward I. The area of the castle within its outer walls and fosse was 3 acres. Fragments of these walls, with the principal entrance or Blackgate (portions of which are, however, of later construction), and the Watergate or southern postern, still remain, but the inner wall surrounding the keep has been entirely removed. The massive keep, with walls 14 feet thick, is in a state of good preservation, as is also the chapel, a beautiful specimen of the Late Norman style, for some time used as the cellar of a public house. The castle was purchased by the corporation in 1809 for £600, and is now under the charge of the Newcastle Society of Antiquaries, who have fitted up a portion of it as an antiquarian museum. Near the castle is St Nicholas church, now forming the cathedral of the diocese of Newcastle (instituted in 1882). The church, which is principally Decorated, consists of nave, aisles, chancel, and transepts, the total length of the interior from east to west being 245 feet, and the width at the transepts 128 feet. The principal feature of the church is the lantern tower, a later addition and a very fine specimen of Early Perpendicular. The church has been frequently repaired, and underwent extensive renovation (1873–76) at a cost of £30,000. Among other interesting old churches is St Andrew's church, erected in the 11th century, principally Norman, with a low square tower and a peal of six bells. During the siege by the Parliamentary army in 1644 it was greatly damaged. St John's church is a stone building of the 14th century with an ancient font. Of the nine conventual buildings at one time existing in Newcastle or its immediate neighbourhood, a few fragments of the monastery of the Black Friars still remain, and the chapel of the hospital of St Mary at Jesmond forms a picturesque ruin.

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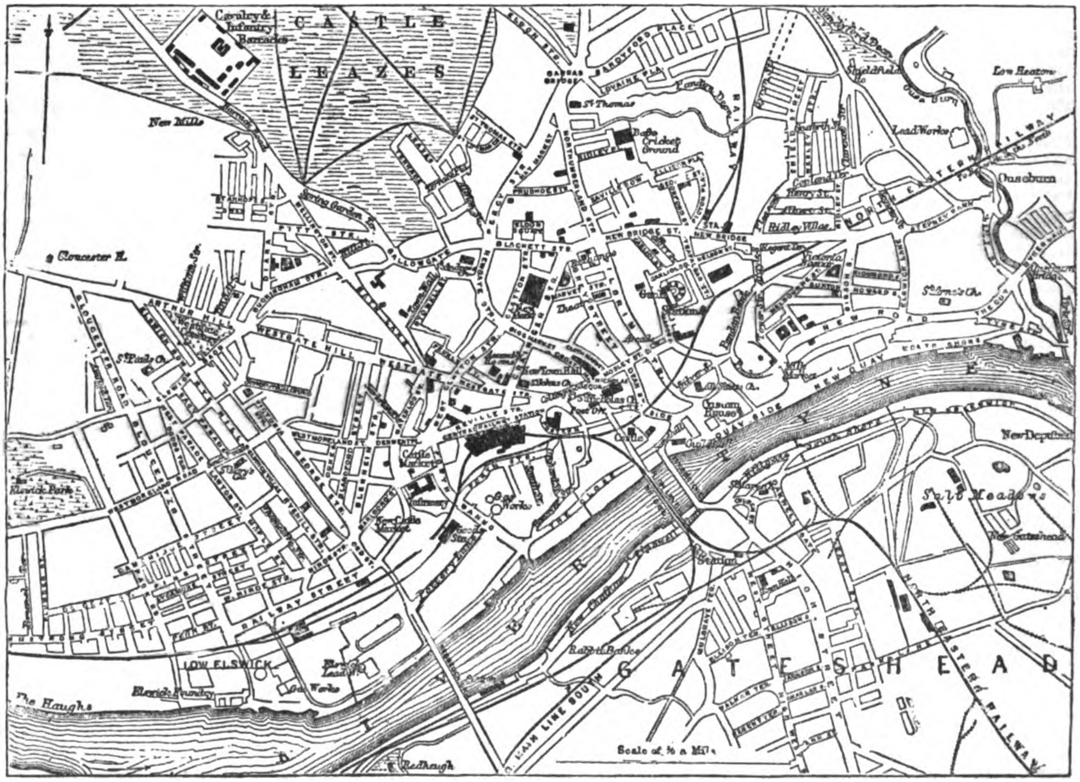
[1] Fourteen varieties have been found.

[2] A similar usage exists in Malay. See paper by Colonel Yule in *Jour. Anthrop. Inst.*, ix. p. 290.

The most important public buildings are the corporation buildings, including a large public hall, and a corn exchange, erected (1863) at a cost of £100,000; the guildhall, originally a hospital called the Maison de Dieu, and afterwards used as "the stately court of merchant adventurers," re-erected in 1658; the moot-hall (1810) for the meetings of assizes and sessions and the transaction of county business; the exchange (1860); the central news-room and art gallery (1838); the assembly-rooms



Plan of Newcastle.

(1774, re-erected 1876); the barracks (1806); the market (1835); the central railway station, opened 1849, at a cost of £130,000; the police courts (1874); the general post office (1876); the Wood memorial hall (1870), used for the meetings of the North of England Institute of Engineers; the custom-house; the theatre royal; Trinity house, with a chapel dating from 1491: and the (branch) Bank of England.

The Grey monument in Grey Street, an Ionic column surmounted by a statue of Earl Grey, was erected in 1836 to commemorate the passing of the Reform Bill; the Stephenson monument near the railway station was erected in 1862.

The principal educational establishments are the colleges of medicine and of physical science, affiliated to the university of Durham; the royal free grammar school, founded in 1525, and rebuilt by the town council in 1870 out of the funds of the hospital of St Mary; the school of science and art in connexion with South Kensington, opened in 1879; and Allan's endowed schools, founded in 1705, and reorganized by the charity commissioners in 1877. Among the clubs and similar institutions are the Literary and Philosophical Society, founded in 1793, possessing buildings erected in 1825 at a cost of £16,000; the Society of Antiquaries, founded in 1813, with a museum in the castle; the Natural History Society; the Tyneside Naturalists' Club, established in 1846; the Mechanics' Institution, 1824; the North of England Institute of Mining Engineers, 1852; the Fine Arts Society; the Farmers' Club; the Northern Counties Club; the Union Club; and the University Club. There is a public library and news-room, erected at a cost of £20,000. The benevolent institutions include the infirmary (originally founded in 1751 and enlarged in 1801 and 1851), the dispensary (1777), the fever house (1803), the lying-in hospital (1760), the eye infirmary (1822), Trinity almshouses (1492), the hospital of the Holy Jesus (1682), the keelmen's hospital (1701), the female penitentiary (1831), the Royal Victoria asylum for the blind (1838), the Northern Counties institution for the deaf and dumb (1839), the Northern Counties female orphan institution, and the Philipson memorial orphanage for boys (1876).

Newcastle owes its prosperity to its convenient situation on a tidal river, and to the immense stores of coal in the neighbourhood, which, besides being largely exported, have stimulated a great variety of industries which are dependent on their use. It began to export coal about the end of the 13th century, but the trade received a severe check by the Act of Edward I. which made the burning of it in London a capital offence. In the reign of Edward III. licence was granted to the inhabitants "to dig coals and stones in the common soil of the town without the walls thereof in the place called the Castle Field and the Forth." North and South Shields are both important ports at the mouth of the Tyne, and the whole of the river to about 10 miles from its mouth is lined on both sides with quays, shipbuilding yards, chemical works, furnaces, and numerous manufactories. The quay in front of the town, extending from the hydraulic bridge to the Ouseburn, forms a fine thoroughfare of about a mile in length; and by means of dredging a depth of water has been obtained at the shore permitting vessels of large tonnage to approach, although the berths of the ocean steamers are a little farther down the river. The quay is supplied with the most improved mechanical appliances, and by a double line of rails has direct communication with the North-Eastern Railway.

In 1858 the number of sailing vessels in the coasting trade that entered with cargoes was 2132 of 164,440 tons, cleared 11,172 of 1,502,813 tons; of steamers—entered 399 of 81,886 tons, cleared 429 of 97,154 tons. In the same year, in the foreign and colonial trade, the entrances with cargoes were 2555 sailing vessels of 350,190 tons, and 70 steamers of 17,248 tons; the clearances 5396 sailing vessels of 864,291 tons, and 70 steamers of 17,248 tons. In the annual statement of the shipping of the United Kingdom for 1882 the returns for the coasting trade are not given for Newcastle separately; but for the Tyne ports, which include, in addition to Newcastle, North and South Shields, the numbers were—entered with cargoes and in ballast 10,152 of 3,377,108 tons, cleared 8214 of 2,861,248 tons. The following table gives similar details of the foreign and colonial trade of the Tyne ports for the same year:—

Entered.

Ports.	British Ships.	Tonnage.	Foreign Ships.	Tonnage.	Total Ships.	Total Tonnage.
Newcastle	2,514	1,232,803	2,369	767,515	4,883	2,000,318
North Shields......	426	236,254	437	92,650	863	328,904
South Shields......	471	297,493	185	81,638	656	379,131
Tyne ports..........	3,411	1,766,550	2,991	941,803	6,402	2,708,353

Cleared.

Ports.	British Ships.	Tonnage.	Foreign Ships.	Tonnage.	Total Ships.	Total Tonnage.
Newcastle..........	4,115	2,233,373	3,166	1,056,721	7,281	3,290,094
North Shields	633	334,077	447	79,042	1,080	413,119
South Shields......	368	253,150	95	42,632	463	295,782
Tyne ports..........	5,116	2,840,600	3,708	1,158,395	8,824	3,998,995

In 1878 the value of the imports of foreign and colonial merchandise for Newcastle was £5,367,931, and for the whole Tyne ports £6,540,359; in 1882 the values were £7,650,085 and £9,028,925 respectively. The value of the exports of the produce of the United Kingdom for Newcastle in 1878 was £3,712,899, and in 1882 £4,597,700,—the value for the whole Tyne ports being £4,128,227 in 1878, and £5,337,983 for 1882. Besides coal, which is brought down the river in broad boats called keels, and of which 4,557,277 tons left Newcastle by sea in 1882, the principal exports are coke, iron, machinery, chemicals, alkali, glass, hardware, earthenware, and pig and sheet lead. The imports include various ores and chemical substances, timber, corn, provisions, and cattle. There is regular steam communication with the principal British ports, the Baltic ports, Norway, Montreal, and New York. The number of vessels built at Newcastle in 1882 for British owners was 75 of 85,121 tons, of which 68 with a tonnage of 82,468 were iron, and 3 with a tonnage of 1785 were steel. In the same year there were built for foreigners 25 ships of 27,102 tons burden. The principal other industrial establishments of the town and neighbourhood are engineering and machinery shops, ordnance works, including the well-known Armstrong factory at Elswick, alkali manufactories, sheet and plate glass works, bottle works, stained glass works, potteries for earthenware, coachbuilding yards, hat factories, chemical works, sail, cable, and anchor works, and manufactories of nails, files, and spades and shovels. Within the present century the population of Newcastle has more than quadrupled. In 1781 the houses numbered 2389, with an estimated population of 30,000. The census of 1801 gave the number of houses as 3141 and the population as 28,294; the numbers in 1821 were 4031 and 35,181; in 1871 they were 16,460 and 128,443; and in 1881 they had increased to 20,264 and 145,359. The number of males in 1881 was 71,100, and of females 74,259. The area of the municipal and parliamentary borough is 5371 acres.

History.—Newcastle owes its origin to the *Pons Ælii* mentioned above. The most important relics of Roman occupation are a well in the centre of the buildings of the old castle, a mutilated statue of Hercules and a figure of Mercury preserved in the castle, numerous coins, altars, and various specimens of Roman pottery. The foundations of the old Roman bridge, with the remains of the piers, were discovered during the dredging operations after the destruction of the old wooden bridge in 1771. On account of its position as a fortified town affording protection to the inhabitants of the monasteries of Tynemouth, Jarrow, Lindisfarne, and Wearmouth, Newcastle was known in early times as Monkceastre or Monkchester; along with these monasteries it was ravaged by the Danes, who massacred the monks and nuns within its walls. After the union of the kingdom under Egbert it continued till the Conquest to be the residence of the earls of Westmoreland and Northumberland. The town was destroyed by William the Conqueror in 1068, after he had defeated Edgar Atheling and Malcolm of Scotland on Gateshead Fell, but in 1080 a fortress was reared at it by Robert Courthose, eldest son of the Conqueror, which, in contradistinction to the old fortress, was named Newcastle, and formed the nucleus of the present town, burgesses being gathered round the fortress to defend the country against the Scots. After the conspiracy of the barons under Earl Mowbray the town was stormed and taken by William Rufus in 1095. After the death of Henry I. it was seized by the Scots under David, and it remained in their possession until 1157, when it was restored by treaty to Henry II., who established at it a mint. The town was, under the three Edwards, the chief rendezvous of troops for the invasion of Scotland. In the reign of Edward I. it was surrounded by walls, after which it withstood attempts of the Scots to capture it in 1322, 1342, and 1389. In 1640 it was taken by the Scottish Covenanters under Leslie, who held it for a year, and are said to have destroyed most of the public documents. After the battle of Marston Moor it was besieged and taken by the Scots in October 1644, from which time it was held by the Parliament till the close of the war. When Charles gave himself up to the Scottish army at Newark-upon-Trent, they took him to Newcastle, where he remained in their hands until, on the 28th January 1647, he was delivered up to the Parliament.

Newcastle is a borough by prescription, and was first incorporated by Henry II. In the reign of Henry III. the government was vested in a mayor chosen by the burgesses, in lieu of a provost appointed by the crown. In 1400 it obtained a charter from Henry IV. constituting it a county in itself, with lord-lieutenant, sheriff, and magistrates of its own. Its privileges were confirmed and extended by Queen Elizabeth in 1589. Though it still retains the constitution of a county, the old corporation was dissolved by the Municipal Act of 1835, and the government vested in a mayor, sixteen aldermen, and forty-eight town councillors. Since 1282 it has returned two members to parliament. The gross estimated rental of the borough in 1871 was £457,868, and the rateable value £402,030; in 1882 these were £808,961 and £714,470.

Among the eminent persons who have been connected with Newcastle are Ridley the martyr, Akenside the poet, Hutton the mathematician, Brand the antiquary, Lords Eldon and Stowell, Lord Collingwood, Thomas Bewick, and George and Robert Stephenson.

See *Chorographia, or a Survey of Newcastle-upon-Tine*, by W. G., 1649, reprinted 1813 and 1818; John Bell, *Collections for a History of Newcastle-on-Tyne*, 1833; and Histories of Newcastle on-Tyne, by Bourne (1736), Brand (1789), and Mackenzie (1827).

NEWCASTLE, a city of New South Wales, and the principal seaport on the northern coast, is situated on a steep acclivity rising from the sea, at the mouth of the Hunter river, about 75 miles north of Sydney. It is a well-built town, and most of the streets are paved, and lighted with gas. For the water supply a reservoir has been constructed on Monument Hill capable of holding 500,000 gallons. Among the public buildings the principal are the court-house, the lunatic asylum, the grammar school, the school of arts (with a library of over 4000 volumes), the Victoria market building, and the custom-house. The harbour, which is defended by a fort, and protected by a breakwater rendering it more easy of access in stormy weather, affords ample accommodation for present requirements, and has a depth at the shores of 23 feet. In 1883 the number of vessels that entered was 945 of 656,906 tons, the number that cleared 1305 of 925,926 tons. There is daily communication with Sydney by two lines of steamers. Besides the agricultural produce of the Hunter river district, the principal export is coal from the extensive mines in the neighbourhood of the town, which give employment to over 5000 men. The industries of the town include copper and iron founding, engineering, carriage building, shipbuilding, and brewing. The population of the census district in 1881 was 15,595.

The mouth of the Hunter river was discovered in 1797. The station, which for a long time was a convict depôt, was formerly called Port Hunter. In 1821 it became a free settlement, and in 1859 it was erected into a municipality, since which time its progress has been very rapid.

NEW CASTLE, a post-borough of the United States, the capital of Lawrence county, Pennsylvania, 2 miles above the junction of the Shenango and Mahoning (subtributaries of the Ohio), and 45 miles north-north-west of Pittsburg. It contains blast furnaces, rolling-mills, iron and brass foundries, tube-works, boiler-works, machine shops, planing-mills, nail factories, glass-works, grist-mills, and breweries. The population increased from 6164 in 1870 to 8418 in 1880, and was estimated at upwards of 13,000 in 1883.

NEWCASTLE-UNDER-LYME (or Lyne), a municipal and parliamentary borough of Staffordshire, England, is situated on a small stream, the Lyme brook, and near the Grand Trunk Canal, 16 miles north-north-west of Stafford, and 35 south from Manchester. The parish church of St Giles was, with the exception of the old square tower, which dates from the 12th century, rebuilt (1873–76) from the plans of Sir Gilbert Scott, in the Decorated style, at a cost of £15,000. The free grammar school, originally founded in 1602, possesses very large endowments, increased by the amalgamation of various subsequent bequests for educational purposes, and now consists of a high school for boys, a middle school for boys, and Orme's school for girls. The high school is a fine structure of red brick in the Elizabethan style, erected in 1874 at a cost of £12,000. There are also national and board schools and a school of art. The other principal buildings are the town-hall, recently rebuilt, the covered market (1854), and the militia barracks. The manufacture of hats was at one time the staple trade, but it has now greatly declined. There are silk, cotton, and paper mills; and tanning, brewing, malting, and sugar-refining are also carried on. In the neighbourhood there are large collieries. The population of the parliamentary borough was 15,948 in 1871, and in 1881 it was 17,493. The municipal borough, which was slightly increased in extent in 1877, had 17,506 inhabitants in 1881.

The town, which was of some importance before the Conquest, derives the name Newcastle from the rebuilding of the castle in the reign of Henry I. The addition Lyme was due to the neighbouring extensive forest of Lyme, which stretched into Cheshire. The town and manor reverted in 1231 to Henry III. In 1263 the town and castle were bestowed on Simon de Montfort, on whose death they were forfeited to the crown. The town received its first charter from Henry II., and this was extended by Henry III. and Elizabeth. It possessed the privilege of returning two members to parliament some time before 1352.

NEWCASTLE, Dukes of. Within the space of a century there were no less than four successive creations of dukes of Newcastle. William Cavendish, nephew of the first earl of Devonshire, was raised to the dignity of duke of Newcastle-upon-Tyne in 1664. His son and successor Henry died leaving daughters only, and one of these married John Holles, earl of Clare, who was created duke in 1694. This duke died also without male issue in 1711, leaving his estates to his sister's son Thomas Pelham, who, with other dignities, had the title of duke of Newcastle-upon-Tyne conferred on him in 1715, and a second and similar ducal title (that of Newcastle-under Lyme) in 1757. His first dukedom became extinct at his death, but the second title was granted him with remainder to the earl of Lincoln, at once his nephew and nephew-in-law, whose descendants (Pelham-Clintons) have been dukes of Newcastle-under-Lyme in direct lineal succession down to the present time. Two of the dukes of Newcastle, and one duchess, call for separate notice:—

I. **William Cavendish, duke of Newcastle** (1592–1676), son of Sir Charles Cavendish, youngest brother of the first earl of Devonshire, by Catherine, daughter of Cuthbert Lord Ogle, was born in 1592. In his early years he showed little inclination for study, and while at St John's College, Cambridge, he took "more delight in sports than in learning.". At an early age he acquired marvellous proficiency in horsemanship and weapons, "which increased much his father's hopes of his future perfections." His personal beauty and manly accomplishments gained him special favour at the court of James I., who, when his son Henry in 1610 was created prince of Wales, made Cavendish a knight of the Bath. Ten years afterwards he became Viscount Mansfield and in 1628 earl of Newcastle-upon-Tyne. In 1638 he was appointed by Charles I. governor of Charles, prince of Wales. When the king in 1639 visited Scotland, he was entertained with great splendour by the earl of Newcastle at Welbeck. On the outbreak of the civil war the earl was appointed governor of the town of Newcastle and the four neighbouring counties, and a short time afterwards he was named general of the forces north of the Trent. In this position his energy and circumspection proved invaluable to the royal cause. For his victory over Fairfax at Adderton Heath, near Bradford, June 30, 1643, he was created marquis. The Parliamentary generals were step by step losing their hold on the north, and were reduced to the hardest straits, when they were relieved by a Scottish army under the earl of Leven. Newcastle had to fall back on York, where he was closely besieged when Prince Rupert hurried to his assistance. Contrary to his advice Prince Rupert risked the battle of Marston Moor, which resulted in the utter rout of the royal forces and the ruin of the king's cause in the north of England. Newcastle, with about eighty gentlemen, retired to the Continent. He returned with Charles II. at the Restoration, when he was appointed chief justice of the counties north of the Trent, and in 1664 he was created duke. From this time, however, he ceased to take an active part in political life, occupying himself chiefly with literary pursuits and the retrievement of his broken fortunes. He died December 25, 1676, and was buried in Westminster Abbey.

Dryden's *Even Song* is dedicated to Newcastle in very eulogistic terms. The duke, besides publishing *A New Method and Extraordinary Invention to Dress Horses*, 1667, which had previously appeared in 1657 in French, was the author of several comedies, including *The Exile* (doubtful); *The Country Captain*, 1649; *Variety*, 1649; *The Humorous Lovers*, 1677. He also translated Molière's *L'Étourdi* under the title *Sir Martin Mar-All*. His wife's *Life* of him is noticed below.

II. **Margaret Lucas, duchess of Newcastle** (*c.* 1625–1673), second wife of the duke of Newcastle noticed above, was born about 1625, the youngest daughter of Thomas Lucas of St John's, near Colchester, Essex. She joined the court at Oxford in 1643 as maid of honour to Henrietta Maria, and met there the marquis (afterwards duke) of Newcastle, whom she married at Paris in 1645, after the battle of Marston Moor. Throughout life they continued to cherish a mutual admiration of a very exaggerated character, each regarding the other as endowed with transcendent merits both of person and mind. The duchess cultivated literary composition with exuberant fervour, and kept a bevy of maids of honour obliged to be ready at all hours "to register her Grace's conceptions." Walpole speaks of her as a "fertile pedant" with an "unbounded passion for scribbling"; and, although giving evidence of learning, ingenuity, and imagination, her writings are fatally marred by a deficiency in judgment and self-restraint.

She is best known by *The Life of the Thrice Noble, High, and Puissant Prince, William Cavendish, Duke, Marquess, and Earl of Newcastle; written by the Thrice Noble, Illustrious, and Excellent Princess, Margaret, Duchess of Newcastle, his Wife*, originally printed by A. Maxwell at London in 1667. She also published *Philosophical Fancies*, 1653; *Poems and Fancies*, 1653; *The World's Olio*, 1655; *Nature's Picture drawn by Fancie's Pencil to the Life*, which includes an autobiography, 1656; *Philosophical and Physical Opinions*, 1655; *Orations*, 1662; *Plays*, 1662; *Sociable Letters*, 1664; *Observations upon Experimental Philosophy*, 1666; *Letters and Poems*, 1676. Her *Select Poems* were edited by Brydges in 1813, and her *Autobiography* in 1814. The latter, edited by Lower, was published along with her *Life of the Duke of Newcastle* in 1872.

III. **THOMAS PELHAM HOLLES, DUKE OF NEWCASTLE** (1693–1768), who was for thirty years one of the two secretaries of state, and for seven more prime minister, and whose official life extended throughout the Whig supremacy of the 18th century, was the elder son of Thomas, first Lord Pelham, by his second wife Lady Grace Holles, younger sister of John Holles, duke of Newcastle-on-Tyne. Born in 1693, he was educated at Westminster and at Clare Hall, Cambridge. In 1711 his uncle the duke of Newcastle died, and left the whole of his vast estates to him. In 1712 he also succeeded his father in his peerage and estates, and in 1714, when he came of age, was one of the greatest landowners in the kingdom. He vigorously sustained the Whig party at Queen Anne's death, and had much influence in making the Londoners accept King George. His services were too great to be neglected, and in 1714 he was created earl of Clare, and in 1715 duke of Newcastle in Northumberland. He also became lord-lieutenant of the counties of Middlesex and Nottingham and a knight of the Garter in 1718, in which year he increased his Whig connexion by marrying Lady Henrietta Godolphin, granddaughter of the great duke of Marlborough. In 1717 he first held political office as lord chamberlain of the household, and in 1724 was chosen by Sir Robert Walpole to be secretary of state in place of Lord Carteret. This office he held continuously for thirty years (1724–1754), and only changed it for the premiership on his brother's death. His long tenure of office has been attributed to his great Whig connexions and his wealth, but some praise must be given to his inexhaustible activity and great powers of debate. He was a peculiarly muddle-headed man, and unhappy if he had not more to do than he could possibly manage, but at the same time he was a consummate master of parliamentary tactics, and knew how to manage the Houses of Lords and Commons alike. Lord Hervey compares him with Walpole in 1735, and says—"We have one minister that does everything with the same seeming ease and tranquillity as if he were doing nothing; we have another that does nothing in the same hurry and agitation as if he did everything." He continued in office on Walpole's fall in 1742, and became more powerful on his younger brother Henry becoming prime minister in 1743. On Henry Pelham's death in March 1754, Newcastle succeeded him as premier; but people who had been accustomed to him as secretary of state would not stand him as premier, and in November 1756 he gave place to the duke of Devonshire. For his long services he was created duke of Newcastle-under-Lyme, with remainder to the earl of Lincoln, who had married his niece Catherine Pelham. In July 1757 he again became prime minister—for Pitt, though a great statesman, was a bad party leader—on the understanding, according to Horace Walpole, that "Mr Pitt does everything, the duke gives everything." Under this ministry England became famous abroad, but it gradually fell before the young king's affection for Lord Bute, who, after supplanting Pitt, became prime minister in the room of Newcastle in May 1762. The duke went into strong opposition, and lost his two lord-lieutenancies for opposing the peace of 1763. In 1765 he became lord privy seal for a few months, but his health was fast giving way, and he died in August 1768. The duke was certainly not a great man, but he must have possessed far more ability than has generally been allowed to have maintained office as long as he did; he was industrious and energetic, and to his credit be it said that the statesman who almost monopolized the patronage of office for half a century twice refused a pension, and finally left office £300,000 poorer than he entered it.

The best authority for the duke of Newcastle's life is the *Memoirs of the Administration of the Right Hon. H. Pelham*, by the Ven. W. Coxe, 1829. See also the histories of his time, and such books as Lord Hervey's *Memoirs* and Horace Walpole's *Letters*.

NEW-CHWANG, a city of China, in the Manchurian province of Liau-tung (Shing-king or Fing-tien), is situated in 40° 25′ N. lat. and 122° 40′ E. long., about 35 miles (90 miles by water) from the coast of the Gulf of Liau-tung, on what is now a small branch of the main eastern affluent of the Liau-ho or Sua-muren. The city proper is a comparatively unimportant place with broken-down walls, but it is surrounded by a number of large and most flourishing suburbs. About the beginning of the present Ta-tsing dynasty (1644) New-chwang was the chief port on the river, but in the reign of Keen-lung, owing mainly to physical changes, it was supplanted by Tien-chwang-tai farther down the stream, and towards the close of the 18th century this had in turn to give place to Ying-tze still nearer the mouth. In ignorance of these facts New-chwang (now scarcely to be reached by a flat-bottomed river boat) was chosen as one of the ports to be opened to foreign trade by the treaty of Tien-tsin; and, though Ying-tze had of necessity to be adopted as the site of the foreign settlements, Europeans still continue to speak of the port of New-chwang. Ying-tze (otherwise known as Ying-kow, New-kow, and in Mandarin as Muh-kow-ying) lies on the left bank of the Liau-ho on the lowest dry portion of the plain, not much above high-water mark. The British settlement immediately above the town has a river frontage of 1000 yards opposite the deepest of all the reaches, and runs back to the highway leading to New-chwang. Off the mouth of the river there is an extensive bar of hard mud which can only be crossed by certain channels at high tide, when it is covered by from 18 to 20 feet of water; and the port is altogether closed by ice for four or five months of the year between November and May. But in spite of these drawbacks Ying-tze is the seat of an extensive and growing trade. The staple articles of export are pulse (beans), pulse-cake, and pulse-oil; and pulse-warehouses and pulse-mills are the characteristic buildings of the town. The cake is a popular article of food with the natives of Kwang-tung and Fuh-keen, and is also largely employed for manuring the rice and sugar fields in the neighbourhood of Shanghae, Amoy, Swatow, &c. Other leading articles of export are castor oil, raw silk, ginseng, and samshu,—this last manufactured with great success in the city of New-Chwang, but very badly in Ying-tze. The port was opened to foreign trade in 1858; in 1882 316 vessels (of 152,871 tons) entered. The total value of the trade was £934,374 in 1864, £2,606,134 in 1878, and £1,904,740 in 1882. In 1864 Mr Meadows Taylor estimated the population of Ying-tze as about 80,000, though the mandarins stated it to be 200,000.

NEWCOMEN, THOMAS, one of the inventors of the steam-engine, was a native of Devonshire, and was born about the middle of the 17th century. While employed as an ironmonger in Dartmouth he corresponded with Robert Hooke about the previous investigations of Papin and the marquis of Worcester as to the applicability of steam-power for the purpose of driving machinery, and in conjunction with Cawley, a glazier in Dartmouth, and Savary, the manager of a Cornish mine, he obtained in 1705 a patent for a "fire-engine," now known as the "atmospheric steam-engine," which was the first piece of mechanism in which steam was used with practical success. He died about 1713. See STEAM-ENGINE.

NEW ENGLAND is the north-eastern portion of the United States, comprising the six States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island. It formed part of the territory of "North Virginia" granted by James I. to the Plymouth Company in 1606; and in 1614 the name of New England was bestowed upon it by Captain John Smith (1579–1631), whose *Description of New England* appeared at London in 1616.

NEWFOUNDLAND. This island, which is a British colony, lies off the eastern coast of North America, directly across the Gulf of St Lawrence. Its south-western extremity approaches within 50 miles of Cape Breton, while its most easterly projection is only 1640 miles from Valentia, on the coast of Ireland. It is situated between 46° 36′ 50″ and 51° 39′ N. lat., and between 52° 37′ and 59° 24′ 50″ W. long. Its greatest length, from Cape Ray to Cape Norman, is 317 miles; its greatest breadth, from Cape Spear to Cape Anguille, 316 miles; and the total area about 42,000 square miles. Its figure roughly approaches an equilateral triangle. Two large peninsulas project from the main body of the island. One of these (Petit Nord) points northwards, and is long and narrow. The other is the peninsula of Avalon, pointing south-east, and almost severed from the principal portion of the island, the connexion being a narrow isthmus, in one place but 3 miles in width. On the eastern side of the Avalon peninsula is situated St John's, the capital. Owing to its extensive frontage on the Atlantic, its numerous good harbours, and its proximity to the Banks[1] and the smaller fishing grounds, Avalon is the most thickly populated and commercially important part of the island.

Physical Features.—The shores of Newfoundland present generally a rock-bound aspect when seen from the ocean, but the line of cliffs (200 to 300 feet in height) is broken by numerous magnificent bays, running in some instances 80 to 90 miles inland, and throwing out smaller arms in all directions, so that, though the circumference of the island, measuring from headland to headland, is about 1000 miles, the actual length of coast-line is more than twice as great. The bays frequently present scenes of much beauty, being studded with islands, and having their shores clad in dark green forests to the water's edge.

The part of the island nearest the sea consists of a hilly country with eminences of no great elevation. The interior proper consists of an elevated undulating plateau, traversed here and there by ranges of low hills, the surface being diversified with valleys, woods, lakes, ponds, and marshes. Much of this is a savanna country, sustaining vast herds of reindeer. All the great hill ranges take a north-easterly and south-westerly direction, the highest land occurring along the western and southern shores. The principal mountain chain, the Long Range, extends along the western side of the island for nearly its entire length, and has peaks more than 2000 feet high, and parallel to this, but nearer the coast, is the Cape Anguille range. The peninsula of Avalon is very hilly; but the highest summits do not exceed 1500 feet. The country is remarkable for a number of isolated sharply-peaked summits which rise abruptly here and there from the level plain, and bear the local name of "tolts."

The largest river is the Exploits, 200 miles in length, and having a drainage area of between 3000 and 4000 square miles. It rises in the extreme south-western angle of the island, and flows in a north-easterly direction through Red Indian Lake, terminating in the Bay of Exploits, Notre Dame Bay. The valley through which it flows contains large areas of fertile land, capable of yielding crops of all kinds, and in many places is covered with pine forests containing timber of large growth. The next largest river is the Humber, which rises 20 miles inland from Bonne Bay, and after a circuitous course empties itself into Deer Lake, thence flowing into the Bay of Islands. It drains an area of 2000 square miles. The Gander, which rises near the southern coast, and, flowing through Gander Lake, falls into Gander Bay on the east, has a drainage area of 2500 square miles.

One of the most remarkable of the physical features of the island is the immense number of lakes and ponds, which occupy nearly a third of the whole surface. The largest is Grand Lake, 56 miles in length, and covering an area of 192 square miles. It contains an island 22 miles in length and 5 in breadth. Red Indian Lake is 37 miles long and 64 square miles in area; Gander Lake and Deer Lake occupy 33 and 24 square miles respectively; Sandy Lake, Victoria, Hind's, Terra Nova, and George IV. Lakes range next in size. The shores of these great lakes, and the fertile valleys through which their rivers flow, are as yet absolute solitudes, the very existence of which was until recently all but unknown.

Of the bays already alluded to, special mention may be made of St Mary's Bay (25 miles wide at the mouth and 35 miles long, with two arms—Salmonier and Colinet—which stretch still farther into the interior), Placentia Bay (55 miles wide at the entrance and 90 miles long), Fortune Bay (25 miles wide and 70 in length, with numerous arms, the chief of which are Bay D'Espoir, Hermitage Bay, and Connaigre Bay). At the entrance of Fortune Bay are the two islands of St Pierre and Miquelon, ceded by treaty to France for the shelter of its fishermen, and now all that remains to France of the vast possessions it once held in North America. Around Bay St George, on the western coast (40 miles wide at the mouth and with a good harbour at its head), are some of the most fertile valleys in the island, with fine forests of timber, and a coal-field of large extent. Bay of Islands has three fine arms running 20 miles inland. It is the seat of a valuable herring fishery. Notre Dame Bay is 50 miles wide at its mouth, and runs inland 70 or 80 miles. On its shores are the now famous copper mines, which are worked with great success.

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[1] These Banks, which have played such an important part in the history of the colony, and are the chief source of its wealth, stretch for about 800 miles in a south-east direction towards the centre of the North Atlantic, and probably at one time formed a part of the North American continent. The depths range from 15 to 80 or 90 fathoms. The deposits consist of sand and gravel composed of ancient rocks, and fragments of quartz, mica, hornblende, felspars, and magnetite; along with these are many calcareous fragments of echinoderms, polyzoa, and many foraminifera. In the deeper parts there is sometimes a fine mud containing the above-mentioned minerals and calcareous fragments, and in addition numerous frustules of diatoms. The Banks are swept by the cold Labrador current, and icebergs are frequently stranded upon them. The Gulf Stream passes over their southern portions. These two currents bear along many species of pelagic algæ and animals, which supply abundant food to the myriads of echinoderms, molluscs, annelids, cœlenterates, and other invertebrates which live at all depths on the Banks. These invertebrates in turn supply food to the cod and other fishes which are sought for by the fishermen. Sea birds frequent the Banks in great numbers; and, as diving birds are not met with at any great distance from them, the presence of these in the sea gives seamen an indication of the shallower water.

Bonavista Bay is of great extent, contains numerous groups of islands, and presents some of the finest scenery in the island. Conception Bay is the most populous and commercially important, having on its shores towns and villages containing a population of 42,000. The harbour of St John's is spacious and well sheltered.

Geology.[1]—All the great ancient rock systems, between the Lower Laurentian and the Coal-measures, are more or less represented at one part or another of Newfoundland.

The Laurentian system has an immense spread in the island. It constitutes the principal mountain ranges, coming to the surface through the more recent deposits, on the axes of anticlinal lines, or brought up by great dislocations, most of which trend nearly parallel with each other in a general bearing of about north-north-east and south-south-west. The Laurentian gneiss of the Long Range, on the western side, extends in a nearly straight course from Cape Ray to the headwaters of the Castor in the great northern peninsula. On the south-western extremity of the island these rocks occupy the coast from Cape Ray to La Poile. They are largely exhibited on the Grand Lake, running in a spur from the Long Range between it and the Red Indian Lake, and bearing for the south-eastern shores of Hall's Bay. The central portion of the northern peninsula is Laurentian, which also spreads over a wide expanse of country between Grand Lake and the Humber and Exploits rivers, and shows itself on the coast between Canada Bay and White Bay. Another range of Laurentian comes up in the district of Ferryland, and shows itself occasionally on the coast of Conception Bay. Thus more than half the island is Laurentian.

Three-fourths of the peninsula of Avalon are Huronian, a formation which does not extend west of Fortune Bay. The town of St John's and, in fact, nearly all the settlements between Fortune Bay and Bonavista Bay are built upon it. Signal Hill, overlooking the harbour of St John's, is capped with the sandstone of this formation. The whole Huronian system is not less than 10,000 feet thick, and has been cut through by denudation to the Laurentian floor. The rocks of the Primordial Silurian age are spread unconformably over the area thus ground down. These evidences of denudation and reconstruction are very clear in Conception Bay, where the rocks of the intermediary system have been ground down to the Laurentian gneiss, and, subsequently, the submarine valley thus formed has been filled up with a new set of sediments, the remains of which are still to be found skirting the shores of the bay and forming the islands in it.

Rocks of the Silurian age are most extensive on the peninsula of Cape St Mary, and around the head of Trinity Bay. These belong to the Primordial Silurian group. The Lower Silurian rocks have a large development, and in them the metallic ores occur which seem destined to render the island a great mining centre. The Lauzon division of the Quebec group, which is the true metalliferous zone of North America, has an immense spread in the island. It consists of serpentine rocks associated with dolomites, diorites, &c., and is well known throughout North America to be usually more or less metalliferous. The Newfoundland rocks are no exception, but give evidence of being rich in metallic ores. The Middle Silurian division of rocks is also widely spread; and the most fertile belts of land and the most valuable forests are nearly all situated on the country occupied by this formation. The great valley of the Exploits and Victoria rivers, the valley of the Gander, and several smaller tracts belong to it.

The Carboniferous series occupies a large area on the western side of the island, in the neighbourhood of St George's Bay and Grand Lake. There is also a wider spread of the same series along the valley of the Humber and round the shores of Deer Lake and the eastern half of Grand Lake, and as far as Sandy Lake. "Coal," says Mr Howley, "is known to exist at several places in this series; and seams, apparently of workable thickness, judging from their out-crops, occur on the Middle Barachois and Robinson's Brook, in St George's Bay."

It will thus be seen that the Carboniferous series is confined to the western side, while the middle, eastern, and southern portions are occupied by Silurian, Huronian, and Laurentian formations. From the extent to which the Lauzon division of the Quebec group, the true metalliferous zone of North America, prevails in the island, its yet undeveloped mineral wealth must be very great, while it is fitted to sustain a large agricultural population.

Climate.—The climate is more temperate than that of most portions of the neighbouring continent. It is but rarely, and then only for a few hours, that the thermometer sinks below zero in winter, while the summer range rarely exceeds 80° Fahr., and for the most part does not rise above 70°. The Arctic current exerts a chilling influence along the eastern coast, but as a compensation it brings with it the enormous wealth of commercial fishes and seals which has rendered the fisheries the most productive in the world. The Gulf Stream, while it creates fogs, modifies the cold. The salubrity of the climate is evidenced by the robust healthy appearance of the inhabitants. Open fireplaces are sufficient to warm the houses, and free exercise in the open air is attainable at all seasons. The average mean temperature at St John's for eight years ending 1864 was 41°·2 Fahr., the maximum being 83° and the minimum 7°; the average height of the barometer was 29·37 inches.[2] The average rainfall is 58·30 inches. Winter sets in, as a rule, in the beginning of December, and lasts until the middle of April. Generally the snow lies during this period, and the frost rarely penetrates the ground to a greater depth than a few inches. Spring is sometimes late in arriving, but once vegetation sets in it advances with marvellous rapidity. The autumn is usually very fine, and is often prolonged till November. There is nothing in the climate to interfere with agriculture. Tornadoes are unknown, and thunderstorms are very rare. Fogs, of which so much is said in connexion with the country, are confined to the shores and bays of the south-eastern and southern coasts.

Fauna.—Among the well-known wild animals indigenous to the country the caribou or reindeer hold a conspicuous place. They migrate regularly between the south-eastern and north-western portions of the island. The winter months are passed in the south, where "browse" is plentiful, and the snow is not too deep to prevent them from reaching the lichens on the lower grounds. In March they begin their spring migration to the barrens and mountains of the north-west. In May or June they bring forth their young. As soon as the frosts of October begin to nip the vegetation they turn south. September and October are the best months for stalking. In addition to the caribou, the wolf and black bear are found in the interior; the fox (black, silver, grey, and red), beaver, otter, arctic hare, North-American hare, weasel, bat, rat, mouse, and musquash or musk-rat are numerous. The famous Newfoundland dog is still to be met with, but good specimens are rare, and he appears to thrive better elsewhere. The common dogs are a degenerate mongrel race. It is estimated that there are three hundred species of birds in the island, most of them being migratory. Among them may be enumerated the eagle, hawk, owl, woodpecker, swallow, kingfisher, six species of fly-catchers and the same number of thrushes, warblers and swallows in great variety, finches, ravens, jays. The ptarmigan or willow grouse is very abundant, and is the finest game-bird in the island. The rock ptarmigan is found in the highest and barest mountain ridges. The American golden plover, various species of sandpipers and curlews, the brent goose, ducks, petrels, gulls, and the great northern diver are met with everywhere. The great auk, now extinct, was once found in myriads around the island. The little auk, guillemot, and the razor-billed auk are abundant. No venomous reptiles, toads, or frogs occur. Of molluscous animals the common squid, a cephalopod about 6 or 7 inches in length, visits the coasts in immense shoals in August and September, and supplies a valuable bait. A gigantic species of cephalopod was discovered in 1873, which excited much interest among naturalists: the body varies from 7 to 15 feet in length, with a circumference of 5 or 6 feet; from the head ten arms radiate, the two longest (tentacles) being from 24 to 40 feet in length, and covered with suckers at their extremities; the other eight arms vary from 6 to 11 feet, and on one side are entirely covered with suckers. Professor Verrill, of Yale College, has distinguished two species—one he named *Architeuthis Harveyi*, after the discoverer, and the other *Architeuthis monachus*.

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[1] The geological survey of the island was commenced in 1864, and has been prosecuted steadily since; the results are embodied in *The Geological Survey of Newfoundland*, by A. Murray, C.M.G., 1881.

[2] See *Tables of Aqueous Precipitation for Series of Years*, collected by the Smithsonian Institution, United States, 1872.

Flora.—The pine, spruce, birch, juniper, and larch of the forests of the interior furnish ample materials for a large timber trade as well as for shipbuilding purposes. The white pine grows to the height of 70 or 80 feet in some places, and is 3 or 4 feet in diameter. The mountain ash, balsam poplar, and aspen thrive well. Evergreens are in great variety. The berry-bearing plants cover large areas of the island. The maidenhair or capillaire yields a saccharine matter which is lusciously sweet. Flowering plants and ferns are in vast varieties, and wild grasses and clover grow luxuriantly. Garden vegetables of all kinds, and strawberries, raspberries, gooseberries, currants, &c., thrive well.

Fisheries.—These constitute the grand staple industry of the country. The most important is that of the cod, which is the most extensive of the kind in the world. During six years from 1877 to 1882 the average annual export of codfish from Newfoundland amounted to 1,326,259 quintals (cwts.). (For earlier statistics see FISHERIES, vol. ix. p. 266.) The cod are taken on the shores of the island, on the Banks, and along the coast of Labrador. The Bank fishery is now prosecuted chiefly by the French and by Americans, Newfoundlanders occupying themselves with the shore and Labrador fishery. The aggregate annual catch of cod at present in the North-American waters is estimated at 3,700,000 quintals, say 150,000,000 fish. The value at $4 a quintal would be $14,800,000. Nearly four-fifths of the entire returns of the Newfoundland fisheries arise from the cod fishery.

While the cod fishery does not show any marked advance in the quantities taken during the last thirty years, the market value of dried codfish has risen more than 50 per cent., and the average value of the exported products of the fishery may be fairly reckoned at $5,500,000 per annum. Adding to this the local consumption, we must place the entire annual value at $6,364,000, or £1,325,834 sterling.

The last census (1874) showed that there were 26,377 able-bodied fishermen in the colony, and 45,845 persons engaged in catching and curing fish out of a population of 161,374, 1197 vessels of a tonnage of 61,551 tons, 8902 fishing rooms in actual use, and 18,611 boats employed in the shore fishery. There are now (188[illegible]) about 53,000 persons engaged in catching and curing fish out of a population exceeding 180,000. The French Newfoundland fisheries on the Banks and along the shores average from 400,000 to 500,000 quintals,—the number of men employed being 5000 to 6000.

The cod fishery has been prosecuted for about 380 years, but, notwithstanding the enormous drafts every year, to all appearance the cod are as abundant as ever. They begin to appear on the coasts of the island about the first of June, at which time they move from the deep waters of the coast to the shallower and warmer waters near the shore, for spawning purposes. Their approach is heralded by the caplin, a beautiful little fish about 7 inches in length, vast shoals of which arrive, filling every bay and harbour. The cod follow in their wake, feasting greedily upon the caplin, which supply the best bait. In six weeks the caplin disappear, and their place is taken by the squid about the 1st of August. These also supply a valuable bait, and are followed by the herring, which continue till the middle or end of October, when the cod fishery closes. The cod are taken by the hook-and-line, the seine, the cod-net or gill-net, the cod-trap, and the bultow. Newfoundland exports cod to Brazil, Spain, Portugal, Italy, Great Britain, the West Indies, and the United States. Brazil and Spain are the largest consumers.

Next to the cod fishery in value comes that of the seal, which is not more than eighty years old. At present the average annual value of the seal fishery is about $1,100,000, being an eighth part of the entire exports. The number of men employed is from 8000 to 10,000. Steamers were first used in 1863, and now there are about 25 engaged, some of them from 400 to 500 tons burthen; sailing vessels are rapidly diminishing in numbers. According to law, no sailing vessel can clear for the seal fishery before the 1st of March, and no steamer before the 10th. The young seals are born on the ice from the 15th to the 25th of February, and increase in bulk so rapidly that they are in perfect condition by the 20th March.

The seals frequenting the coasts of Newfoundland have regular migratory movements. They are found on the ice from the middle of February till May, when they commence their northerly movement. In June they are seen in enormous numbers on the Greenland coast, where they spend two or three months. As the early winter sets in they begin their southern migration, keeping ahead of the ice as it forms, and moving towards the coast of Labrador, feeding in its fiords and bays. Reaching the Great Banks by the close of the year, they feed there till the beginning of February, when their northern migration begins, to meet the ice on which their young are to be brought forth and cradled. For more than sixty years they have borne an annual draft of from a quarter to half a million without showing any sensible diminution in their numbers, but the introduction of steam has given increased facilities for following the old seals at a later period of the season, and for shooting them on the ice,—a practice which may ultimately lead to their extermination.

There are no finer salmon streams than those of Newfoundland, but no proper measures have been taken for their preservation, and in consequence such practices as closing the mouths of the rivers with nets at a time when the fish are ascending to spawn, and constructing weirs, traps, and dams, have been followed to such an extent that in many of the rivers salmon are almost exterminated. The average value of the pickled and fresh salmon exported, during the last ten years, has been about $106,000 per annum. Until recently the chief mode of curing the salmon was salting. In 1842 the export was 4715 tierces; in 1871, 3977; in 1880, 6765; in 1881, 3689; and in 1882, 3825 tierces. The methods of preserving salmon in hermetically sealed tins and of exporting it in ice have been lately introduced with success. Of tinned salmon 34,584 ℔ were exported in 1880, 20,000 ℔ in 1881, and 10,000 ℔ in 1882, while 68,551 ℔ of frozen salmon were exported in 1881, and 313,000 ℔ in 1882.

The chief seats of the herring fishery are Fortune Bay, St George's Bay, Bay of Islands, Bonne Bay, and the whole coast of Labrador. The finest fish are those taken off Labrador and in the Bay of Islands. The average annual value of herrings exported during the seven years 1877–83 was $358,359. The value of the herrings sold to the French and Americans as bait is about $150,000 per annum. Allowing 73,000 barrels for home consumption, at $3 per barrel, we have as the total value of the annual catch of herrings $727,359.

Fifty years ago the mackerel, once very abundant, deserted the Newfoundland waters, and have not since reappeared. But few holibut or haddock are taken. Within the last few years the exportation of preserved lobsters has increased rapidly. Lobster factories have been established at various points. In 1881, 1,299,812 ℔ of preserved lobsters were exported, and 46,428 ℔ of frozen lobsters, the total value being $111,408. In 1882 the export was 1,265,224 ℔ of preserved lobsters, the value being $105,432.

Agriculture.—Up to a comparatively recent period the people of Newfoundland were so exclusively engaged in the fisheries that no attention was given to agriculture; and persons who were interested in keeping the inhabitants on the sea-coast employed in fishing systematically represented the country as hopelessly barren. That this is not the case has been conclusively proved by the geological survey. According to its *Reports* there are in the valleys on the western coast 1320 square miles "perfectly capable of being reclaimed and converted into fairly productive grazing and arable land"; and these valleys are also for the most part well wooded. In the great valleys of the Gander, Gambo, Terra Nova, and Exploits there are 3320 square miles of land suited admirably for settlement. There are also many smaller fertile tracts around the heads of the bays, along the margin of the smaller streams, and in the islands, so that in all there are 5,000,000 acres of cultivable land. At present these fertile tracts are almost wholly unoccupied, but the railway now being constructed will render them accessible and promote their settlement. The last census showed that only 34,293 acres are actually cultivated, the value of the produce being $612,350 per annum.

Minerals.—The first copper mine was opened in 1864, and at the end of 1879 the customs returns showed that copper and nickel ore to the value of £1,000,000 had been exported in the interval. At present Newfoundland stands sixth among the copper-producing countries of the world. The mines are all situated around the shores of the Bay of Notre Dame; and until the interior is opened by roads and railways this will be the chief scene of mining enterprise. From one of these mines—Betts Cove—35,000 tons of ore were taken in 1877. The ore is found in proximity to the serpentine rocks, but more immediately associated with a chloritic slate which occurs both above and below the serpentine. The area of serpentine rocks in the island is estimated at 5097 square miles. Many other minerals besides copper have been found, such as lead (in many places), silver, and magnetic iron ore; gold was recently discovered in one locality. In St George's Bay there are large workable seams of coal as yet untouched; a seam of excellent cannel coal, 3 feet in thickness, was discovered there many years ago. Mr Jukes estimated the coal basin at 25 miles by 10. Gypsum exists in great abundance in the Carboniferous region, especially at

Codroy and around St George's Bay. Marbles of almost every shade are found on various parts of the coast; limestone, granite of the finest quality, roofing slate, and building stones are abundant.

Shipping.—On December 31. 1881, the registered tonnage of the colony was 1895 vessels, having a tonnage of 89,655 tons. Of these 1866 were sailing vessels and 29 were steamers. In addition, 60 vessels were engaged in the foreign carrying trade which, though owned in Newfoundland, were registered in Britain. The number of vessels entered at the various ports in 1881 was 1366, of 158,345 tons; the number cleared was 1018, of 132,743 tons. The number of steamers cleared at the various ports in 1881 was 181, their tonnage 162,285. The total value of exports in 1882 was $8,228,291; of imports, $8,350,222.

Manufactures.—These are yet on a limited scale, and are confined to St John's. There are a boot and shoe factory, a woollen factory, two tobacco factories, three furniture factories, a rope and cordage factory, three biscuit factories, a tannery, and soap works.

Population.—The earliest estimate of the resident population of Newfoundland was made in 1654, when the total amounted to 1750. In 1680 it reached 2280; in 1763, 7000; in 1804, 20,000; in 1832, 60,000; in 1836, 75,094; in 1857, 124,288; in 1869, 146,536; and in 1874, when the last census was taken, the total population was 161,374. It is now (1883) probably 185,000. St John's, the capital, contained a population of 15,000 in 1835, and in 1882 it was close on 30,000. From 1845 to 1857 the rate of increase for the island was 25 per cent., from 1857 to 1869 18½ per cent., and from 1869 to 1874 10 per cent.

The following table shows the numerical strength of the various religious denominations in 1874:—

Church of Rome	64,317	Presbyterians	1,168
Church of England	59,561	Congregationalists	461
Wesleyans	35,702	Baptists and others	165

The Protestant portion of the population are descendants of English settlers chiefly, and the Roman Catholic portion descendants of Irish emigrants.

Education is conducted on the separate or denominational principle, each religious denomination receiving an amount for its elementary schools and academies proportionate to its numbers. The grant amounts to $98,252 per annum. The total number of scholars in attendance at the schools is 24,971, and the number of schools 416. There are four academies in St John's, and grammar schools in some of the larger towns.

Finance.—The revenue is chiefly derived from duties levied on imports. These are partly *ad valorem* and partly specific, but only to a very slight extent differential, the tariff being designed for revenue purposes only, not for protection. There are no direct taxes, and no city or town corporations. The expenses connected with the various branches of the public service are all defrayed out of the general revenue. The taxation in 1882 was only $4·94 per head of a population of 185,368. Within the last twenty years the revenue has more than doubled. In 1860 it amounted to $534,432, and in 1882 to $1,119,385. The consolidated and debenture debt of the colony on December 31, 1881, was $1,351,008. The colony has placed to its credit at 4 per cent. $757,704, being a portion of the fishery award in connexion with the treaty of Washington; and a sinking fund has been established which in twenty-one years will remove over half the public debt.

Government.—Newfoundland is a British colony, directly dependent on the crown. Representative government and a constitution were granted to it in 1832, and "responsible government" in 1855. Two legislative chambers were appointed—the house of assembly, to be elected, and the legislative council, to be nominated by the governor in council. This form of government has worked satisfactorily. It consists of a governor who is appointed by the crown, and whose term of office is usually about six years; an executive council chosen by the party commanding a majority in the house of assembly, and consisting of seven members; a legislative council or upper house, of fifteen members, nominated by the governor in council and holding office for life; and a house of assembly of thirty-three members, elected every four years by the votes of the people. There are seventeen electoral districts. The members of the lower house are elected by household suffrage. The governor receives a salary of $12,000 per annum, paid by the colony. The supreme court, instituted in 1826, is composed of a chief justice with a salary of $5000 per annum and two assistant judges with salaries of $4000. They are appointed by the crown, and hold their office for life. The jurisdiction of Newfoundland extends over the whole of the Atlantic coast of Labrador.

Roads and Railways.—The first road was made in 1825 (from St John's to Portugal Cove), and about $100,000 per annum are now devoted to making and repairing roads and bridges. At present there are 727 miles of postal roads and 1730 miles of district roads, besides 1200 miles in process of construction. In 1880 Government was authorized by the legislature to raise a loan of £1,000,000 sterling, on the credit of the colony, for the purpose of constructing a railway from St John's to Hall's Bay, the centre of the mining region, with branches to Brigus, Harbour Grace, and Carbonear, the whole length to be 340 miles. At the close of 1882 there were 45 miles open for traffic. This railway, when completed, will traverse the great valleys of the Gander and Exploits, and afford access to the finest agricultural and timber lands. In 1882 a charter was granted to "The Great American and European Short Line Railway Company" to construct another line which is to run from a point on the eastern coast to Cape Ray, the object being to shorten the route between Europe and America by crossing Newfoundland. The proposed plan is to place a line of the swiftest steamers between Newfoundland and a port on the Irish coast; the proposed railway across the island would convey passengers to Cape Ray, whence a steam-ferry would carry them to Cape North, in the island of Cape Breton, and the railway system of Canada would be reached. The company calculate on shortening the time of travel between London and New York by two days.

History.—Newfoundland, the most ancient of Great Britain's immense colonial possessions, was discovered by JOHN CABOT (see vol. iv. p. 622) in 1497. Gasper Cortoreal, who ranged the coast of North America in 1500, discovered and named Conception Bay and Portugal Cove in Newfoundland, and established the first regular fisheries on its shores. Seven years after Cabot's discoveries the fishermen of Normandy, Brittany, and the Basque Provinces were engaged in these. In 1517 40 sail of Portuguese, French, and Spaniards took part in the cod fishery. In 1578, according to Hakluyt, the number of vessels employed in it had increased to 400, of which only 50 were English, the remainder being French and Spanish. At length, however, England awoke to the importance of Cabot's great discovery, and an attempt was made to plant a colony on the shores of the island. Sir Humphrey Gilbert (see vol. x. p. 591), provided with letters patent from Queen Elizabeth, landed at St John's in August 1583, and formally took possession of the country in the queen's name. This first attempt at colonizing was frustrated by the loss of Gilbert soon afterwards at sea. In 1610 James I. granted a patent to Mr Guy, an enterprising Bristol merchant, for "a plantation" in Newfoundland; but no marked success attended his efforts to found settlements. In 1615 Captain Richard Whitbourne of Exmouth in Devonshire was despatched to Newfoundland by the British Admiralty to establish order and correct abuses which had grown up among the fishermen. On his return in 1622 he wrote a *Discourse and Discovery of Newfoundland Trade*, which King James, by an order in council, caused to be distributed among the parishes of the kingdom "for the encouragement of adventurers unto plantation there." A year after the departure of Whitbourne, Sir George Calvert, afterwards Lord Baltimore, obtained a patent conveying to him the lordship of the whole southern peninsula of Newfoundland, and the right of fishing in the surrounding waters. He planted a colony at Ferryland, 40 miles north of Cape Race, where he built a handsome mansion and resided with his family for many years. The French so harassed his settlement by incessant attacks that he at length abandoned it and went to Maryland, where he founded the city of Baltimore.

In 1650, or about a century and a half after its discovery, Newfoundland contained only 350 families, or less than 2000 individuals, distributed in fifteen small settlements, chiefly along the eastern shore. These constituted the resident population; but in addition there was a floating population of several thousands who frequented the shores during the summer for the sake of the fisheries, which had now attained very large dimensions. So early as 1626 150 vessels were annually despatched from Devonshire alone; and the shipowners and traders residing in the west of England sent out their ships and fishing crews early in summer, to prosecute these lucrative fisheries. The fish caught were salted and dried on shore; and on the approach of winter the fishermen re-embarked for England, carrying with them the products of their labour. Hence it became the interest of these traders and shipowners to discourage the settlement of the country, in order to retain the exclusive use of the harbours and fishing coves for their servants, and also a monopoly of the fisheries. They were able to enlist the British Government of the day in their project, and stringent laws were passed prohibiting settlement within 6 miles of the shore, forbidding fishermen to remain behind at the close of the fishing season, and rendering it illegal to build or repair a house without a special licence. The object of this short-sighted policy, which was persisted in for more than a century, was to preserve the island as a fishing station, and the fisheries as nurseries for British seamen.

There was, however, another element which retarded the prosperity of the country. The French had early realized the immense value of the fisheries, and strove long and desperately to obtain possession of the island. Their constant attacks and encroachments harassed the few settlers, and rendered life and property insecure during the long wars between England and France. When at length, in 1713, the treaty of Utrecht ended hostilities, it did not deliver Newfoundland from the grasp of France, as it yielded to her the right of catching and drying fish on the western and northern side of the island. Though no territorial rights were conferred on the

French, and the sovereignty was secured to England, the practical effect was to exclude the inhabitants from the fairest half of the island. Interminable disputes have arisen regarding those treaties, which are not yet settled, and, as a consequence, the fine lands of western Newfoundland are still untenanted, and the mineral treasures untouched.

In spite of the restrictive regulations, the number of the resident population continued to increase. The sturdy settlers clung to the soil, combated the "adventurers," as the merchants were called, and after a lengthened conflict obtained freedom of settlement and relief from oppression. But the contest was severe and so prolonged that only seventy years have elapsed since the repeal of the last of those laws which prohibited settlement and the cultivation of the soil. The progress of the colony since has been most satisfactory.

The merchant-adventurers strenuously opposed the appointment of a governor; but at length, in 1728, the British Government appointed Captain Henry Osborne first governor of Newfoundland, with a commission to establish a form of civil government. This constituted a new era in the history of the colony. In 1763 the fixed inhabitants had increased to 8000, while 5000 more were summer residents who returned home each winter. In 1765 the coast of Labrador, from the entrance of Hudson's Strait to the river St John, opposite the west end of the island of Anticosti, was attached to the governorship of Newfoundland. The population in 1785 had increased to 10,000. During the wars between England and France which followed the French Revolution, Newfoundland attained great prosperity, as all competitors in the fisheries were swept from the seas, and the markets of Europe were exclusively in the hands of the merchants of the country. The value of fish trebled; wages rose to a high figure; and in 1814 no less than 7000 emigrants arrived. The population now numbered 80,000. In 1832 representative government was granted to the colony, and provision was made for education. In 1846 a terrible fire destroyed three-fourths of St John's, and with it an enormous amount of property; but the city rose from its ashes improved and beautified. In 1855 the system of responsible government was inaugurated. In 1858 the first Atlantic cable was landed at Bay of Bull's Arm, Trinity Bay.

Unproductive fisheries, causing a widespread destitution among the working classes, marked the first eight years of the decade between 1860 and 1870. A system of able-bodied pauper relief was initiated to meet the necessities of the case, but was attended with the usual demoralizing results. The necessity of extending the cultivation of the soil in order to meet the wants of the growing population was felt more and more as the pressure arising from the failure of the fisheries showed their precarious nature more sensibly. In 1864 copper ore was discovered in the north, and mining operations, furnishing employment for the people, were successfully initiated. In 1869 a series of successful fisheries began, which enabled the Government to terminate the injurious system of able-bodied pauper relief. In 1871 the revenue rose to $881,160. In 1873 direct steam communication with England and America was established.

Authorities.—Hakluyt's *Chronicles*; Captain Richard Whitbourne, *A Discourse and Discovery of Newfoundland*, 1622; Nicholls, *Life of Cabot*; Anspach, *History of Newfoundland*; (Chief-Justice) Reeve, *History of the Government of the Island of Newfoundland*, 1793; Jukes, *Newfoundland*, 1841; Sir Richard Bonnycastle, *Newfoundland*, 1842; Pedley, *History of Newfoundland*, 1863; Murray and Howley, *Geological Survey of Newfoundland*, 1881; and Harvey and Hatton, *Newfoundland, the Oldest British Colony*, London, 1883. (M. H.)

NEW GRANADA. The vast regions of the north-west of South America conquered by Spanish adventurers in the first half of the 16th century received from Quesada, one of the great leaders of the movement, the title of the New Kingdom of Granada. It was not till 1718, however, that the Spanish Government granted the president of the colony, Pedroza y Guerrero, the rank of viceroy; and at the desire of his successor, Jorge Villalonga, the honour was again withdrawn. In 1739 the New Kingdom of Granada was re-established under a viceroy, whose authority extended over the provinces of Tierra-firma (state of Panama), Cartagena (state of Bolivar), Santa Marta and Riohacha (state of Magdalena), Maracaibo, Caracas, Cumana, and Guiana (republic of Venezuela), Antioquia (state of Antioquia), Pamplona and Socorro (state of Santander), Tunja (state of Boyaca), Santa Fé (state of Cundinamarca), Neyva and Mariquita (state of Tolima), Popayan and Pasto (state of Cauca), and Quito, Cuenca, and Guayaquil (republic of Ecuador). In 1777 the provinces of Maracaibo, Caracas, Cumana, and Guiana were separated from the viceroyalty to form the captaincy-general of Venezuela. For the republic of Colombia (1820–30), the republic of New Granada (1831–61), and the United States of Colombia (1861 to the present time), which have successively taken the place of the viceroyalty, see COLOMBIA (vol. vi. p. 156); and compare Pereira, *Les États-Unis de Colombie* (Paris, 1883).

NEW GUINEA, the largest island in the world (excluding Australia), lies immediately north of Australia, between 0° 25′ and 10° 40′ S. lat. and between 130° 50′ and 150° 35′ E. long. It is 1490 miles long, with a maximum breadth of 430 miles, its area being about 306,000 square miles.[1]

Physical Features.—It was probably in Miocene times, if not later, united to Australia; the average depth of Torres Straits, which are 80 miles wide, is only 8 or 9 fathoms, and the maximum 20,—three-fourths of the distance being occupied by coral reefs, a prolongation of the great eastern barrier reef of Australia. At either end of New Guinea a few large islands, with a number of smaller islets, are only separated from the mainland by narrow channels. From difficulties connected with the navigation, the climate, and the people, the coasts are still imperfectly surveyed, while of the interior, relatively to its vast extent, very little is known. At the north-west end the deep M'Cluer Inlet almost cuts off a great peninsula of some 200 by 115 miles, while this inlet and another farther south almost if not entirely insulate the great tract known as Onin. The south coast, from Cape Bourou westwards, is mostly precipitous, limestone cliffs rising several hundred feet, with dense forest and a mountainous country behind. There are occasional tracts of flat swampy ground, and the steep coast-line is besides broken by some large rivers, whose banks for some distance inland are usually swampy. Off M'Cluer Gulf are numbers of curious mushroom-shaped islands with sea-worn bases.

The north coasts are sometimes level, as at parts of Geelvink Bay and the extensive delta of the great Amberno river, at Walckenaar and Humboldt Bays, and farther east towards Cape della Torre, near which, and near Huon Gulf, there are large rivers; otherwise the shores are steep-to, and apparently rising, with promontories jutting 20 to 40 miles out, and some good harbours. There is no barrier reef off this coast. High distant mountains are observed at every opening, those towards the east rising in successive and highly fertile terraces to some 13,000 feet. No active volcanoes have as yet been observed on the mainland, but Mr W. Powell reports masses of pumice on the slopes of the Finisterre mountains. Severe earthquakes, too, occur on the north side, and there is a line of volcanic activity parallel to this coast some 20 to 50 miles distant. Near its east end are the D'Entrecasteaux Islands (7000 feet), richly wooded, with rocks of raised coral and boiling alkaline springs. Cape Bourou appears to be the extremity of the lofty Charles Louis range, over 16,000 feet, the tops of which seem from the distance to be snow-covered. East from Cape Bourou the mountains recede out of sight, the sea is shallow, and the flat mangrove-covered coast is intersected by creeks and rivers laden with mud, as far as the Gulf of Papua, where Signor D'Albertis reports that he steamed 500 miles up the Fly river, probably one of several channels draining a vast swamp country between the mountains and the sea. He found the tropical forest scenery varied by treeless plains, with isolated hills rising from them, like the islands in the neighbouring Torres Straits from the sea. These tracts are Australian in character. The hills probably escaped the submersion which, besides forming Torres Straits, covered the surrounding country, and thus remained as nuclei of an Australian flora,—the plains, on

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[1] That of Borneo is about 286,000.

again emerging, being occupied, in great measure, by the tropical vegetation from the westward. Beyond Redscar Head in the Gulf of Papua the country again rises, having an Australian appearance,—open grassy hills with scattered timber sloping to the coast, which is here skirted by a barrier reef with occasional openings, affording good shelter to vessels. Inland, densely wooded hills and valleys with rivers and rich cultivable soil are backed by the great Owen Stanley range (13,000 feet), which terminates at the east forks in bluffs 2000 feet high.

Geology.—Of the geology of New Guinea little is known. In the north-west the Arfak mountains are mainly granite and gneiss. Near Geelvink Bay dark limestones occur, apparently ancient, and stratified clay slates. Bismuth is found here at Moom. Miosnom island, opposite, is volcanic. Raised coral is frequent on this (north) coast, and the streams bring down pebbles of plutonic rocks and sandstones. Clay ironstone is found at Humboldt Bay, on the river Jakata near M'Cluer Gulf, and at Lakahia Island, and a Tertiary coal (lignite) at Lakahia and in Galewo Strait. On the east side of the Gulf of Papua the coast range is of recent limestone. At Hall Sound calcareous clays from the Lower Miocene contain fossil shells identical with those found in Victoria and South Australia. Small fragments and pebbles, sent from Redscar and Astrolabe Bays (probably coming from the great central range), consisting of mica slate, quartz, sandstones, greenstones, and jasperoid rocks, are undistinguishable from those of the Devonian and Silurian series of the gold-fields of New South Wales. A black magnetic-iron sand (with traces of gold) and plumbago are reported from this (south-east) coast. Some of the Torres Straits islands are of raised coral, others of stratified sandstones with huge overlying blocks of the same and conglomerates, others volcanic.

Climate.—The climate of the coast is unhealthy, especially during the transition between the monsoons, which is long and irregular owing to the action of the high mountain ranges on these winds. The heat is tempered by the heavy rainfall, discharged by the north-west monsoon chiefly in the west and north; the south-east monsoon also is often wet, especially in the east and south districts. Torres Straits are healthier, though the heat is great and the amount of salt in the air is trying to many. From July to September the force of the south-east monsoon there is such that even steamers cannot always face it and the tide together.

Flora.—The flora is mainly that of the Indian Archipelago, which predominates even in the islands of Torres Straits; but on the shores of the Gulf of Papua, and inland, Australian vegetation is represented by *Eucalyptus*, acacias, and *Pandanus*; and Australian types are found as far north as Humboldt Bay. Over great part of New Guinea dense forests prevail, clothing the mountains to a height of several thousand feet, the timber of enormous height, though the species are fewer than in the great islands of the archipelago. Among them various kinds of *Ficus*, *Casuarina*, *Araucaria*, *Dammara*, *Podocarpus*, *Calophyllum*, *Aleurites*, *Ebenaceæ*, *Canarium*, *Durio*, *Wormia*, and many species of palms. The trees are matted with creepers (*Bauhinia*, *Bignonia*, *Asclepias*, &c.), with a dense undergrowth of brushwood, ferns, and lycopodiums, but their density often makes the herbaceous vegetation poor. Of the smaller growths are great reeds and grasses covering the swamps and open spaces; aloes, aroids, orchids, *Scitamineæ* (ginger, cardamum, &c.), *Laurineæ*, *Piperaceæ* (betel and others, wild and cultivated), *Myrtaceæ*, *Viniferæ*, pine-apple, nutmeg, cotton shrubs, *Urticeæ*, *Apocyneæ*, *Malvaceæ*, *Papilionaceæ* (*Butea*, *Erythrina*, *Clitoria*, *Mimosa*, &c.), *Justiceæ*, and *Begoniæ*; and in the mountains a sub-alpine flora, oaks, rhododendrons, vacciniums, epilobiums, *Umbelliferæ*, &c. Among cultivated plants are the banana, papaya, orange, sugar cane, maize, millet, taro (*Arum esculentum*), *Abelmoschus Manihot*, *Jambosa*, yams, sweet potato, and pumpkins, and among the Amberbaki the dry rice. The cocoa-palm grows everywhere; the sago-palm grows wild in abundance in the swamps, and in the north-west each hill tribe, apparently to avoid collisions, draws its supplies from a different district of the coast. They have also in the hills a tree called "sali," with top and pith resembling sago. Tobacco of good quality is brought down from the interior, and an illustrious antiquity is claimed for the plant by a tradition which describes it as the miraculous fruit of a woman named Heva. In some places the kava of the Pacific (*Piper methysticum*) is used. At Doreh a cotton plant (*G. vitifolium*) grows wild, and is also cultivated.

Fauna.—New Guinea is very poor in *Mammalia*. According to Mr Wallace (*Geographical Distribution of Animals*), there are as yet known, besides a peculiar form of pig, some mice, and various *Pteropidæ*, four families of marsupials, all Australian, viz., *Dasyuridæ*, *Peramelidæ*, *Macropodidæ*, and *Phalangistidæ*, with nine species Among them are a *Dendrolagus* or tree-kangaroo and several cuscus. There are also two echidnas. The large animals reported by travellers may possibly be gigantic marsupials akin to those found fossil in the Queensland Pleistocene. The wealth and beauty of the avifauna are great. Count Salvadori gives 1028 species, belonging to 321 genera, for the Papuan subregion (*i.e.*, from the Solomon Islands westwards to, but excluding, Celebes). Of these about 470 are peculiar to New Guinea and the adjacent islands, including Aru. The more numerous and important genera are pre-eminently Australian in character, with many species peculiarly developed. There is also, as might be expected, a considerable number of Malayan forms, some common to the whole region, some only found here and at other far distant spots in it. The most remarkable orders, besides the birds of paradise, which are only found in New Guinea and the neighbouring islands, are the honeysuckers, flycatchers, parrots, kingfishers, and pigeons, all rich in special forms. Birds of prey are rare; vultures, pheasants, woodpeckers, and finches absent. Mr Wallace attributes the unusually large number of "beautiful" birds, 50 per cent. of the whole, to the numbers of parrots, lories, cockatoos, pigeons, and kingfishers, and to the absence of thrushes, shrikes, warblers, and other dull-coloured groups. Of snakes, which may migrate freely on floating timber, we find out of 24 genera (belonging to 11 families) 6 Oriental, 4 Australian, and only 4 specially Papuan; of lizards 3 families with 24 genera, of which only 3 are peculiarly Oriental, 3 Australian, 6 Papuan. The *Amphibia* (6 families with 8 genera), for which the salt water is a barrier, have no western affinities, and those not of wide distribution are almost exclusively Australian,—a fact of obvious geological significance. The *Lepidoptera* are numerous and singularly beautiful, as are the *Coleoptera*, which Mr Wallace says often display the metallic lustre characteristic of the plumage of the New Guinea birds.

Population.—The population consists of a great number of isolated tribes, differing much in appearance and language. The level of civilization varies, but seldom reaches even the average Pacific standard.

They have no single name for New Guinea, nor any idea of its extent, only using terms signifying "great land," to distinguish it from the adjacent islands or from Australia.

The name Papúa is a Malayan term signifying frizzled, in reference to the hair; and, as distinguishing the peoples so characterized from the Australians, the term "Papuan" is by some writers thought more suitable than "Melanesian" while equally distinguishing the race from the brown Polynesians. The type of man known as Papuan or Melanesian (see MELANESIA) is found here in its greatest purity, and appears to occupy the whole island excepting its east extremity. But among tribes occupying so wide an area, having little intercommunication, and with other races at no great distance, many deviations from the normal type must be expected, and in fact it is not very easy to define this type. Its leading characteristics are—a medium height; fleshy rather than muscular frame; colour a sooty brown, varying, but decidedly darker than the Malay; high but narrow and rather retreating forehead, with thick brows; nose sometimes flat and wide at the nostrils, but oftener hooked and "Jewish," with depressed point, a feature represented in their karwars or ancestral images; prognathism general, but not universal; lips thick and projecting, so as to make the chin seem retreating; high cheek bones; hair black, frizzly, trained into a mop. The appearance is thus negroid, and is said to resemble the population of the African coast opposite Aden. But in the Arfak mountains in the north-west, and at points on the west and north coasts and adjacent islands, very degraded and stunted tribes are found, with hardly the elements of social organization (possibly the aboriginal race unmixed with foreign elements), and resembling the Aetas or Negritos of the Philippines, and other kindred tribes in the Malay Archipelago. On the banks of the Fly river D'Albertis observed at least two widely differing types, those on its upper course bearing some resemblance to the tribes of the eastern coast. Here, wedged in among the ruder Papuans, who reappear at the extremity of the peninsula, we find a very different-looking people, whom competent observers, arguing from appearance, language, and customs, assert to be a branch of the fair Polynesian race. But there are obvious signs among them of much admixture of blood; and they or their congeners again may easily have modified their neighbours immediately west of them, just as Malay and other influences have done on the other end of the island. Indeed the greater degree of intelligence and good looks observed at points along the north coast may be due simply to this cause. On the west coasts there is a semi-civilization, due to intercourse with Malays and Bughis, who have settled at various points, and carry on the trade with the neighbouring islands, in some of which, while the coast population is Malay or mixed, that of the interior is identical with the people of the mainland. On the west coasts Mohammedan teaching has also some civilizing effect. Many of the tribes at this west end of New Guinea are, at all events in war time, head-hunters, and in the mountains cannibals. Cannibalism in fact is practised here and there throughout New Guinea. The frequent hostility and mistrust of strangers are partly due to slave-hunting raids and ill-treatment by traders, but the different tribes vary much in character. Thus in the mountains of the north-west the Karons, a short, hardy, well-built people, cultivate very little, living chiefly on wild plants which their women cook in hollow bamboos, and obtaining what they require from without, as knives, ornaments, &c., either by plunder, or by disposal of slaves or bird skins; while their neighbours the Kebars grow vegetables and very fine tobacco, which they sell to the Amberbaki, a peaceful industrious coast tribe. The mountain tribes are usually despised by their coast neighbours as ruder and more destitute of resources, but when more numerous and fiercer, as in the south of west New Guinea, the tables are turned, and the coast people live in perpetual terror of their neighbours, who plunder and enslave them.

At Humboldt Bay the people, though uncertain, rude, and warlike, are ready to trade, and tribes of a kindred race are found farther east, at Astrolabe Bay; here the Russian Miklucho Maclay lived among them for some time, and was favourably impressed by them. Still farther east, the plateaus of the Finisterre ranges are highly cultivated and artificially irrigated by a comparatively fair people. Many tribes in the south-west seem to be migratory. At Princess Marianne Straits tribes much wilder than those farther west, naked and painted, swarm like monkeys in their trees, the stems of which are submerged at high tide. But the Torres Straits islanders are employed by Europeans in the pearl shell fishery, and are liked as labourers; and in some of the Ké and Aru Islands the Papuan inhabitants form orderly Christian communities. The people of the south-east peninsula seem generally, like the typical Polynesian, of a mild, accessible type. Englishmen, wandering inland and losing their way, have been found and brought back by them. Their manners are more courteous, their women better treated, than is usual with Papuans, but they show perhaps less ingenuity and artistic taste. Their children, in the mission schools, show much intelligence.

While tribes allied to the Papuan have been traced through Timor, Flores, and the highlands of the Malay Peninsula to the Deccan of India, these "Oriental negroes" have many curious resemblances with some East-African tribes. Besides the appearance of the hair, the raised cicatrices, the belief in omens and sorcery, the extraction of diseases in the form of bits of wood or stone, and the practices for testing the courage of youths, they are equally devoid of forethought or ambition, rude, merry, and boisterous, but amenable to discipline, and with decided artistic tastes and faculty.

Several of the above practices are also common to the Australians, who, though generally inferior, have many points of resemblance (osteological and other) with the Papuans. The extinct Tasmanians were more closely allied to the Papuans.

The constitution of society is everywhere simple. Among the more advanced tribes rank is hereditary, otherwise the chiefs generally have but little power, most matters being settled by the assembly, a contrast to the Polynesian respect for birth and hereditary rank. The Papuan's religious institutions are likewise simpler; there is no general object of worship, consequently no regular priesthood; the institution of *tabu* is less oppressive, and its sanction less awful, but the transgressor may still have to reckon, not only with the society or individual who imposed it, but also with offended spirits. Almost every crime is condoned by payment. A characteristic example of the feeling of the fair race towards the dark was seen in the contempt shown by the tribes of the south-east towards certain Melanesian teachers introduced by the English missionaries, while others brought from the Polynesian islands were treated with respect.

The Papuan women are, as a rule, more modest than the Polynesian.

In western New Guinea, according to the Dutch missionaries, there is a vague notion of a universal spirit, practically represented by several malevolent powers, as *Manoin*, the most powerful, who resides in the woods; *Narwoje* in the clouds, above the trees, a sort of Erl-König who carries off children; *Faknik* in the rocks by the sea, who raises storms. As a protection against these the people construct—having first with much ceremony chosen a tree for the purpose—certain rude images called karwars, each representing a recently dead progenitor, whose spirit is then invoked to occupy the image and protect them against their enemies and give success to their undertakings. The karwar is about a foot high, with head disproportionately large; the male figures are sometimes represented with a spear and shield, the female holding a snake. Omens are observed before starting on any expedition; if they are unfavourable the person threatened retires, and another day is chosen and the process repeated. They have magicians and rain-makers, and sometimes resort to ordeal to discover a crime. Temples (so-called) are found in the north and west, built like the houses, but larger, the piles being carved into figures, and the roof-beams and other prominent points decorated with representations of crocodiles or lizards, coarse human figures, and other grotesque ornamentation; but their use is not clear. Neither temples nor images (except small figures worn as amulets) occur among the people of the south-east, whose religious ideas seem vague and rudimentary; but they have a great dread of departed spirits, especially those of the hostile inland tribes, and of a being called Vata, who causes disease and death.

The dead are disposed of in various ways. The spirit is supposed not to leave the body immediately, which is either buried for a time and then taken up and the bones cleaned and deposited in or near the dwelling, or it is exposed with the same object on a platform of branches, or dried over a fire, and the mummy kept for a few years. Sometimes the head, oftener the jaw bone, is kept as a relic. Food is placed on a grave,—with an infant a calabash of its mother's milk,—and a path is made to the sea that the spirit may bathe; but the spirits are everywhere dreaded as likely to injure the living. No one likes to go about, or into the water, after dark. Little imitation houses are placed in the woods to allure the spirits away. These dwell chiefly in the moon, and are particularly active at full moon. The houses which they haunt, and beneath or near which their bodies lie buried, are deserted from time to time, especially by a newly-married couple, or by women before childbirth. Probably the effluvium from the buried corpse produces the feelings of sickness which are supposed to be caused by the spirit's presence, and which subside when they leave the spot.

Feasting and dances take place on the setting up of a karwar, on the return of warlike and other expeditions, at a marriage, birth, change of name, child's first hair-cutting, and also some time after a death.

The chief diseases are skin diseases, with which in some places one-third of the population is affected,—among these a sort of leprosy to which, as well as to a dropsy (*beri-beri*), Europeans are subject,—catarrhs, boils, syphilis, and intermittent fevers, especially where there is much coral on the coast.

The Papuan varies his vegetable diet with the flesh of the wild pig, wallabi, and other small animals, which are hunted with dogs. Birds are snared or limed. Fish abound at many parts of the coast, and are taken by lines, or speared by torchlight, or netted (the netting pattern is the same as ours); or a river is dammed and the fish stupefied with the root of a milletia. Turtle and dugong are caught. The kima, a great mussel weighing (without shell) 20 to 30 lb, and other shell-fish are eaten, as are also dogs, flying foxes, lizards, beetles, and all kinds of insects, and an edible earth.

Food is cooked in various ways, being stewed or roasted, or baked with hot stones as in Polynesia. A third part of sea water, which is carried to the interior in hollow bamboos, is added in place of salt, which is also obtained from the ashes of wood saturated by the sea. The sexes generally eat apart.

Their very scanty clothing is made of the bark of *Hibiscus*, *Broussonetia*, and other plants, or of leaves, and in more civilized parts of cotton. Tight belts and armlets of split rattan and fibre are often worn. The people have usually a great dislike to rain, and carry a mat of pandanus leaves as a protection against it.

The chief home-made ornaments are necklaces, armlets, and earrings of shells, teeth, or fibre, and cassowary, cockatoo, or bird of paradise feathers,—the last two, or a flower, are worn through the septum of the nose. The hair is frizzed out and decorated variously with flowers, leaves, feathers, and bamboo combs. The fairer tribes at the east end tattoo, no definite meaning apparently being attached to the pattern, for they welcome suggestions from Manchester. For the women it is simply a decoration. Men are not tattooed till they have killed some one. Raised cicatrices usually take the place of tattooing with the darker races. Rosenberg says the scars on the breast and arms register the number of sea-voyages made.

The use of the bow and arrow is little known among the eastern tribes. The Papuan bow is rather short, the arrows barbed and tipped with cassowary or human bone. Other weapons are a short dart, a heavy spear and shield, stone clubs and axes. They are mostly ignorant of iron, but work skilfully with their axes of stone or tridacna shell, and bone chisels, cutting down trees 20 inches in diameter. Two man working on a tree trunk, one making a cut with the adze lengthwise and the other chopping off the piece across, will soon hollow out a large canoe. Every man has a stone axe, each village generally owning a large one. Their knives are of bamboo hardened by fire. In digging they use the pointed stick.

The eastern tribes salute by squeezing simultaneously the nose and stomach, and both there and on the north coast friendship is ratified by sacrificing a dog. In other places they wave green branches, and on the south (Papuan) coast pour water over their heads, a custom noticed by Cook at Mallicolo (New Hebrides). Among other pets they keep little pigs, which the women suckle.

The Papuan numerals extend usually to 5 only. In Astrolabe Bay the limit is 6; with the more degraded tribes it is 3, or, as in Torres Straits, they have names only for 1 and 2; 3 is 2+1.

The houses are mostly (so far as is known) built in Malay fashion on piles, and this not only on the coast but on the hill-sides, though the houses there are smaller. Small houses are also found perched high up in trees as a safeguard against enemies and evil spirits, and possibly malaria; and one or two of these in a village act as its fortress or watch-tower.

The piles support a platform made from old canoes or branches, the whole covered with a rounded or inverted boat-shaped roof thatched with palm branches, sometimes 500 feet long, and looking inside, when undivided, like a dark tunnel.[1] Otherwise the coast houses are 60 to 70 feet long, often more, with a passage down the centre, and the side spaces partitioned off as needed. Each house has a sort of paterfamilias, the rest of the numerous inhabitants being his relations or slaves. A bridge, when the house is over the water, connects it with the land, and near this is sometimes a small jointure house for widows of former occupants, and a separate one for bachelors or for pregnant women. A veranda towards the sea is usually occupied during the day by the men, and one on the land side by the women. The gable ends are often prolonged upwards and carved, and the houses adorned with drawings of animals, and hung round with weapons, and crocodiles', dogs', and boars' teeth. On the north coast, about Astrolabe Bay, the houses are not built on piles; the walls, of bamboo or palm branches, are very low, and the projecting roof nearly reaches the ground; a barrier at the entrance keeps out pigs and dogs. A sort of table or bench stands outside, used by the men only, for meals and for the subsequent siesta.

In east New Guinea sometimes the houses are two-storied, the lower part being used for stores. The furniture consists of earthen bowls, drinking cups, wooden neck-rests, spoons, &c., artistically carved, mats, cordage, small plaited baskets and boxes, and various weapons and implements. The pottery is moulded and fire-baked.

West New Guinea exports a certain amount of sago, nutmegs, massoi and pulasaria barks (all wild), birdskins, tripang, tortoise- and pearl-shell, the trade with the Dutch being worth about £20,000 a year. Misol is rich in all these products, and Salawatti in sago. They are sent to Ceram, Ternate, and Macassar in exchange for iron and copper ware, cotton cloths, indigo, knives, mirrors, beads, arrack, &c. The Ké islanders are great boatbuilders. An active trade is carried on between the hill and coast tribes, the former bringing down vegetable produce in exchange for fish and shell ornaments. In the north-west some of the coast villagers spend six months in the forest collecting massoi bark, and live the rest of the year by fishing. Often a village has its special industry, as canoe-building, pottery, or manufacture of shell ornaments, or of the little sticks worn in the septum of the nose. Large trading canoes pass up and down the coast, probably combining a little piracy and kidnapping with other business. The Papuan pirates were formerly dreaded in these seas. For trading purposes several large canoes are lashed together, with a platform above and a house at each end united by a palisade. Coasting voyages of several weeks are made in these craft. The canoes vary from the common "dug-out" to the great war-canoe elaborately carved and ornamented.

Both races show considerable agricultural skill—probably an old Asiatic tradition, for the plants cultivated seem mostly Asiatic. In some places the hill-sides are carefully terraced, plantations well kept and fenced, and flowers grown for ornament. Any one may clear and cultivate a piece of land belonging to his tribe, but often after one or two deaths a kampong is deserted, and new forest-land taken up; on the west coast, where the mainland is too steep for cultivation, the people cross over and cultivate the neighbouring uninhabited islands. They have a strong sense of proprietorship, even of the fruit trees in the forest and of the fish in their own streams or on their own coast.

History.—The claims to superiority over New Guinea on the part of the rulers of some of the small neighbouring islands are curious when we compare the extent of their dominions with New Guinea. These claims date at all events from the spread of Islam to the Moluccas at the beginning of the 15th century, and were maintained by the Malay rulers both of Batjan and of Gébé. Latterly they have been exercised by the sultan of Tidore. When the Dutch first came to these seas it was their policy to ally themselves with certain chiefs, and support their claims over various islands, so as to extend their own commercial monopoly; and they now support the claims (admitted by Great Britain in 1814) of their former rival and ally the sultan of Tidore over both the Raja Ampat (*i.e.*, the four Papuan kingships, Waigiu, Salawatti, Misol, and Waigamma[2]) and certain islands or points on the north-west coast of New Guinea, and the rulers of these places are nominated, on his recommendation, by the Dutch governor of Ternate, under the titles of rajah, major, singaji, or korano.

Salawatti and till lately Misol have dominated the coasts respectively adjacent to them, but certain dues (consisting of sago, massoi bark, occasional slaves, and other produce) are levied in the sultan's name, at irregular intervals, all along the coast for hundreds of miles. These extortions make Islam unpopular, and have retarded progress, for we read in former days of Papuan pirate fleets, and of "the Papuas" in league with the Moluccas against the Portuguese. The Dutch, however, in their dealings with the people still find it convenient to use the sultan's name and authority. As his suzerain they claim possession of the west half of New Guinea as far as 140° 47′ E., but his claims never extended so far, and their sovereignty is little more than nominal. There is a small coaling station at Doreh, in Geelvink Bay, and the Dutch flag is hoisted by many of the coast chiefs, ignorant even of its meaning; all attempts at settlement have been abandoned owing to the bad climate, the difficult navigation, and the constant fighting and laziness of the people,—all this limiting the amount of produce available for trade. The Dutch missionaries,[1] who have laboured on the shores and islands of Geelvink Bay for many years, have a certain influence, and their schools are well attended, but with no more definite result than a certain softening of manners and slight increase of material prosperity.

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[1] These large houses, like the custom of head-hunting, are traceable west through Borneo up to the north-east frontier of India, where the custom above-mentioned of exposing the dead also prevails.

[2] On Misol island.

Though probably sighted by A. Dabreu, 1511, New Guinea was apparently first visited either by the Portuguese Don Jorge de Meneses, driven on his way from Goa to Ternate in 1526 to take shelter at "Isla Versija" (which has been identified with a place Warsia on the N.W. coast, but may possibly be the island of Waigiu), or by the Spaniard Alvaro de Saavedra two years later.

By Ortiz de Retez, or Roda, who in 1546 first laid down several points along the north coast, the name of "New Guinea" was probably given. In that and the two following centuries, though the coasts were visited by many illustrious navigators, as Schouten and Lemaire, Tasman, Dampier, Torres, Bougainville, and Cook, little additional knowledge was gained. This was due first to the difficulties of the navigation, next to the exclusiveness of the Dutch, who, holding the Spice Islands, prevented all access to places east of them, and lastly to the stream of enterprise being latterly diverted to the more temperate regions farther south. The Dutch barrier was broken down by the arrival of Dampier and other "interlopers" from the east, and of emissaries from the (English) East India Company in search of spice-bearing lands. The voyage of Forrest (1774) in the "Tartar galley" of 10 tons, and his account of New Guinea, are still full of interest. New Guinea was actually annexed in 1793 by two commanders in the East India Company's service, and the island of Manasvari in Geelvink Bay held for some months by their troops. After the peace of 1815 Dutch surveying expeditions to the west coasts became more numerous. Surveys of the east coasts have been made since the visits of D'Entrecasteaux (1793) and D'Urville (1827–40) by Captains Owen Stanley, Yule, Blackwood, and other English officers, the latest being that of Captain Moresby; and English missionaries and traders are doing around the Gulf of Papua what the Dutch have done at Geelvink Bay. The islands of Torres Straits, which are the headquarters of a valuable pearl-shell and tripang fishery, have all been annexed to Queensland, and practically command the few available channels by which ships can pass.

Latterly the colonial authorities in Australia, alarmed at the prospect of the annexation by some foreign power of territory so near their shores, and also desirous to prevent the abuses that must soon arise from the influx of convicts or of European adventurers under no control, have urged the home Government to annex the east half of New Guinea.

Authorities.—The principal are Von Rosenberg, *Der Malayische Archipel*; Müller, *Nieuw Guinea, ethnogr. en natuurkundig onderzocht*, Amsterdam, 1862; Robidé van der Aa, *Reisen naar Nederlandsch Nieuw Guinea*, 1879; Moresby, *New Guinea and Polynesia*; D'Albertis, *New Guinea*; *Quart. Rev.*, July 1877; Beccari, *Malesia* (botanical); Kolff's *Voyage*, translated by Windsor Earl; Parliamentary Papers, 1876 and 1883; lecture by Prof. W. H. Flower at the Royal Institution, 31st May 1878; A. B. Meyer, "Anthrop. Mittheil. über die Papuas von N. G.," in *Jour. Anthrop. Inst.*, 1877–78; papers in *Cosmos*, 1875–77; *Trans. of Brit. Assoc.*, 1883; *Proc. R. Geog. Soc.*, March 1884. (C. T.)

NEW HAMPSHIRE, one of the New England States of the American Union, lies between 70° 37′ and 72° 37′ W. long., and between 42° 40′ and 45° 18′ 23″ N. lat., and has an area of 9336 square miles. Its boundaries are partly natural. On the W. it is separated from the State of Vermont by Connecticut river; on the N. from the province of Quebec by the natural ridge of the watershed between the St Lawrence and the streams flowing south to the Atlantic; on the E. from Maine by a straight line from Quebec to the source of Salmon river, thence by this river to the ocean, and south-easterly through the middle of the Isles of Shoals; the boundary on the S.E. is the Atlantic; and that on the S. is a line 2½ miles distant from and parallel to the lower Merrimack, until that river changes its course to due north and south, when the line runs magnetic west to Connecticut river. The general shape of the State is nearly that of a right-angled triangle, having the perpendicular 180 and the hypothenuse 190 miles long. The greatest width is 100 miles, from Chesterfield to the outermost of the Isles of Shoals.

Physical Features.—The State lies on the Atlantic slope of the continent, forming part of the elevated belt bordering upon the ocean which culminates in three mountain districts, viz., Newfoundland, the White Mountains, and the Black Mountains in North Carolina. It is also situated east of the Blue Ridge and its northerly continuation in the New York highlands and the Green Mountain range, both of which are distinct from the true Appalachians—the latter being west of the great Appalachian limestone valley, and well-shown in the Catskill, Alleghany, and Cumberland ridges and plateaus. The Atlantic and White Mountain ranges are comparatively short, consisting of obtusely-pointed summits of gneissic or granitic rocks, either arranged *en échelon* or scattered in irregular groups. The White Mountains group first becomes noticeable in northern Maine, reaching the height of a mile at Mount Katahdin, and continues at less elevation south-westerly to the New Hampshire line, where it rapidly rises to its culmination in Mount Washington (6293 feet). The part of this mountainous area that lies within New Hampshire extends to about 1400 square miles. It is continued south-westerly, much reduced in elevation, beyond Mount Moosilauke, along the highlands separating the tributaries of the Merrimack and Connecticut rivers, through New Hampshire and Massachusetts into Connecticut. The distinctive Montalban elevation is limited on the west and on the south by the Connecticut.

The geological reports published in 1878 show four important topographical features:—(1) the mountainous ridge following the eastern rim of the Connecticut river basin along the longest straight line that could be drawn within the State; (2) the elevated White Mountain tract, just north of the middle of the territory; (3) the comparatively low country between the two elevated districts just noted and the sea—three-fourths of which, away from the foothills, scarcely exceeds 500 feet above the sea-level; (4) a mountainous district north of the White Mountains, occupying Coos county in New Hampshire, Essex county in Vermont, and an indefinite region in Maine near the Quebec line. The average elevation of the land in New Hampshire is estimated to be 1200 feet above the sea. Of this more than one-half is situated below 1000 feet, and about one-sixth exceeds 2000 feet, and is comprised in the third area mentioned above. The average height of the Coos and Essex district will be found to exceed 1500 feet. Mount Washington is the only mountain peak exceeding 6000 feet; and eight others are above 5000 feet (Adams, Jefferson, Clay, two Monroes, Madison, Lafayette, and Lincoln).

Climate, Fauna, Flora.—These elevations have produced a marked effect upon the climate and natural products. The greatest annual precipitation is along the Merrimack river, 44 inches near Manchester and 46 above Franklin. It is only 35 inches near the sea-coast, and 40 inches on the upper Connecticut. The greatest precipitation is therefore on the seaward side of the long mountainous ridge constituting the backbone of the State. The annual isothermal lines vary from 48° Fahr. at Manchester to 40° in Coos county and 25° upon the summit of Mount Washington.

No less than four faunal areas are recognized, known as the Alleghanian, Canadian, Hudsonian, and Labrador. The first enters New Hampshire from the south, and is limited on the north by the line of 600 feet altitude, which is not far from the isothermal line of 45° Fahr., or the winter average of 20° Fahr. and the summer average of 65° Fahr. A few distinctive animals are the red-headed woodpecker, humming bird, bobolink, Baltimore oriole, blue jay, the box and painted turtles, and the rattlesnake. Among plants which are employed to determine the northern limit of this district are the hickory or shell bark,

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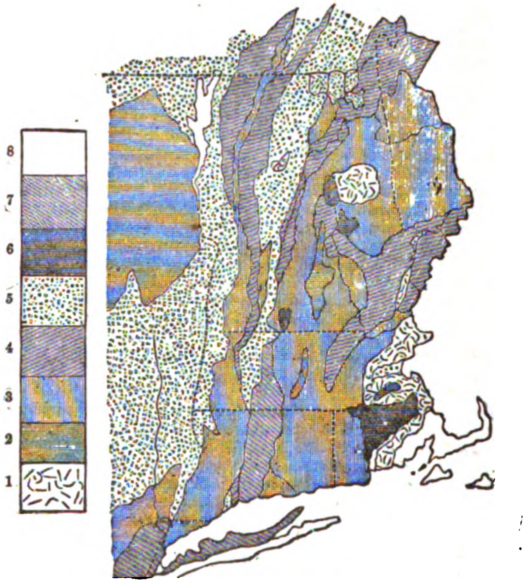
[1] One of these, Mr Van Hasselt, is the chief authority on the languages and customs of west New Guinea.

chestnut, mountain laurel or *Kalmia*, grape, and cranberry. A few characteristic animals of the Canadian district are the rose-breasted grosbeak, Canada jay, spruce partridge, crossbill, snowbird, caribou, and Canada lynx; the absence of reptiles is marked. A few of the trees are spruces, balsam fir, canoe birch, and bush maples. This district, comprising the northernmost county, reaches the height of 4000 feet, or the upper limit of trees. The Hudson district is a region of dwarfed spruces extending above the Canadian upper limit to the 5000 feet line, and limited to the White Mountains. None of the larger animals which flourish about Hudson's Bay could be expected in such limited and mountainous peaks, so that the proof of the presence of this fauna is afforded by the plentiful distribution of the butterfly known as *Brenthis montinus* and the grasshopper *Pezotettix glacialis*. Owing to the small areas occupied by the Hudson and Labrador floras in the White Mountains, botanists have not yet succeeded in separating the plants peculiar to each. Fifty-three species are referred to them, called the sub-alpine and alpine districts, embracing such genera as *Arenaria*, *Geum*, *Solidago*, *Potentilla*, *Nabalus*, *Cassiope*, *Rhododendron*, *Salix*, *Saxifraga*, *Diapensia*, *Carex*, *Poa*, &c. The Labrador fauna is specially characterized by the abundant presence above the 5000 feet line of the butterfly *Oeneis semidea*. The presence of these faunal islands in the midst of the Canadian district is accounted for by the greater coldness of the climate in the glacial period. The whole country was then overspread by the peculiar animals and plants of the Arctic regions. As the climate moderated these organisms migrated both northwards and upwards into the higher districts, where they found the conditions favourable to their existence. Those which ascended the mountainous regions soon became separated from their congeners by the warmer temperature of the lowlands, and are now securely imprisoned in these mountain fastnesses.

New Hampshire was originally nearly covered by a dense forest. In 1876 it was estimated that more than one-fourth of the territory was still covered by trees, not of the original growth, but occupying land that had not been cleared. The trees valued for lumber, growing naturally in the forest, are the white, red, and pitch pines, spruces, hemlock, larch, red and sugar maple, beech, birch, red and white oak, chestnut, elm, hickory, poplar, cherry, &c. The pines have been described by the early settlers as commonly exceeding the height of 200 feet. One that was cut upon the Dartmouth College grounds, measured 270 feet in length.

Geology.—The topography has a less intimate connexion with the geology. The rocks are nearly all crystalline, and show very few peculiarities of sculpturing except the eruptive massive granites. These are more or less conical, like volcanic accumulations of modern times. Examples may be seen in Mount Chocorua, Mount Pequawket, and Mount Moat. At the base is a coarse porphyritic gneiss, not less than 5000 feet thick. This shows itself principally along the Connecticut-Merrimack watershed south of the White Mountains. Next comes a protogene gneiss, saccharoidal and easily crumbling, having the same thickness, and developed most extensively in Cheshire county. A third gneissic group, 18,000 feet thick, was first separated from the other series in the Lake Winnipiseogee basin, and it is the principal component of the several ridges supposed to be repetitions of the Green Mountains. These three groups may be referred to the Laurentian system. Fourth there succeeds an imperfect gneiss, deficient in felspar, 10,000 feet thick, but developed in the highest of the White Mountains, and hence receiving the name of "Montalban." Fifth comes the first of the schistose aggregates, occupying the synclinal positions between the gneisses. As it corresponds closely in stratigraphical and lithological features with that large series first separated from the Laurentian by Sir W. E. Logan upon Lake Huron, the name of Huronian is adopted for its development in New England. The largest terrane borders the Green Mountains through Vermont and Massachusetts. A second commences in the Connecticut basin near Bellows Falls, enlarging very much in the extreme northern part of New Hampshire. These rocks are 12,000 feet thick. Other terranes of related rocks are to be found in Merrimack, Hillsborough, and Rockingham counties. Veins of copper and gold are wrought in the Huronian. Sixth there follows a succession of schists and slates 11,000 feet thick, whose relations are not well established. Seventh is a series of clay slates, auriferous, and 3000 feet thick, referred to the Cambrian. Eighth follows a group of mica schists and limestones, known as the Coos group, and the calciferous mica schist, perhaps 7000 or 8000 feet thick. These are claimed as Silurian by some. Ninth, and last, are fossiliferous beds of undetermined thickness, as much as 1000 feet, in which occur well-defined *Pentamerus* and *Halysites*. These show the rock to belong to the Niagara group of the Upper Silurian. The principal localities are at Littleton and Lisbon, at the west base of the White Mountains. The most natural association of these groups is (1) Laurentian, (2) the Montalban, and (3) Huronian,—all of which are Eozoic, with an aggregate thickness of 40,000 feet. Next would follow the Huronian and indeterminate groups, reaching 23,000 feet, all believed to antedate Palæozoic time. Thirdly there remains the supposed Palæozoic series, 12,000 feet.



Distribution of the rocks over a large part of New England on a scale of about 100 miles to the inch. For convenience they are grouped thus:—(1) granite; (2) Laurentian of New York, and porphyritic gneiss of New England; (3) the later gneisses—Bethlehem, Lake, and Montalban; (4) Huronian, &c.; (5) Cambrian and Silurian; (6) Carboniferous; (7) Triassic; (8) Quaternary.

Few parts of the country display better evidences of the existence of an ice age than New Hampshire. No extensive rock exposures can be found that do not exhibit marks of scarification. Even Mount Washington has been striated, and boulders weighing 90 lb occur there, which have been brought at least a dozen miles and left 3000 feet higher than their source. The prevailing direction of the striæ and transportation of fragments was to the south-east. Local glaciers existed in the decline of the period, leaving well-marked moraines. It was in New Hampshire that the nature of the eskers or kames was first understood in America. A very noted one follows the course of the Connecticut river, from Lyme, N.H., to Windsor, Vt., a distance of 80 miles. The terraces along the Connecticut, the Merrimack, and other rivers are well shown. Careful measurements indicate that they all slope equally with the descent of the river, and resulted from accumulations of detritus pushed forward when the streams were fed by the waters of the melting ice sheet and stood 200 feet or more higher than at present.

Minerals occurring in sufficiently large quantities to be the object of mining are gold, silver, copper, zinc, lead, arsenic, tin, iron, bismuth, manganese, and molybdenum. Articles used for building purposes occurring largely are granite, coloured porphyries for ornamentation, slate, clays for brick, limestone, and soapstone or steatite. Other useful minerals either obtained directly from the rock or capable of special manufacture are quartz and felspar for glass, mica, plumbago, precious stones, whetstones, copperas, alum, pyrites, titanium, polishing powder, moulding sand, and ochres for paints. There are forty extensive quarries of granite in the State. The stone is very fine grained, of a light grey colour, and is used largely for obelisks in cemeteries. The mineral beryl is very abundant. Crystals weighing 2900 ℔ have been described as occurring at Grafton. (C. H. H.)

Population.—The population of New Hampshire in 1880 was 346,991 (170,526 males, 176,465 females)—46,294 being of foreign birth. The growth of the population is shown by the following table:—

	Population.	Gain per cent.	Rank in Union.		Population.	Gain per cent.	Rank in Union.
1790	141,885	...	10	1840	284,574	5·6	22
1800	183,858	29·5	11	1850	317,976	11·7	22
1810	214,460	16·6	16	1860	326,073	2·5	27
1820	244,042	13·7	15	1870	318,300	−2·3	31
1830	269,328	10·3	18	1880	346,991	9	31

The decrease in the decade ending with 1870 was due to the effects of the civil war and to emigration to other States. The latter cause greatly checked the growth of the preceding decade. So constant has it been that 128,505 natives of New Hampshire are resident in other parts of the Union. The density of population is 37·17 to the square mile, but the southern part of the State is more thickly inhabited. The tendency of the population is towards the towns. Of the total increase in the last decade (28,691, of whom 58 per cent. were immigrants), nine towns received 20,649, Manchester alone gaining 9094. Canada supplied the largest number of immigrants (14,979), and Ireland the next (6544). Since 1850 the native population has decreased 2866. The number of families in 1880 was 80,286, and the number of births 6141, one to 56·5 of the inhabitants, and the deaths 5584. The average size of families was 4·32, the smallest average of any State in the Union, though larger than in a few of the new Territories. It is steadily decreasing, having been 4·41 in 1870, 4·72 in 1860, and 5·15 in 1850. The decrease in the size of the family has been accompanied by an increase in the number of divorces. The tendency of the State legislation for a number of years was to facilitate divorces; between 1860 and 1870 the number increased (one county not reporting) from 90 to 147, and between 1870 and 1878, in the whole State, from 157 to 240. At the present time public sentiment is setting towards greater stringency of legislation, and has already diminished the number of divorces. The number of paupers in 1880 was 2037.

The cities of largest population in 1880 were—Manchester, 32,630; Concord, the State capital, 13,843; Nashua, 13,397; Dover, 11,687; Portsmouth, 9690; Keene, 6784; Rochester, 5784; Somersworth, 5586.

Manufactures.—The principal industry of New Hampshire is manufacturing. In 1880 the number of establishments was 3181, and the invested capital $51,112,263, giving employment to 45,811 operatives. The total annual product was valued at $73,978,028. The most important manufactures, mentioned in the order of the value of their products, were those of cotton and woollen goods, boots and shoes, leather, lumber, mixed textiles, and worsted goods. Other valuable manufactures are hosiery and knitted goods, paper, foundry and machine-shop products, flouring and grist-mill products, and malt liquors. There is a large annual cut of logs in the northern part of the State. The total horse-power employed in manufacturing was 87,750, of which water furnished 78·81 per cent. and steam 21·19 per cent. Manchester is the chief manufacturing centre, but large mills are built at Dover, Nashua, and Great Falls. The growth of manufactures in New Hampshire has been steady and constant. The first cotton mill was built in 1804. By 1826 there were fifty different buildings for the manufacture of cotton, and about half as many for that of wool. Since 1850 the capital invested in manufacturing has increased nearly 300 per cent., the annual value of materials employed 350 per cent., and the value of products 320 per cent.

Agriculture.—The value of the agricultural productions of the State is about one-fifth of the manufactures. In 1879 it was $13,474,330. The large farms are growing at the expense of small ones. In the decade ending 1880, the average size decreased from 122 to 116 acres. Within that time the farm acreage increased 115,179 acres, but the improved acreage diminished by 26,375 acres. The value of farms and farming implements remained about the same, but there was a general falling off in the quantity and value of farm productions (decrease about $9,000,000, without allowance for change in currency).

Fisheries.—An effort is being made to stock the inland waters of the State with food and game fish. A hatching house is maintained from which thousands of fry (black bass, Schoodic salmon, carp, brook trout, and other fish) are distributed to the ponds and streams. The sea fisheries are of slight importance.

Railroads.—The first railroad charter was granted in 1835. Since then the growth of railroads has kept pace with the development of the State, the present mileage (1051) being greater in proportion to population and wealth than in the case of any other New England State. The number of persons employed is 2389. The Mount Washington Railway is one of the triumphs of modern engineering. Extending 2¾ miles from the base to the summit of Mount Washington, it makes an ascent of 3625 feet. Its maximum gradient is 1980 feet to the mile, and the sharpest curve has a radius of 497 feet. The peculiarity is a central cog-rail into which plays the cog-driver of the engine, while the weight rests upon two lateral rails.

Finance.—The first bank in New Hampshire was established at Portsmouth in 1792. In 1882 there were under a State charter one bank, with a capital of $50,000, and forty-nine national banks under the National Banking Act. Their capital was $6,080,000; circulation, $5,704,691; surplus, $1,102,631; deposits, $4,859,827 loans and discounts, $8,137,442; dividends (1882), $447,525 (about 7½ per cent. on capital). The first savings bank was established in 1823. They now number sixty-five, with deposits of $36,181,186, by 104,432 depositors. In thirty years the depositors have increased by nearly 90,000, and the average deposit from $127 to $372. Every banking company pays annually to the State a tax of ½ per cent. on its actual capital, and the amount thus paid constitutes a "literary fund" for the support of schools. All are under the supervision of two bank commissioners, whose duty it is to inspect the accounts and securities of each bank at least once each year, and who have power to petition the supreme court against any bank which they think unsound. In 1880 the valuation of the State was $122,733,124 for real estate, and $42,022,057 for personal property. The taxes assessed by the State were $395,372, and the local taxes amounted to $2,302,268 (about $7·75 per head). The net State debt was $3,561,200, and the local debt $7,162,970, or taken together about $31 per head.

Religion and Education.—The largest religious denomination is the Congregationalist, which has 188 churches, 179 ministers, 20,039 members, and 21,948 in its Sabbath schools. The Methodists have 119 churches, 107 pastors and 63 local preachers, 12,100 members and 1362 probationers, and 13,509 Sabbath school scholars. The Baptists have 80 churches, 90 ministers and 7 licentiates, and 8932 members. The Episcopalians have 28 churches, 32 ministers, and 2062 communicants. The Free-will Baptists have an organization, and there are two societies of Shakers. New Hampshire has always fostered education. In earlier colonial times, when it was united with Massachusetts, the same laws applied to both, and on becoming a distinct province it placed on its statute book the Massachusetts law requiring townships of 50 householders to provide instruction for their children, and those of 100 householders to set up a grammar school. This law, with slight changes designed to render it more effective, remained in force till after the Revolution. The State constitution, adopted in 1784, contained a clause, still in force, making it the duty of "legislators and magistrates to cherish the interests of literature and the sciences, and all seminaries and public schools." In 1789 the school laws were revised, and towns required to raise for school purposes £4 for every 20s. of their several apportionment of the State tax. This requisition has been gradually increased, until now it is $350 for each dollar of the apportionment. In 1805 the towns were authorized to divide into districts, and each district was directed to maintain a school. This system, with modifications, is still in force. Towns are now authorized to abolish districts and form central schools, and to grade them when the attendance exceeds fifty. High schools may be established when there are not less than one hundred school children between the ages of six and sixteen. In 1829 the "literary fund" was divided among the towns according to the apportionment of the State tax for the support of "common free schools, or for other purposes of education." To the tax on bank capital is added one on the savings banks deposits of non-residents. In 1881 it was $26,584. The general supervision and control of the educational interests of the State are committed to a superintendent of public instruction appointed by the governor. The immediate charge of all schools is given to local boards of education or committees, which, within the requirements of the law, have complete authority to engage teachers and fix their compensation, to regulate the studies and discipline of the schools, and to direct their expenditures. Attendance upon the public school or some reputable private day school for at least twelve weeks in a year is required, except in case of sickness, of all children between the ages of eight and fourteen. Teachers, except graduates of the normal school, are engaged only after examination. The State normal school, established in 1870, and supported by an annual appropriation of $5000, confers upon its graduates the right to teach three or five years in the common schools. The number of schools in 1882 was 2644, including 481 graded and 56 high schools. The number of scholars was 64,349, and in private schools 4275. The schools are supported by the literary fund, the tax required by law, with the additional taxes voted by the towns and a few other taxes. The total amount appropriated for schools in 1882 was $584,527·74. There are also, existing under special charters, 53 academies and seminaries, many of them endowed, and furnishing a preparatory training for college. They have 161 teachers and 3112 pupils. The largest of these is Phillips Academy at Exeter, founded in 1781. Dartmouth College, the only college in the State, was founded in 1769. It has nearly 7000 graduates, among whom are some of the most noted names in American history. With its academic course are connected a scientific department, a department of civil engineering, the New Hampshire Medical College, and the New Hampshire

College of Agriculture and the Mechanic Arts. The faculty has 36 members, and there are 427 students. Its library contains 63,000 volumes.

Government.—The executive department consists of a governor and five councillors elected biennially by a majority vote, or by the general court when there is no popular election. In addition to the usual powers of the executive, the governor and council have the right of pardon, and appoint all judicial officers, the attorney general, notaries, coroners, judges of probate, and general and field officers of the militia. The legislative department consists of a senate of 24 members, elected by districts, and a house of representatives of 231 members, elected by the towns according to population. They are styled the General Court, and meet biennially in June. The judicial department is a supreme court consisting of a chief justice and six associate justices appointed by the governor, and holding office during good behaviour, or till they reach the age of seventy. Law terms are held twice each year at the capital, by the full bench, and by single justices two or four times yearly in each of the ten counties. This court has civil, criminal, and equity jurisdiction. Exceptions on questions of law, taken at the trial terms, are heard at the law terms, and cases not exceeding $100 in value, or affecting the title to real estate, may be tried before referees without jury. Commitments for offences are made by justices of the peace and by police courts. Probate courts are held by the judges of probate in the different counties, but there is a right of appeal to the supreme court. All native or naturalized male inhabitants of the State, except paupers, are entitled to vote. The State is represented in congress by two senators and two representatives, and has four votes in the electoral college.

The enrolled militia under the command of the governor numbers 33,288 men, but the active militia, known as the "New Hampshire National Guard," consists of infantry, cavalry, and a battery, and is formed into a brigade of 1208 men. An annual encampment of not less than four days is held in September.

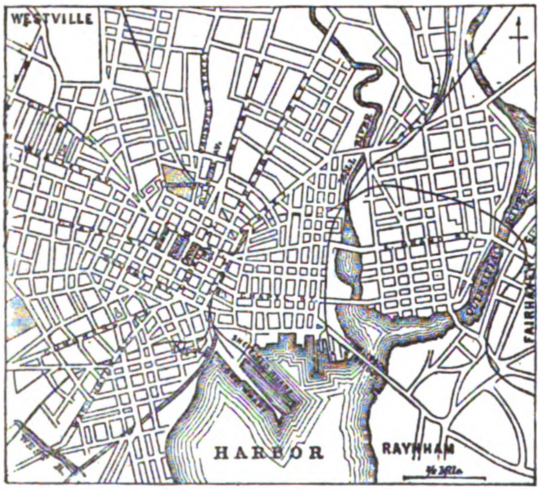
State Institutions.—There are several institutions under State control. The State's prison in 1880 had 151 inmates. The number confined in the county jails was 122. The State reform school for "juvenile and female offenders against the laws" was opened in 1858, and has received 1087 boys and girls. The asylum for insane, established in 1838, and partly supported by the State, had in 1880 285 patients (129 men and 156 women). The total number of insane in the State was 1056.

History.—New Hampshire was unknown to the earliest European explorers of America, who passed its short sea-coast without observation. The first recorded visit of a white man was that of Martin Pring, who in June 1603 sailed with two small ships into the Piscataqua. The French discoverer De Champlain visited it in July 1605, and discovered the Isles of Shoals, but in 1614 Captain John Smith made a more careful examination of this and the contiguous coast. The map which he made was presented to Prince Charles of England, who gave to the whole country the name of New England. In November 1620 James I. chartered the Plymouth Company "for the planting, ruling, ordering, and governing of New England," which was the territory lying between the 34th and 48th parallels of north latitude. On the 1st of August 1622 this company gave a sub-charter to Sir Fernando Gorges and Captain John Mason of all land lying between the Merrimack and Kennebec rivers and a line supposably 60 miles inland. This was called "Maine," though from another charter covering about the same territory sometimes spoken of as "Laconia." Under this charter settlements were made in 1623 at the places now known as Portsmouth and Dover, by companies sent out by Mason and Gorges. These continued for several years without enlargement, mere fishing and trading posts; and the next settlements, those at Exeter and Hampton, were not made till 1638 and 1639. In November 1629 Gorges and Mason divided their grant, and Mason obtained from the Plymouth Company, of which he was then a member, a grant of the land between the Merrimack and the Piscataqua for 60 miles inland. To this tract he gave the name of New Hampshire, from the county of Hampshire, in which he had been a resident. The efforts of Mason, his heirs and assigns, to enforce the proprietary rights of this patent gave rise to litigation that lasted more than a century and a half. The settlers disturbed in their possession resisted his claim, opposing to it the rights of occupancy and a prior deed of a considerable portion of the same land, said to have been obtained of four Indian sagamores in May 1629 by one Wheelwright, a minister expelled from Boston for errors of doctrine. This deed was probably a forgery, but it was made the basis of resistance to Mason's grant. Cases arising from the conflict of the two deeds were repeatedly brought before the colonial courts and appealed to England. Conflicting decisions, resisted when adverse to those in possession, delayed settlement till 1746, when a company purchased the Mason claims, and by refraining from the extreme assertion of their claims brought the quarrel nearly to an end, but it did not wholly disappear till it was settled by the legislature in 1787. In 1641 the four New Hampshire settlements, fearful of their weakness, voluntarily petitioned for union with Massachusetts. They were received, and with some towns on the Merrimack formed into a county. This union continued till 1680, when the claim which Massachusetts had put forward for jurisdiction over New Hampshire, by the terms of its charter, was denied by royal authority, and New Hampshire was declared a separate province with a governor of its own. The province ceased to have a special governor when Joseph Dudley was appointed governor of New England in 1685. In 1691, when Massachusetts regained the charter of which it had been deprived, New Hampshire was anxious to unite with it, and did act with it for a time. It did not, however, cease to be a royal province until the Revolution, having governors of its own, or jointly with Massachusetts and all New England. New Hampshire suffered severely in the French and Indian wars, as its settlements were most exposed to the attacks that came from Canada. It furnished 500 men for the siege of Louisbourg in 1745, of whom 150 were paid by Massachusetts. It sent 500 to the attack on Crown Point in 1755, and raised 2600 in the succeeding years of the war. The boundaries of New Hampshire, owing to conflicting charters given in ignorance of the country, were long a matter of dispute. The claim of Massachusetts to its whole territory was not settled, and the southern boundary definitively established, till 1740. In 1749 a controversy arose with New York, which claimed as far east as the Connecticut river, while New Hampshire claimed to extend as far west as did Massachusetts. It was determined in favour of New York in 1764, but not till New Hampshire had chartered 138 towns in the disputed territory. After the Revolution many of these towns attempted to unite with those on the western border of New Hampshire into a new State. The bitter quarrel that arose and proceeded almost to bloodshed was settled only by the interposition of congress. The settlement of New Hampshire, which had been retarded by fears of Indian invasions and questions of jurisdiction, followed very rapidly after the province was quieted, so that by the outbreak of the Revolution it had 80,000 inhabitants. It took a prominent place in the assertion of American liberty. It was represented in the successive continental congresses by two delegates, who in 1776 subscribed the declaration of independence, and in 1787 contributed to the formation of the constitution. Two New Hampshire regiments took part in the battle of Bunker Hill. The battle of Bennington, that turned the scale of the war, was won by New Hampshire and Vermont troops under the command of General Stark, who bore a commission from New Hampshire. In the whole war New Hampshire furnished 12,497 soldiers. It was the ninth State to adopt the Federal constitution, June 21, 1788, thus securing the success of the Union. Its own provisional government, formed on the retirement of the royal governor in 1775, was replaced by a State constitution in 1784. This was thoroughly revised in 1792, and with minor changes continued till 1877, when another though less radical revision was made. In the war of 1812 the State, though divided on the question of the rights of the States and the general Government, sent its quota of men. More than 2000 took part in the various battles. In the civil war of 1861–65 New Hampshire earnestly supported the Union cause. It furnished 18 regiments of infantry, 1 of cavalry, 1 light and 1 heavy battery, and 3 companies of sharpshooters, in all 32,750 men, or about 10 per cent. of the population.

The earlier history of New Hampshire is given in Belknap's *History of New Hampshire*, and illustrated by a series of *Provincial and State Papers*. Its later history is found in Sanborn's *History of New Hampshire*, and various local histories and official reports. (J. K. L.*)

NEWHAVEN (anciently MEECHING), a seaport of Sussex, is situated on the English Channel near the mouth of the Ouse, and on a branch of the London, Brighton, and South Coast Railway, 56 miles south from London, 6½ miles south of Lewes, and 8½ east of Brighton. The village, which is distant about half a mile from the sea, is clean and well built, but is little more than a shipping station, although it possesses a small ship-building yard, flour-mills, and a brewery celebrated for its Tipper ale. The church of St Michael, which has a Norman square embattled tower surmounted by a spire, was restored in 1854. The cliffs in the neighbourhood of the port are about 200 feet in height, and Castle Hill, formerly a military encampment, is very strongly fortified. A harbour was first granted to Newhaven in 1713, and during the early part of the 18th century it possessed a large shipping trade. This afterwards declined, but within the last forty years has again revived, and it is now one of the principal points of communication between England and France. The roadstead is one of the finest on the whole coast of England. The extensive additions being made to the dock accommodation are expected to give a great impetus to the trade of the port. The limits of the port after January 1, 1882, are defined by the Customs Consolidated Act of 1876. The total number of vessels in the foreign and colonial trade in 1882 was—entered 901 of 204,106 tons, cleared 881 of 197,327 tons. In the same year the vessels engaged in the coasting trade were—entered 224 of 36,309 tons, cleared 224 of 35,929 tons. Steamers ply daily to and from Dieppe in connexion with the Western Railway of France. With France there is also a large traffic in wines, spirits, silk, and general provisions. The coasting trade consists chiefly of imports of coal and provisions, the exports being principally timber for shipbuilding and flint for the Staffordshire potteries. The population of Newhaven (area 906 acres land and 184 acres water and foreshore), 2549 in 1871, had increased in 1881 to 4009.

NEW HAVEN, a city and town of New Haven county, Connecticut, U.S., in 41° 19′ 28″ N. lat. and 72° 55′ 19″ W. long. (local time 16 minutes before that of Washington), is widely known as the seat of Yale College. The town includes the city and two outlying suburbs—Westville and Fair Haven East. The city occupies an alluvial plain, from 3 to 4 miles in breadth, at the head of New Haven harbour, which is an indentation of the northern shore of Long Island Sound, extending inland about 4 miles, and formed by the confluence of three small rivers flowing through the township; the plain is partly enclosed on the east and west by two prominent trap rocks, with precipitous faces towards the city, respectively 360 and 400 feet in height. The mean annual temperature is 49° Fahr.; and the city ranks among the healthiest in the United States. It is 74 miles north-east from New York, with which it is connected by rail, as well as by daily steamboats; it has communication by three railway lines with Boston, 120 miles to the north-east, and two other railways have their termini here.



Plan of New Haven.

1. Yale College. | 2. City-Hall. | 3. City Market.

The central and older portion of the city is laid out in regular squares, surrounding a public green of 16 acres, on which stand the three oldest churches and a building formerly used as a State-house; the abundance and beauty of the elms planted about this square and along many of the streets has caused the place to be familiarly known as the "Elm City." On the squares bordering upon this central park are the interesting grounds and buildings of Yale College, the city-hall and county court-house, the post-office and custom house, and several churches. The college buildings include six dormitories (accommodating about 400) for the undergraduate academical department, which contains 620 students, under 36 instructors; and there are thirteen buildings for recitation rooms, laboratories, museums, library, &c. The handsome buildings of the theological department are in the immediate vicinity. Other public buildings are—the general hospital and training school for nurses, an armoury, the orphan asylum, the almshouse, the county prison, the halls of the Sheffield Scientific School, the college observatory, and the Connecticut Agricultural Experiment Station. The finest private residences are in the section of the city north of the central square. There are ten smaller squares within the town limits, and two private parks, of 55 and 30 acres respectively, the smaller being the college athletic grounds. A beautiful park of 352 acres (partly in an adjoining town) was opened in 1881; it lies 2 miles to the north-east of the city green. The public buildings include sixty-one places of worship, of which nineteen belong to the Congregationalists, the only denomination in the town for a century after its settlement; twelve to the Methodists, first organized here in 1795; eleven to the Protestant Episcopal Church, first organized about 1736; seven to the Baptists, who formed a church here in 1816; and seven to the Roman Catholics, whose first church was erected in 1834. There are thirty-six public schools; the expenditure for their maintenance was $368,000 in 1882–83. Twenty-nine schoolhouses owned by the town, with their furniture and grounds, represent an outlay of about $675,000. There are also about twenty private schools, the oldest being the Hopkins Grammar School, founded in 1660.

The harbour, which originally determined the site of the city, and has always been a large factor in its prosperity, is large and safe, though shallow, and is under improvement by the construction of a costly breakwater. Long Wharf, begun in 1682, is 3480 feet in length, the longest pier in the United States. Natural oyster-beds formerly abounded in the harbour and its tributary streams; and extensive beds are still maintained by planting, which give large returns, and make New Haven the chief centre of the important oyster trade of Connecticut. The harbour is still more valuable in its relation to the extensive manufacturing industries of the vicinity. Within a radius of 20 miles not less than $50,000,000 is employed in the manufacture of hardware, carriages, arms, and wire. For this New Haven is the commercial centre, and through its port there annually passes merchandise (largely coal and iron) valued at $175,000,000. The foreign trade is chiefly with the West India Islands and Demerara, and its prosperity dates from the latter part of the 18th century. The exports in the thirty-six vessels employed in this branch of trade in 1882 (breadstuffs and live stock) were valued at $3,150,000, the imports (sugar and molasses) at $6,281,000; it should, however, be noted that three-fourths of these imports and exports enter and leave the port of New York, although the capital and management of the trade remain in New Haven. The estimated total value of foreign importations received (in 84 vessels of 18,126 tons) at the port in the year ending June 1883 was $1,155,888, the chief articles being sugar and molasses, salt from the West Indies and Spain (about $100,000), and paper-rags from Alexandria. The value of the foreign exports for the same period, in 42 vessels of 7228 tons, was $670,046, the largest item being the shipments of the Winchester Repeating Arms Company. For the same year the estimated value of cargoes received from domestic ports (in 2200 steam vessels and 4125 sailing vessels and barges) was $93,968,900. Of these receipts the largest items were—iron, valued at $2,000,000; lumber, $3,000,000, twice as much more being received by railroad; and coal (a rapidly increasing business of recent growth), $3,750,000. The value of shipments to domestic ports was $74,812,000.

In the production of carriages and carriage trimmings, New Haven, which is the chief seat of the trade in New England, employs a capital of perhaps 1¼ millions dollars; nearly 2000 workmen receive annual wages of about $750,000; and the estimated value of the yearly product is $2,240,000. Another important industry is represented by the Winchester Repeating Arms Company, which, with a capital of $1,000,000, employs 1200 hands, and does a business in sporting guns and ammunition of about $2,500,000 a year. Another noticeable manufacture is that of superior blotting paper from cotton waste; blotting paper was made here for the first time in America in 1856. The other principal manufactures are locks, rubber, clocks, organs, corsets, fish-lines, and paper boxes. There are nine banks of deposit, with an aggregate capital of $4,664,000, and a circulation of $3,088,940; also three savings banks, with deposits of about $9,000,000. About $225,000 is annually paid in New Haven in fire insurance premiums, for the protection of property valued at upwards of $25,000,000.

New Haven (Indian name Quinnipiac, meaning "long-water land") was settled in 1638 by nearly three hundred English emigrants of more than the average wealth and business ability, led by John Davenport and Theophilus Eaton, with the design of founding a commercial colony to be governed by the laws of the Bible. Davenport, an Oxford graduate, and for fourteen years a minister in London, became the pastor of the New Haven church; and Eaton, a successful London merchant, was the first governor of the colony which grew up about the town. The colony (of the same name) included five other towns, and remained independent until merged, by a charter of Charles II. in 1662, in the older colony of Connecticut; this result was largely due to the waning prosperity of New Haven (in contrast with Connecticut), and to the prejudice against its more rigidly Puritan tone, as shown, for instance, in its code of laws, and in such incidents as the shelter given to Whalley and Goffe, two of the regicide judges. In recognition of its former standing, the sessions of the legislature were held alternately here and in Hartford (the original capital of Connecticut) from 1701 to 1874. From the original territory of the town (about 13 by 13 miles) ten new towns have been wholly or partly taken. New Haven was from the beginning distinguished for its care of public education,—a free school being ordered to be set up as early as 1641, and the establishment of a college being contemplated in 1648. In 1716 Yale College was removed from Saybrook to New Haven, which had then somewhat under a thousand inhabitants. A period of quiet and regular growth ensued. In 1754 a printing press was set up, and in 1755 the first newspaper published in Connecticut appeared here. There are now six daily and six weekly papers, besides several college periodicals, *The American Journal of Science*, founded in 1818 by Professor Silliman, and another review (*The New Englander*). The Connecticut Academy of Arts and Sciences, incorporated in 1799, and the American Oriental Society, have their libraries here, and publish valuable transactions. In the American Revolution the town favoured resistance to the British Government, and in 1779 was invaded by a detachment of about 3000 British troops, under General Tyron. In 1784 New Haven received a city charter (the earliest in the State), the territory incorporated having then a population of about 3350. With the close of the Revolutionary War commerce revived and expanded; and after the war of 1812 manufactures were introduced.

The population numbered in 1790, 4510; in 1800, 5157; in 1810, 6967; in 1820, 8327; in 1830, 10,678; in 1840, 14,396; in 1850, 22,529; in 1860, 39,267; in 1870, 50,840; and in 1880, 62,882, of whom 15,668 were born in foreign countries. The city was in 1880 the third place (next to Boston and Providence) in size in New England, and the twenty-sixth in the United States. Since 1880 new territory has been annexed, and the population is estimated in 1883 at nearly 74,000. The real and personal estate of the inhabitants was in 1882 valued at $48,335,632 (real estate 34 millions, personalty 14 millions). The net indebtedness of the city (principally contracted in building sewers) was $631,907 at the close of 1882; there was also a debt contracted by the town government of $941,637. The amount appropriated to meet the city expenses for 1883 was $559,435. The city is divided into twelve wards, and is governed by a mayor and twenty-four aldermen (twelve elected yearly) and thirty-six councilmen. The town affairs are controlled by a separate board of seven select men.

For the history of the town see Bacon, *Thirteen Historical Discourses*, 1839; Atwater, *History of the Colony of New Haven*, 1881; *Papers of the New Haven Colony Historical Society*, 3 vols., 1865–82.

NEW HEBRIDES AND SANTA CRUZ. These islands form part of the long chain of groups in the west Pacific known as MELANESIA (*q.v.*), having the Solomon Islands about 200 miles west and north-west of their northern and New Caledonia at the same distance west of their southern extremity. They extend for about 700 miles between 9° 45′ and 20° 16′ S. lat., and between 165° 40′ and 170° 30′ E. long.,—the Santa Cruz group lying about 100 miles north of the New Hebrides. Excepting the small Torres group in the North New Hebrides, and some other small islands north of Santa Cruz which are all perched on reefs, but without lagoons, all the islands are of volcanic formation, the larger ones lying on both sides of the line of volcanic activity. The largest of them, being thought by its discoverer, Quiros (1606), to be the long-sought Terra Australis, was named by him Australia del Espiritu Santo. It is 75 by 40 miles; its peaks and mountains have a fine appearance from the sea. Pottery is made here as in Fiji and New Caledonia, the manufacture being suggested, it is said, by the form and material of the hornet's nest (*Eumenes xanthura*). South-east from Espiritu Santo lie Mallicolo (56 by 20 miles), with a fine harbour, and Ambrym (22 by 17 miles), very beautiful, with a great volcano, 2800 feet; south of this Lopevi, a perfect volcanic cone, also active, rises to 5000 feet. Farther south are Vaté or Sandwich Island (30 by 15 miles), with the very fine harbour of Havannah; Erromango (30 by 22 miles; 3000 feet), where sandalwood is still found; Tanna (18 by 10 miles), containing Yasowa, the largest volcano of the group; and Aneiteum, the most southerly (2788 feet). Sulphur from the volcanoes is exported. Santa Cruz or Nitendi Island was the scene of Mendaña's ill-fated attempt in 1595 to found a colony; and on Vanikoro, south of Santa Cruz, La Pérouse's expedition was lost (1788). Except in the two localities above mentioned, and at Aneiteum, the coasts are almost free from reefs (the subterranean heat being probably fatal to zoophyte life), and the shores rise abruptly from deep water, the hills being densely wooded, and the scenery and vegetation singularly varied and beautiful. The trees—*Casuarina*, candle nut (*Aleurites triloba*), kaurie pine (on Tanna), various species of *Ficus*, *Myrtaceæ*, and many others—are magnificent; the cocoa-nut is not confined to the coast, but grows high up the valleys on the hill-sides. Beautiful crotons and dracænas abound. Besides the breadfruit, sago-palm, banana, sugar, yam, taro, arrowroot, and several forest fruits, the orange, pine-apple, and other imported species flourish; and European vegetables are exported to Sydney. The fibres of various *Urticeæ* and *Malvaceæ* are used.

No land mammals are known except the rat and *Pteropidæ*. Birds (species) are less numerous than in the Solomon Islands. Pigeons, parrots, ducks, and swallows are common, and a *Megapodius* is found. Of fish more than one hundred kinds are known, mostly inferior as food, and some poisonous. Whales and bêche-de-mer abound and are fished for. There are two kinds of serpents (harmless), three or four lizards, and two turtles; locusts, grasshoppers, butterflies, and hornets are numerous.

The population is perhaps 50,000. Isolated Polynesian communities occur on the smaller islands; and on Vaté—and perhaps also on Santa Cruz and Vanua Lavu—there is an infusion of Polynesian blood, producing a taller, fairer, and less savage population. The people, however, vary on every island. At Aneiteum they are all Christians, and this influence predominates in the neighbouring southern islands of the group; on Vaté and Tanna, too, there are European factories (cotton and copra), but the population is dwindling rapidly. Motu, in the Santa Cruz group, was the late Bishop Patteson's principal island station. The general type is an ugly one: below the middle height, fairer than the typical Papuan, with low receding foreheads, broad faces, and flat noses. They wear nose- and ear-rings and bracelets of shells, and frequently nothing else. The men, but not the women, drink kava. They are constantly fighting; their weapons are bows and arrows, often beautifully designed, clubs of elaborate patterns, spears, and latterly muskets. Their houses are either the round huts described by Mendaña three hundred years ago, or rectangular with pitched roofs resting on three parallel rows of posts; in Vaté the reception houses are adorned with festoons of bones and shells. In Aurora the roof is set directly on the ground, with a square doorway 2 feet high in a deep gable at the end. The villages are scrupulously clean and neat, and ornamented with flowering shrubs, crotons, and dracænas.

In character the people differ in different islands, but much of their inhospitality and savagery, disastrously shown in the murder of several missionaries, Bishop Patteson, and Captain Goodenough, is traced to the misconduct and cruelty of traders and labour agents, or to revenge for the introduction of epidemic diseases. In some islands there is the objection also found among Malays to mention their names, or as in Australia the name of the mother-, sister-, and daughter-in-law. They are inveterate cannibals, with a few exceptions, as at Santa Cruz and Banks's Islands (North New Hebrides). They believe much in sorceries and omens; but prayer and offerings (usually of shell money[1]) are addressed mainly to the spirits of the (recently) dead, and there is another class of spirits, called Vui, who are appealed to when incorporate in certain stones or animals; of one or two such the divinity is recognized generally. By the villages a space shadowed by a great banyan tree is often set apart for dances and public meetings. A certain sacredness attaches also sometimes to the *Casuarina* and the *Cycus*. An important institution is the club-house, in which there are various grades, whereon a man's rank and influence mainly depend, his grade being recognized even if he goes to another island where his language is unintelligible. In like manner a division into two great exogamous groups prevails, at all events throughout the northern islands. It would therefore seem that the present diversity of languages in the group must be of relatively recent origin. These languages or dialects are numerous, and mutually unintelligible, but alike as to grammatical construction, and belonging to the Melanesian class.

Principal Authorities.—Lieut. A. H. Markham, R.N., in *Roy. Geog. Soc. Jour.*, 1872; Brenchley, *Cruise of the Curaçoa*; Rev. R. H. Codrington, "On Religious Beliefs and Practices in Melanesia," in *Jour. Anthrop. Inst.*, vol. x.; Walter Coote, *Wanderings South and East*. (C. T.)

NEW IRELAND. See New Britain.

NEW JERSEY. The State of New Jersey, one of the original colonies which formed the United States of America, lies between 38° 55′ 39″·65 and 41° 21′ 19″ N. lat., and 73° 53′ 51″ and 75° 33′ 3″ W. long., and is bounded on the E. by the Hudson river, Staten Island Sound, Raritan Bay, and the Atlantic Ocean, on the S. by Delaware Bay, on the W. by the Delaware river, and on the N. by the State of New York, their common boundary being a straight line from the west bank of the Hudson river in latitude 40° N. to a point on the north bank of the Neversink river at its junction with the Delaware. The extreme length is 167⅝ miles, and the width ranges from 59 to 32 miles; and the State has an area of 7576 square miles, and is divided into 21 counties and 223 townships.

Physical Features.—New Jersey lies entirely on the Atlantic slope of the United States. In the north and north-west it is traversed by the Appalachian chain; the Red Sandstone belt, intersected by trap dykes, and extending from Massachusetts to South Carolina, occupies the central portion; and the lower half of the State is a part of the level sandy tract, covered with pine woods, which borders the Atlantic from New York to Florida.

The ridges of the Appalachian chain in New Jersey may be grouped in two main ranges—the Blue or Kittatinny Mountains and the Highland range. The first of these is an almost unbroken ridge from the New York State line to the Delaware Water Gap, and is the highest ground in the State, being at the Water Gap 1479 feet above the sea, and at High Point, near the New York line, 1800 feet high. Its level crest is clothed with forests, but the slopes are to a great extent cultivated. The Highland range, on the other hand, consists of a number of detached ridges, the highest of which is 1488 feet above the sea. These vary greatly in their surfaces; many admit of cultivation to the summit, while others are so covered with loose stones or bare rock that cultivation is impossible. The mineral wealth of the range is considerable.

The Red Sandstone central region is traversed by a number of irregularly distributed trap dykes, which are rough and wooded, and rise in the midst of a rich and productive district. These vary much in elevation, the highest being 868 feet. In southern New Jersey there are no rocky eminences or elevations worthy of the name of mountains. Its rounded hills are all earthy, and the results of denudation or erosion; the most elevated—the Navesink highlands—are about 400 feet high.

The southern half of the State is a great plain, sloping gently from its centre towards the Atlantic and the Delaware, and has been eroded in the Drift period.[2] It contains tracts of gravelly loam largely used for market gardens and vineyards. Extensive tidal marshes border the Atlantic and Delaware Bay, to the extent of nearly 300,000 acres. The Delaware river and bay receive all streams flowing from the western half of the State; the Passaic and Raritan are the most considerable rivers entirely within New Jersey. In the north-western part are many beautiful lakes abounding with fish; the largest is Lake Hopatcong, 5½ miles long by 4½ to 1½ miles wide.

Geology and Minerals.—Nearly all the geological periods, except the Coal-measures, are represented in the State. It may be stated in a general way that all the stratified formations cross the State from north-east to south-west; that the Highland range, to which they run parallel, is made up of the oldest rocks in the State; that almost all of the Palæozoic rocks, which are next in order, lie on the north-west side of these mountains; that the Triassic rocks lie next to the mountains on the south-east; and that the Tertiary and recent formations are then found in succession towards the south-east. The Azoic rocks occur mainly in the Highland range, and here consist chiefly of syenitic gneiss and white crystalline limestone, the former greatly predominating. This limestone is found chiefly on the north-west border of the gneiss, interstratified with and conformable to it. Magnetic iron ore abounds here, and occurs in beds or veins interposed between the strata of the gneiss. New mines are constantly being discovered, and the supply seems inexhaustible.[3] Graphite is also found and worked. Valuable deposits of zinc ore occur in the crystalline limestone, and large quantities of excellent lime are made from this rock.[4] The Potsdam limestone is found in comparatively small quantities, always near the borders of the gneiss and limestone. Magnesian limestone, found between the Highland range and Kittatinny Mountains, is extensively used for making lime, and contains hæmatite iron ore. Hudson River slate (used for roofing and flagging) exists most largely on the south-east slope of the Kittatinny Mountains. Water lime and Lower Helderberg limestone, which produce the Rosendale cements, are found in quantity along the north-west foot of the Kittatinny. Red sandstones and shales underlie the region immediately south-east of the Highland range, extending from the Hudson to the Delaware. They are in regular layers, dipping gently to the north-west, and form an excellent building material. Copper occurs in this formation, and was worked at an early period. To the south-east of the Sandstone formation follow plastic and fire clays, due to the decomposition of a ridge of granite which once formed the eastern edge of the Red Sandstone valley; these furnish clays of the purest and most refractory kind, suitable for fire-brick; very pure quartz sand is also found here, to mix with the clay, and kaolin, although not yet of the best quality.[5] The greensand, marl, and sand beds occupy a belt some 90 miles long extending from Sandy Hook to the Delaware near

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[1] The *Cypræa moneta* is used here, as in New Caledonia, as a medium of exchange.

[2] The glacial action of the Drift period is well marked in the State by striæ and by boulders as distant as 100 miles from their original position. In Middlesex county there is a boulder of 250 tons nearly 30 miles from its parent rock, another in West Orange. The western boundary of the great terminal or frontal moraine of the glacial Drift period extends across the State in a general north-north-west course from the mouth of the Raritan at Perth Amboy to Morristown, thence northerly to Denville, where the direction changes to the west as far as the Musconetcong valley, where it again turns and bears west-south-west to the Delaware at Belvidere.

[3] 932,762 tons were obtained in 1882.

[4] 40,138 tons were mined in 1882.

[5] In 1882 more than 350,000 tons of these clays were worked, from which 150,000,000 red bricks were made, a large number of porous bricks, 80 per cent. of the architectural terra cotta made in the United States, and a very large amount of pottery and stoneware.

Salem. This formation consists of three distinct beds of greensand, each from 12 to 25 feet thick, separated by beds of sand. The marl is clearly of marine origin, containing sea shells, bits of coral, sharks' teeth, saurian bones, &c., and makes a good manure. Glassmakers' sand is worked in the southern part of the State.[1] Along the shore is an elevation of only 5 to 10 feet above the sea-level, having good alluvial soil, which must within a comparatively recent period have been beneath the sea. Since the first settlement of the country, however, the shore has washed away, and there is good reason to believe that a very gradual subsidence is now taking place.[2] The entire sea-coast is rapidly becoming a continuous line of summer resorts, among which may be enumerated Long Branch, Sea Bright, Spring Lake, and Asbury Park in the northern portion, Atlantic City in the centre, and Cape May in the south. Some of these places, as Atlantic City, are frequented even during the winter months.

Commerce and Industry.—Although only the thirty-fifth among the thirty-eight States in area, it is the nineteenth in population, the eighth in the value of property, and twenty-fifth in value of agricultural products, the sixth in manufacturing and mechanical industries, while in some industries, as silk, pottery, and glass, it far exceeds any other State. The output of the non-precious minerals places it seventh in the list of States, it being the fourth among the iron-producing States, and first as to zinc ore. It has 1869 miles of railways, or 1 mile to every 4·25 square miles of area, exceeded in this by only one State. The average value of farming lands is considerably above that of any other State. In 1880 the total number of farms was 34,307, averaging 85 acres, or a total of 2,929,773 acres of farm lands, of which 24·4 per cent. were unimproved. The value of farm lands was $190,895,833; farming implements and machinery, $6,921,085; live stock, $14,861,412; all farm products, $29,650,756. Among the principal products were—Indian corn, 11,150,705 bushels; oats, 3,710,573; rye, 949,064; wheat, 1,901,739; hay, 518,990 tons; Irish potatoes, 3,563,793 bushels; sweet potatoes, 2,086,731 bushels; 86,940 horses; 9267 mules and asses; 152,078 milch cows; 71,808 other cattle; 117,020 sheep; 219,069 swine; 9,513,835 ℔ butter; 15,472,783 gallons milk.

Omitting fishery products, gas, petroleum, refining, mining, and quarrying, the following table gives the general condition of the manufacturing interests of the State in the years mentioned:—

	No. of Establishments.	Capital.	Hands Employed.	Wages Paid,	Cost of Material.	Products.
1850	4,207	$22,293,258	37,830	$9,364,740	$22,011,871	$39,851,256
1860	4,173	40,521,048	56,027	16,277,337	41,429,100	76,306,104
1870	6,636	79,606,719	75,552	32,648,409	103,415,245	169,237,732
1880	7,128	106,226,038	126,038	46,083,045	165,380,179	254,375,236

Among the most important interests for 1880 are those given in the following table:—

Kind of Industry.	No. of Establishments.	Capital.	Average No. of Hands.	Wages Paid.	Material.	Products.
Anthracite furnaces.	16	$6,825,000	938	$340,035	$3,341,560	$3,580,664
Boots and shoes	396	1,153,290	3,757	1,422,681	3,069,894	5,262,671
Breweries............	48	4,250,000	1,095	662,836	3,179,883	5,798,330
Cotton goods.........	24	3 961,145	4,836	1,309,997	1,284,819	5,039,519
Drugs and chemicals	41	8,830,750	1,272	596,742	3,528,204	4,998,965
Foundry & machine shop products.....	188	7,431,421	8,205	3,432,456	6,128,852	11,282,748
Hats and caps........	79	1,343,900	5.567	2,113,581	2,103,082	6,152,447
Iron and steel........	66	9,741,216	5,544	2,109,740	7,564,205	11,837,846
Jewellery............	68	2,555,899	2,284	1,114,946	1,967,064	4,079,677
Leather..............	111	3,793,796	2,688	1,479,296	12,353,017	15,475,222
Paper mills..........	32	1,830,500	886	272,936	1,286,182	2,015,569
Rubber goods.........	20	1,790,200	2,548	766,523	2,029,415	5,212,695
Sewing machines....	8	1,152,785	3,311	1,519,947	1,484,902	4,640,852
Silk and silk goods..	106	6,952,325	12,549	4,177,745	9,678,836	17,122,236
Stone & earthenware	49	2,057,200	3,180	1,101,511	1,030,598	2.598,757
Sugar and molasses.	4	2,110,000	697	476,216	20,794,961	22,841,256
Woollen goods.......	27	2,530,125	3,363	996,384	3,162,965	4,984,007

Population.—The population of the State was 211,149 in 1800, 277,426 in 1820, 373,306 in 1840, 672,035 in 1860, 906,096 in 1870, and 1,131,116 in 1880. The census of 1880 showed 559,922 males and 571,194 females, 1,092,017 white, 38,853 coloured, 172 Chinese, and 74 Indians. The inhabitants of foreign birth numbered 221,700. To every square mile of area there were 151·73 inhabitants, the State being the third in the Union in respect of density of population.

The largest cities, with population in 1880, are—Newark, 136,508; Jersey City, 120,722; Paterson, 51,031; Camden, 41,659; Hoboken, 30,999; Trenton (the State capital), 29,910; Elizabeth, 28,229; New Brunswick, 17,166; Orange, 13,207.

Government.—The executive power is vested in a governor elected by the people for a term of three years; no one can serve in this capacity two successive terms. The legislative power is in the legislature, composed of a senate and general assembly meeting on the second Tuesday of January each year at Trenton, the capital of the State. A senator is elected for three years by each of the twenty-one counties, one-third of the whole number being elected each year. The assembly consists of not more than sixty members, elected for one year, and apportioned among the counties as nearly as may be according to the number of their inhabitants, with the condition, however, that each county shall at all times be entitled to one member. The principal officers of the State are a secretary of state, attorney-general, adjutant-general, and quartermaster-general, all appointed by the governor and confirmed by the senate, and a treasurer and comptroller appointed by the legislature in joint meeting. All judges and prosecutors of the pleas are appointed by the governor and confirmed by the senate; the election system for the judiciary has not yet reached New Jersey.

The judicial power is vested in (1) a court of errors and appeals in the last resort, consisting of the chancellor, the justices of the supreme court, and six judges of the court of errors; (2) a court for the trial of impeachments, consisting of the senate; (3) a court of chancery, consisting of the chancellor and two vice-chancellors; (4) a supreme court, consisting of the chief justice and eight associate justices; (5) circuit courts, held in every county by the justices of the supreme court; (6) an inferior court of the common pleas organized in each county, and consisting of three judges. In some of the sparsely settled counties the inferior courts are presided over by justices of the supreme court; in the other counties one of the three judges is a law judge and presides. The court of pardon consists of the governor, the chancellor, and the six lay judges of the court of errors; a majority of this court, of whom the governor must be one, can remit fines and forfeitures, and grant pardons, after conviction in all cases except impeachments.

State Institutions.—There are two lunatic asylums,—one near Trenton containing more than 600 patients, the other near Morristown capable of accommodating 800; the latter is probably unsurpassed by any similar institution; there are also seven county asylums containing 746 patients. An institution for the deaf and dumb, to contain 125 pupils, has been recently established at Trenton; the blind and feeble-minded are placed in suitable establishments in neighbouring States. The home for disabled soldiers, at Newark, accommodates nearly 400 men. The State prison at Trenton contains some 800 convicts, a large part of whom are employed in contract labour to an extent which pays about 54 per cent. of the cost of the institution. A reformatory school for boys, near Jamesburg, contains about 325 juvenile delinquents. An industrial school for girls, near Trenton, has 30 inmates. The board of health is steadily gaining in importance, and has accomplished much good in spreading useful information, collecting important vital and health statistics, and investigating matters affecting the public health. The labour bureau has done good service in collecting statistics affecting the questions of labour and capital, in bringing about a better understanding between the two, and in indicating new and profitable avenues for industry. The geological survey, of which the geodetic and topographical surveys have necessarily formed part, now approaching its close, is one of the most useful of the State institutions.

Education.—The Agricultural College, attached to Rutgers College at New Brunswick, is supported by the proceeds of certain public lands given by the United States to the State for that purpose. In connexion with this are the college farm and the agricultural experiment stations, which are doing admirable work in systematic and carefully conducted experiments (under the chief of the geological survey) with various fertilizers, and in testing various soils, crops, and methods of agriculture. The public schools are mainly supported by a State tax of $4 for each child between five and eighteen years of age, amounting in 1882 to $1,322,740, supplemented by an annual appropriation of $100,000 from the school fund, which latter now amounts to more than $3,375,000, and is rapidly increasing. Small additional special taxes are also levied in some of the school districts. A normal school has been in successful operation at Trenton for several years, and has nearly 250 pupils. The college of New Jersey at Princeton, and its sister theological seminary, although not State institutions, occupy places in the very front rank of American schools of learning.

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[1] In the year ending June 1880 27,495 tons were mined, and in that year there were in operation in the State 55 furnaces, containing 364 pots, with 3501 work-people, and a product of $2,810,000; window glass, green glass, and glassware are made. One-third of the product of green glass in the United States is made by the Jersey works.

[2] The United States Coast Survey and the New Jersey Geological Survey are engaged on observations to settle this question.

Finance.—The only State debt is that known as the war debt, amounting at present to less than $1,700,000, and paid off at the rate of $100,000 per annum. The sinking fund for the redemption of this debt is valued at something more than $1,100,000. Independently of the general State school tax the receipts and expenditures for 1882 were $1,104,303·75, distributed as follows:—interest on debt, $90,000; charitable and reformatory, $269,793·19; courts, crimes, &c., $274,025·82; State government, $158,171·04; scientific, sanitary, &c., $47,880·49; military, $70,692·22; educational, $33,983·61; publication, $105,225·47; miscellaneous, $54,531·91. It will thus be seen that the State expended for educational purposes $1,356,723·61, as against $1,070,320·14 for other purposes.

History.—The first settlement within the present State was made in 1617 by the Dutch at Bergen opposite New York. Subsequently Cornelius May, who discovered the Delaware in 1623, built a fort on its banks opposite Philadelphia. During the early colonial period the region was the scene of many petty struggles arising out of the rival efforts of the Dutch, Swedes, and English to establish trading posts and settlements on the river. The Indians among whom these early settlers were thrown were generally divided into small tribes; but in the valley of the upper Delaware were the principal and most populous seats of the Leni Lenape—known by the English as the Delawares, a name still retained by the remnants of this most interesting and once powerful tribe in their new homes west of the Mississippi. On the whole the early intercourse between the whites and Indians was peaceful, but there were occasional collisions, some of a serious nature, too often brought about by the rapacity and bad faith of the whites. As a rule the title to the Indian lands was purchased, and after the province fell into the hands of the English the general policy pursued was one of humanity and good faith. At the time of the English accession it is estimated that the Indians in New Jersey numbered about 2000.

When Charles II. wrested their North American possessions from the Dutch—in fact before this was accomplished—he granted them in bulk to his brother the duke of York, who in turn granted what is now New Jersey to Lord John Berkeley and Sir George Carteret, the conveyance (June 23, 1664) providing that "the said tract of land is to be called Nova Cæsarea, or New Jersey."[1] The royal grant was of the proprietary character, that is, it not only conveyed the absolute estate and title to the land, but also the power to govern and rule, and therefore to establish such laws as "might be thought necessary, provided they were not contrary to but, as near as conveniently might be, agreeable to the laws, statutes, and government of the realm of England." As all these rights and powers were assignable, the duke transferred to Berkeley and Carteret, not only the lands, but also the power to govern; and they in turn possessed, and finally exercised, the power to assign to others both land and power to govern. A form of government was accordingly established in a "concession and agreement" issued by them. The governor was appointed by the proprietors, and he appointed a council of from six to twelve members; the governor and council united formed the executive. The freeholders of the province elected not less than twelve representatives, who, with the governor and council, composed the general assembly, in whom rested the legislative power, limited only by the terms of the "concession," especially the article securing entire liberty of conscience. The general assembly established the courts of justice, and took all measures necessary to preserve order and provide for the general defence; they regulated commerce, and determined the time and duration of their own sessions; they possessed the entire power of taxation, and it was required that the executive should neither impose nor suffer to be imposed any tax other than those imposed by the general assembly. The right of petition to the lords proprietors was secured to the freeholders. The first governor was Philip Carteret, a brother of Sir George, who arrived with a number of "adventurers" in August 1665, and established himself at Elizabethtown. Upon the capture of New Amsterdam by the English, their commander, Colonel Nichols, assumed the administration of the entire territory in the name of the duke of York. Ignorant of the grant to Berkeley and Carteret, Nichols at once offered inducements to settlers from New England and Long Island to move into New Jersey, advising them to purchase the Indian titles, and promising immunity from ground rents. In consequence of this promise, which occurred before Carteret's arrival, serious difficulties afterwards arose.

The first general assembly met at Elizabeth, May 26, 1668; another session was held during the same year, but none other for seven years thereafter. In 1672 New Amsterdam and New Jersey were reconquered by the Dutch, but early in 1673 they reverted to England. Doubts arising as to the effect of the reconquest upon the validity of the original grant, the duke of York obtained a new grant from the king, and renewed his own to Berkeley and Carteret. Prior to this renewal the two proprietors had agreed to a division of their interests, and in the new grant the portion assigned to Carteret was the region east of a line drawn from Barnegat Creek to the Rancocus; to Berkeley was assigned the territory west of that line. In 1676, however, the line of separation was changed by the owners, so that it extended from Little Egg Harbour to a point on the Delaware in 40° N. lat.; this remained thereafter the boundary between East and West Jersey.

Immediately after the reconquest Philip Carteret returned to East Jersey as its governor, and on his arrival in 1674 presented a new charter, less liberal in many respects than the original. Berkeley meanwhile sold West Jersey to a firm of Quakers, who at once proceeded to colonize it, establishing their first settlement at Salem in 1675, and another shortly after at Burlington. For some years great annoyance was experienced both in East and West Jersey from the unjust interference of the governor of New York, and of the duke himself, with their internal affairs; these attempts were always met by a firm and spirited resistance, which eventually triumphed. In 1682, soon after Sir George Carteret's death, a society of Quakers under the lead of William Penn, encouraged by their success in West Jersey, purchased from his heirs their rights to East Jersey. It will give some idea of the progress already made to state that at this early period (1682) a smelting furnace and forge were in operation in New Jersey, making good iron, and that contemporary documents show that at the same date there were exported "great plenty of horses, beef, pork, pipe-staves, boards, bread, flour, wheat, barley, rye, Indian corn, butter, and cheese to Barbados, Jamaica, and other adjacent islands, as also to Portugal, Spain, the Canaries, &c.; whale oil, whale fins, beaver, mink, raccoon, and martin furs to England."

Towards the close of the 17th century the number of proprietors in the two provinces increased so much as to render good government impracticable in consequence of the discord arising from divergent interests and views. The evil became unendurable, and in 1702, by the general consent of the proprietors and people, the former, while retaining all their property rights, surrendered their right of government to the crown, by whom the two provinces were reunited, and placed under a governor appointed by the sovereign. With him were associated in the government twelve councillors selected by the crown, and twenty-four assemblymen selected by the freeholders. The sessions of the assembly were at the pleasure of the governor, and its acts subject to the double veto of governor and crown. The governor and council organized the courts of law, determined all salaries, and appointed all civil and military officers.

The population of the two provinces at this period was probably a little more than 15,000. The great majority of the people were Quakers, Presbyterians, and Anabaptists; there were only two Church of England ministers in the province, and their followers were too few and poor to provide churches; nevertheless the Church of England was now made the established church, and its support provided for. Liberty of conscience was permitted to all except Roman Catholics. Quakers were eligible to office. The governor enjoyed the right of presentation to ecclesiastical benefices.

Lord Cornbury was the first governor appointed under the new arrangement, and the commission and instructions which he received, the chief points of which have just been given, formed the constitution and government of New Jersey until the declaration of independence, except that New York and New Jersey had the same governor until 1738, after which year each had its own governor, and in New Jersey the council became a separate branch of the legislature, the governor no longer participating in the debates. From the beginning of Cornbury's administration to the Revolution the political history of the province consisted largely of violent contests between the assembly and the governor and his council,—the latter constantly striving to extend the prerogative and curb the power of the people, and the assembly maintaining a bold and able contest in defence of the principles of liberty. Notwithstanding the large proportion of Quakers among its early inhabitants, New Jersey never failed to furnish its just quota of men and money for the various American wars waged in the 18th century, and its contingent bore a most honourable part in the chief military events of that period. For the campaigns of 1711, 1739, 1746, 1747, and 1748 the province supplied a battalion of 500 men. It was during these last campaigns that the name "Jersey Blues," in vogue since that time, was first applied to the Jersey troops from the colour of their uniform—blue faced with red, grey stockings, and buckskin breeches. They were described at the time as "the likeliest well-set men who ever entered upon a campaign." When the French war of 1754 broke out Jersey again furnished a battalion of 500 men; of these one half were captured by Montcalm at Oswego, after a gallant resistance, and the remainder at the surrender of Fort William Henry. But the province at once made good the losses, and maintained as many as 1000 men in 1758, 1759, and 1760, in which last year its contingent took part in the capture of Montreal. In 1761 and 1762 the contingent was 600 men, and again in 1764 for service against the Indians.

During the years immediately preceding the Revolution New Jersey took an active and leading part in all the discussions and measures growing out of the attempt of parliament to impose stamp duties and taxation upon the colonies without their consent. The

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[1] In compliment to Sir George Carteret, who had defended the Isle of Jersey against the Long Parliament.

province was ably represented at the various meetings of the continental congress preceding and leading to the war of the Revolution, and from the breaking out of hostilities bore more than its full share of the burdens necessary to bring the war to a successful conclusion. The last provincial assembly was prorogued in December 1775. The provincial congress, elected in accordance with the ordinance of the preceding congress, convened in June 1776, and on the 18th of July assumed the title of the "convention of the *State* of New Jersey." An Act of Assembly of September 1777 substituted the word "State" for the word "Colony" in all cases of writs, commissions, indictments, &c., &c. In the war New Jersey furnished to the "continental line" 10,726 men, besides large numbers of militia, and expended for war purposes, on account of the continental government, $5,342,770. Some very important and interesting operations of the war were conducted within the limits of the State; and from its peculiar position New Jersey suffered more from the evils of the war than any of the thirteen colonies, except perhaps South Carolina. In the whisky insurrection of 1794 the State furnished more than 2000 militia, who under Governor Howell formed part of the army in Pennsylvania. In the war of 1812 it furnished nearly 7000 militia, and in the Mexican war three companies of regular infantry and a battalion of volunteers. At the breaking out of the civil war of 1861 the number of men in the State available for military duty was 98,806; and during that war New Jersey organized and maintained 37 regiments of infantry, 3 regiments of cavalry, and 5 batteries. The national guard of the State now consists of 48 companies of infantry and 2 Gatling gun companies, numbering 3220 officers and men, thoroughly organized, drilled, and equipped for service.

See Samuel Smith, *History of the Colony of New Jersey to the year* 1721, Burlington, 1765, republished 1877; Gordon, *History of New Jersey to the Adoption of the Federal Constitution*, Trenton, 1834; Mulford, *Civil and Political History of New Jersey*, Camden, 1848; Barber and Howe, *Historical Collections*; *New Jersey Archives*, first series; Whitehead, *Contributions to the Early History of Perth Amboy*, New York, 1856, and *Contributions to East Jersey History*; Winfield, *History of Hudson County*; Hatfield, *History of Elizabeth, New Jersey*, 1868. For the geology, Cook, *Geology of New Jersey*, 1868; and *Annual Reports of the State Geologist of New Jersey*. (G. B. M'C.)

NEW JERUSALEM CHURCH. See SWEDENBORG.

NEW LONDON, a city and port of entry of the United States, one of the shire towns of New London county, Connecticut, lies on the west bank of the Thames, about 3 miles above its entrance into Long Island Sound. It is the southern terminus of the Central Vermont Railroad, and a station on the New York, New Haven, and Hartford and the New York, Providence, and Boston Railroads, whose trains cross the river by ferry. By rail it is 126 miles from New York and 62 from Providence. Two lines of steamers ply daily to New York. The city is built on a declivity facing the south-east, and from the higher points enjoys fine views over Long Island Sound and the surrounding country. To the south lies Fort Trumbull, having 80 guns and room for 800 men, but too near the city to be a sufficient defence. At Groton Heights on the opposite bank, a small battery occupies the site of Fort Griswold, near which is a granite shaft, 127 feet high, commemorating the massacre of its garrison by Arnold's troops in 1781. As a fashionable summer resort, rivalling Newport, it is well provided both with private residences and public hotels. The city-hall, the county court-house, and the custom-house are among the most conspicuous buildings. The harbour of New London, the best on Long Island Sound, and one of the best in the world, is 3 miles in extent, and has a depth of from 4 to 7 fathoms; the river is navigable also for 3 miles above the city. The granite wharf, built by the New London Northern (Central Vermont) Railroad, is 1125 feet long, 220 feet wide at the river end, and 150 feet at the shore end. On the east side is a United States navy yard. As a whale-fishery port New London was from 1840 to 1857 second only to New Bedford. Since the decline of the whale fishery it has prosecuted the seal fishery (Alaska and New Shetland), and the cod and mackerel fisheries. A woollen mill, a cotton-gin factory, iron foundries, a fruit-canning establishment, and an extensive cracker bakery are the chief manufacturing works in the city. The population was 8991 in 1850, 10,115 in 1860, 9575 in 1870, and 10,537 in 1880. In 1645 John Winthrop the younger settled on what was then known as Pequot Harbour, and in 1658 the Connecticut assembly resolved that the "plantation" should bear the name of New London. During the Revolution the harbour was the headquarters of the Connecticut privateering fleet. In 1781 the city was captured by Benedict Arnold, and, together with Groton, was burned by accident or design.

NEWMARKET, a market-town, partly in Cambridge and partly in Suffolk, and the seat of important races, is situated on the Cambridge and Bury branch of the Great Eastern Railway, 13 miles north-east of Cambridge and 60 north by east of London. The parish church of Saint Mary, an old Gothic building of stone, was recently restored. Newmarket has been celebrated for its races from the time of James I. The house built for this monarch's use during his visit to the races, and enlarged by Charles II., is now partly occupied by a Congregational chapel. The Beacon race-course at Newmarket is about 4 miles long, and is the finest in the world. The town is the chief seat of the Jockey Club, and of the training establishments for races, more than 1000 horses generally occupying the stables at one time. Near the race-course is the Devil's Ditch, consisting of a ditch and mound 4 or 5 miles long and 100 feet broad, with a slope of 50 feet on the south-west side. Roman remains have been found in the neighbourhood. The population of the urban sanitary district (740 acres) in 1871 was 4534, and in 1881 it was 5093.

NEW MEXICO, a Territory of the United States, is bounded on the N. by Colorado, on the E. by Texas and unorganized "public lands" adjacent to the Indian Territory, on the S. by Texas and Mexico, and on the W. by Arizona. It forms nearly a square, being about 335 miles in width from east to west and 345 miles in length from north to south on the eastern border, which lengthens to 390 miles on the west. As formed originally by the Organic Act of 1850, the Territory embraced Arizona and southern Colorado. In 1854 the "Gadsden Purchase" from Mexico added a strip along the southern boundary. In 1863 Arizona was detached and made into a separate Territory, and in 1867 the portion of New Mexico north of the 37th parallel was added to Colorado, leaving the Territory with its present boundaries, and an area of 122,460 square miles.

Physical Features.—The whole area is elevated far above the ocean, the table-lands of the north being 6000 to 6500, those of the centre 5000, and those of the south about 4000 feet above sea-level. The fall in the Rio Grande from the Colorado line to that of Mexico is about 3500 feet. The whole except the eastern portion is traversed by mountains, passing from north to south, not continuously but in broken ranges, which, for convenience of description, may be divided into three parts. The main range of the Rocky Mountains enters the Territory from the north, the highest peaks being the Costilla (12,615 feet), Taos, Mora (12,020), Truchas (13,150), and Baldy (12,661). This range disappears as a continuous chain near Glorieta. Running east from this as a kind of spur along the Colorado line are the Raton Mountains, the pass in which, south of Trinidad, is 7893 feet high. The railroad crosses this range through a tunnel. Commencing about 20 miles south of Santa Fé, and extending southwards on the east side of the Rio Grande, is a broken range, known variously in localities from north to south as the Cerrillos, Placer, Sandia, Chilili, Manzana, Jumanes, Oscura, San Andres, and Organ Mountains,—the last-named crossing into Mexico near El Paso. Nearer to the Rio Grande in Socorro county are the Fra Cristobal and Caballo Mountains. East of the above chain is a series of ranges, generally short, locally known as the Gallinas, Jicarilla, Carrizo, Capitan, Sierra Blanca, Sacramento, Hueco, and Guadalupe Mountains. On the west of the Rio Grande another broken range runs south, commencing at the singularly conspicuous San Antonio mountain, close to the Colorado line, and known in its several parts as the Petaca, Valles, Nacimiento, Jemez, San Mateo, Ladrones, Oso, Madalena, Socorro, San Mateo (of Socorro), Black Range, Mimbres, and Florida Mountains, the latter extending into Mexico. Still farther to the west, and near the Arizona boundary, yet another series of comparatively short ranges is found, consisting of the Carrizo, Tunicha, and Chusca Mountains, which constitute part of the "great continental divide" separating the waters flowing into the Gulf of Mexico from those running into the Pacific, and more to the south the Zuñi, Datil, San Francisco, Escudilla, Tulerosa, Luera, Mogollon, Diablo, Pinos Altos, Burro, Sarampion, Hacha, Perro, Animas, and Peloncillo Mountains. These mountains are seamed with great "cañons," which also penetrate the larger "mesas" or table-lands in various places, where in some way the covering of lava which is their usual protection has been removed. Between contiguous ranges or spurs of the same range are frequently found "parks" of great beauty and fertility. These specially abound in the western part of Colfax county.

New Mexico, while generally requiring irrigation for its cultivation, is more fully provided with rivers than any of the other mining States or Territories. Its waters flow east to the Mississippi, south to the Gulf of Mexico, and west through the Colorado and Gila to the Gulf of California and the Pacific Ocean. The Rio Grande, called also the Rio Bravo del Norte, passes completely through the centre of the Territory from north to south. It receives many tributaries, the principal being the Santa Fé and Galisteo from the east, and the Chama, Jemez, Puerco, and Alamosa from the west. Its valley is of great fertility, and capable of supporting a large population. The north-eastern part of the Territory, including the greater part of the counties of Colfax, Mora, and San Miguel, is drained by the Canadian or Red River, which flows into the Arkansas. The branches of this stream are very numerous, the principal ones being the Cimarron, Mora, Concha, Pajarito, and Ute. The Pecos rises north-east of Santa Fé, and, flowing south, gives value to a vast belt of land, until it crosses the Texas line and finally joins the Rio Grande itself. Its valley is unsurpassed for fertility and agricultural worth. Among other streams, the Tecolote, Gallinas, Hondo, and Peñasco are tributaries to it. In the north-west is the Rio San Juan, from which that whole section is called the "San Juan country." It flows west to the Great Colorado, and has as its principal branches in New Mexico the Animas from the north and the Chaco from the south. In the central west are the headwaters of the Little Colorado, and in the south-west those of the Gila, with the Mimbres, which flows south into Mexico.

Minerals.—In almost all parts of the Territory, except the pastoral plains, the precious metals are found, the mineral extending from the extreme north to the southern boundary. The eastern slope of the Rocky Mountains, in Colfax county, abounds in gold, and Elizabethtown, its chief village, was the scene of great mining prosperity a few years ago. The metal is found in "leads" as well as in extensive "placers." On the opposite side of the range are both gold and silver, and a little farther south, near Picuris, are large deposits of copper. Travelling southwards we find various minerals of value in the mountains east of Santa Fé; and the Cerrillos mining district, about 20 miles south of the capital, presents a rich deposit of silver not as yet fully developed. Here also are the famous turquoise mines, the largest in America, which played so important a part in the early history of the Territory. To the west in the Nacimiento region is a great body of copper. At the "Old Placers" and "New Placers," in the southern extremity of Santa Fé county, are inexhaustible supplies of placer gold, which were washed for many years by the rude methods of former times, but work here has been suspended pending the completion of extensive works now in progress which will provide a sufficient supply of water for large operations. The Manzana, Ladrone, and Madalena ranges, and, indeed, nearly all the mountains on both sides of the Rio Grande, contain rich mineral. Silver mines of great value are worked in the Socorro Mountains, directly west of the city of that name. The Black Range country is rich in silver and copper; and the more recent discoveries on the Percha river and at Lake Valley promise to be of extraordinary richness and extent. The vicinity of White Oaks in Lincoln county is specially noted for its free gold, and the San Andres, Caballo, and Organ ranges abound in valuable ores. The greatest development has taken place in Grant county, whose "Santa Rita," "Hanover," and other copper mines are well known; the vicinity of Silver City and Georgetown produce great quantities of silver, while the newer districts in the south-west, in the vicinity of Shakespeare and Lordsburg, are also rich in the last-mentioned metal. To the north of Silver City are the Mogollon Mountains, where valuable mineral deposits are found. The mines, especially those of silver, were extensively worked by the Spaniards down to the year 1680, when the revolt of the Pueblos, caused by the cruel slavery to which they were reduced in working for the precious metals, resulted in the filling up and concealment of every mine in the country during the thirteen years of Pueblo control. The shafts of these mines are frequently discovered. Development in recent times has been greatly retarded by Indian occupancy in some sections and their incursions into others; but now that these difficulties have ceased it is very rapidly progressing.

Bituminous coal is found in inexhaustible quantities in very many sections of the Territory, notably near Raton in Colfax county, along the Galisteo river on the line of the Atlantic and Pacific Railroad, and near the Chama river in the north-west. Anthracite coal of an exceedingly fine quality exists in large amounts near Cerrillos station, being superior to many of the coals of Pennsylvania, and by far the best fuel thus far discovered west of the Mississippi river. Iron is found in many localities, but has not yet been worked, the more valuable metals monopolizing attention. Mica mines of large extent and excellent quality are at Petaca, Mora, near Nambé, and in other localities. Lead abounds in many sections carrying silver, and notably in the Cerrillos mines. Plumbago is found in Colfax county; and cement of a very superior quality is made at Springer. Gypsum, fire-clay, and mineral paints are among the mineral resources of the Territory; and marbles and other excellent building stones abound.

Mineral springs of various kinds of great excellence are found in different localities. Prominent among them are the Las Vegas hot springs, the Ojo Caliente in Taos county, the Jemez hot springs, and the Hudson springs. These all have special medicinal qualities, and are of high temperature, the Ojo Caliente water being of 114° and the Jemez 168°. There are also important springs south of El Rancho in Taos county and east of Santa Fé.

Climate.—The climate is dry and the air clear throughout almost the entire year. The temperature at Santa Fé, which is considered to have the best climate in the Territory, is sometimes as low in the winter as at New York, but the dryness of the atmosphere prevents the cold from being felt to anything like the same extent. The more southerly towns are of course warmer, not only on account of the difference in latitude, but also because of their decreased altitude.[1] The rainy season occupies about a month, varying in time from the middle of July to the middle of September, but even then a wholly cloudy day is seldom seen, the mornings being bright, with showers in the afternoon. The comparative death-rate from tubercular diseases in New Mexico is less than anywhere else in the United States, the proportions being—New England 25, Minnesota 14, Southern States 6, New Mexico 3.[2] The average rainfall at Santa Fé for eight years (1874–81) was a little less than 14½ inches, whereas the average at New York was 43, Boston 45, Philadelphia 44, Washington 37, St Louis 42, and Savannah 48. The mean temperature was 48½°. The atmosphere is so clear and pure as to be proverbial. From the first characteristic arises the deception as to distances so generally experienced by strangers; and the second is evidenced by the fact that everywhere throughout the Territory the natives hang up their meat out-of-doors to dry, and use pieces of it as required, not the slightest taint arising from it during a series of months.

Agriculture, &c.—The greater portion of New Mexico is pastoral, being unfitted for agriculture from lack of water for irrigation. Wherever there is sufficient water either in streams or springs to supply the wants of animals, the grass is amply sufficient to support either cattle or sheep. The Territory abounds in the most nutritious grasses, which retain their virtues during the winter; and the climate is such that shelter is not required other than that afforded by nature, in valleys and woods. The number of sheep is variously estimated from 7,000,000 to 10,000,000, and they are raised in every county. Within the past few years the breed has been much improved by the introduction of merino, Cotswold, and other fine-woolled varieties. The cattle business has reached enormous proportions within a few years, and is steadily advancing in importance. The immense profits received have induced the investment of large amounts of capital, and all the desirable ranches are being rapidly taken up and stocked. The business is changing in its character in two ways. Large corporations are taking the place of small owners, and, instead of ranging over the plains, the cattle are now generally confined to tracts exclusively owned or occupied, and fenced. Colfax county alone is thought to contain nearly 100,000 head of cattle, and the number in the whole Territory is very large, and rapidly increasing.

Agriculture is mainly limited to the valleys. Those of the Rio Grande, the Pecos, the Canadian, the San Juan, and their tributaries, though generally narrow, contain large areas of arable land of extraordinary fertility. They produce large crops of grain and of most kinds of vegetables, especially onions, beets, turnips, cabbages, cauliflowers, &c. Potatoes succeed best in the mountainous regions. The Taos valley is an exceptionally fine wheat country, and before the advent of railroads supplied a great part of the Territory with its flour. The Mora valley is also celebrated for its wheat. It is as a fruit-producing region, however, that a large portion of the irrigated land in the Territory specially excels. The Rio Grande valley from Embudo to Mesilla is particularly adapted to this purpose. The area of fruit and vine culture is being yearly extended. Peaches, plums, and apricots come to great perfection in the north, and pears, apples, quinces, cherries, &c., as well as the stone fruits, throughout the middle and southern sections. Grapes flourish from Bernalillo to El Paso, and in some favoured spots like La Joya farther north. The grape principally cultivated is the "Mission," which produces excellent wine. Hardy American varieties like the Concord will do well anywhere, and the less hardy European varieties, such as the White Muscat, Flamed Tokay, &c., succeed admirably in the vicinity of Las Cruces. The Pecos valley also produces fruit of extraordinary size and beauty.

The supply of timber, especially of pine, is almost inexhaustible. It exists in nearly all the hilly and mountainous parts of the Territory, but is of very superior quality as regards both height and straightness in the vicinity of Tierra Amarilla. Cedar abounds in many localities, and the piñon makes an excellent fuel. Oak, maple, walnut, and ash are found to a more limited extent. The varieties of poplar commonly known as cottonwood and quaking aspen are the most common deciduous trees, and grow in almost all parts of the Territory. Several other native plants are proving of value. The *Yucca* of different varieties abounds,—*Y. filamentosa*, commonly called amole or soap-weed, covering immense tracts. Experiments have recently been made with a view to utilizing the fibre of the large serrated variety abundant in the south in the manufacture of rope, and the smaller kinds in paper-making, as well as using the root in preparing a substitute for soap. These bid fair to make this very abundant plant of large commercial value. The cañaigre has long been known to possess powerful tanning properties, and recent experiments by the department of agriculture and elsewhere have demonstrated its value as a substitute for bark and other agents. The plant grows wild over a large extent of country, and its importance in a district producing so many hides and skins can hardly be overestimated.

Government and Administration.—The executive officers are a governor and a secretary. The higher judiciary consists of a chief justice and two associates, each of whom presides over the courts in one district, all three sitting together as an appellate supreme court in January of each year. The legislature consists of a council of twelve members and a house of representatives of twenty-four, elected by counties biennially. The governor possesses the veto power. The territorial officials are a treasurer, auditor, attorney-general and two district attorneys, and an adjutant-general. In each county there are a probate judge, sheriff, and other local officers, the chief authority being vested in a board of county commissioners of three members elected by the people. The counties are divided into precincts, in each of which there is a justice of the peace and a constable. At present there are twelve counties in the Territory. Public education is in charge of a board of three school commissioners in each county. A tax of ¼ per cent. is levied for the support of public schools. Precincts may become independent school districts at their option.

Population.—The population of the Territory was 91,874 in 1870 and 119,565 in 1880. Since that time it has steadily increased. The capital, Santa Fé, had 6635 inhabitants in 1880.

History.—The first European that traversed the Territory was Cabeza de Vaca (Nuñez), the treasurer of the unfortunate expedition of Panfilo Narvaez to Florida, who, being cast ashore on the coast of Texas, crossed the continent with three companions, and after encountering infinite difficulties and dangers arrived at Spanish settlements near the Gulf of California. On the way he passed through a land of "fixed habitations," which were evidently the Pueblo towns, followed the Rio Grande for many miles, and on his return to civilization gave such an account of his travels that great interest was excited. In consequence, Coronado, the governor of New Galicia, sent Marcos de Niza, a Franciscan monk, with Stephen, a negro who had been one of Vaca's companions, to reconnoitre the country. They penetrated as far as Zuñi, then called Cibola, where Stephen was killed; but Marcos made up for the lack of substantial success by the marvellous nature of the report he presented. The next year, 1540, Coronado himself headed an expedition of 300 Spaniards and 800 Indians, and started from Culiacan on Easter Monday. He succeeded in finding Cibola, which he subjugated with the surrounding country, and then proceeded to the province of Tiguex (on the Puerco river). After this expedition several friars at various times entered the country, establishing missions, often at the cost of their lives. Among them one of the most prominent was Agustin Ruiz, who was killed in 1581. Almost immediately after this came the expedition of Espejo, who was sent by the viceroy to protect the missions. The next expedition of note was that of Oñate, toward the close of the century, which carried a large number of additional colonists into the Territory. From this time the Spanish population increased rapidly, and mining was extensively engaged in, the natives being reduced to a virtual condition of slavery in the mines. In 1680 the Indians, who had long been on the verge of rebellion, revolted, and under the lead of Popé, a chief of large influence, marched on Santa Fé, and there besieged Governor Otermin and the Spanish army, who were finally compelled to evacuate the town and retreat to El Paso. For thirteen years the Pueblos continued to control the country, defeating successive Spanish expeditions, until in 1698 Diego de Vargas, the new governor, succeeded in conquering them and a peace was made, one of the terms of which was that there should be no more slavery in the mines. In fact the Indians had filled up all the shafts in the meantime. For over a century afterwards little occurred to disturb the tranquillity of the Territory, except occasional wars with the surrounding savage tribes. In 1804 Lieutenant Pike, exploring the head-waters of the Arkansas, by mistake camped on Mexican soil and was brought into Santa Fé and sent to Chihuahua as a prisoner. About this time the first goods were brought across the plains to the New Mexican market, being the commencement of the overland traffic of the Sante Fé "Trail," which increased yearly in importance until the railroads took the place of the "prairie schooner." In 1820 Mexico became independent, and New Mexico began to be governed by political chiefs instead of Spanish "Gobernadores."

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[1] The elevations at some of the principal points are—Costilla, 7774 feet; Tierra Amarilla, 7455; Glorieta, 7507; Santa Fé, 7044; Fort Wingate, 7037; Taos, 6950; Las Vegas, 6452; Fort Stanton, 5800; Bernalillo, 5104; Albuquerque, 4918; Socorro, 4655; Las Cruces, 3844.

[2] The army statistics for six years lead to the same result, the ratio of deaths per 1000 from diseases of the respiratory organs being—west coast of Florida, 6·9; New York, 5·9; New England, 4·8; Great Lakes, 4·5; Texas coast, 4; western Texas, 3·9; East Florida, 2·3; New Mexico, 1·3.

By a change in the constitution in 1835, governors were appointed instead of elected, and Albino Perez was sent from Mexico as the new ruler. This excited much discontent, which was increased by the enactment of a new tax law two years later. About August 1, 1837, a revolutionary movement commenced in the north of the Territory among both Mexicans and Pueblos, having for its centre the town of Cañada or Santa Cruz. Governor Perez marched to meet the insurgents, but was deserted by nearly all his troops and compelled to fly, and was soon after overtaken and killed near Agua Fria. A number of other prominent officials were also killed; and on August 10 Jose Gonzalez, a Taos Indian, was installed as governor in the palace. General Manuel Armijo, who had held high positions before, raised troops at Albuquerque to suppress the revolt, and finally defeated the rebels at Cañada. The Mexican Government confirmed his acts and appointed him governor, which office he held with some intermissions until the coming of an American army in 1846 under General Kearney, who marched from the Missouri and took possession of the Territory without bloodshed,—General Armijo retiring southwards. A provisional government was established by the Americans, and Charles Bent, an old resident, appointed governor, but he was killed in a revolt in January 1847. The treaty of Guadalupe Hidalgo made New Mexico a part of the United States, and by an Act of Congress of September 9, 1850, it was organized as a Territory with a regular government. Early in 1862 a Confederate army from Texas invaded the country and occupied Santa Fé, March 10; they were defeated, however, at Glorieta on March 28, and evacuated the capital April 8. The people of the Territory were commendably loyal, and supplied 6000 men to the Union army.

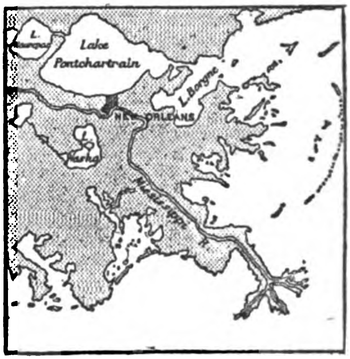
The first rail was laid in New Mexico, November 30, 1878, by the Atchison, Topeka, and Santa Fé Railroad, which reached Las Vegas July 1, 1879, Santa Fé February 9, 1880, and connected with the Southern Pacific at Deming March 18, 1881. This, and the construction of the Denver and Rio Grande and the Atlantic and Pacific Railroads, have given a great impetus to the Territory. (L. B. P.)

NEW MILLS, a township of Derbyshire, is situated at the confluence of the rivers Goyt and Kinder, on the borders of Cheshire, 8 miles south-east of Stockport and 7 south-west of Glossop. Its ancient name was Bowden Middle Cale, and formerly it included seven hamlets, but about a century ago three of these were detached, and it now includes only those of Beard, Ollersett, Thornsett, and Whittle. The name New Mills was given to it from a corn-mill erected on the Kinder in the hamlet of Ollersett, and is now specially applied to the group of factories which have grown up round it. Formerly paper and cloth were the staple industries of the district, but now the inhabitants of the various hamlets are occupied chiefly in iron and brass foundries, cotton-mills, and print-works. A public hall was erected in 1871, to which a lofty tower was added in 1875. There are almshouses and other charities. The population of the urban sanitary district (5200 acres) in 1881 was 6552.

NEW ORKNEY. See NEW SOUTH SHETLAND.

NEW ORLEANS, a city of the United States, situated on the left bank of the Mississippi, 107 miles from its mouth, in that portion of the State of Louisiana which constitutes the river's larger delta. This peculiar region is an irregular expanse of densely-wooded swamps, wide prairies, and sea-marshes, interlaced by innumerable lakes, streams, and bays, formed by the periodic overflows of the river upon the alluvium of its own deposit, and by remnants of the sea which this natural process of land-making has not yet conquered. It embraces the whole coast of Louisiana on its southern border, and, narrowing rapidly northward, presents a total area of some 20,000 square miles of land and water. Through this region the Mississippi, as in its southward course it reaches the 30th parallel of latitude, turns and runs tortuously eastward a few miles south of and parallel with a chain of these delta lakes—Lake Pontchartrain being the chief—which marks the course of the same river in prehistoric, but not geologically remote, ages. At the 90th degree of longitude it bends abruptly southward, then as suddenly eastward again, then northward and again eastward, thus portioning off on the low, concave land, which is always highest at the river's margin, a shallow basin rudely square in shape and not unlike the palm of one's hand. This deep three-sided bend, some 9 miles in total length, is the harbour of New Orleans, and on the low tract walled in by the dyke or levée that lines its bank, and by a similar defence where Lake Pontchartrain, some 4 to 6 miles to the northward, shuts in the fourth side, lies New Orleans, the principal seaport of the Mississippi valley, and a city of 216,000 inhabitants.

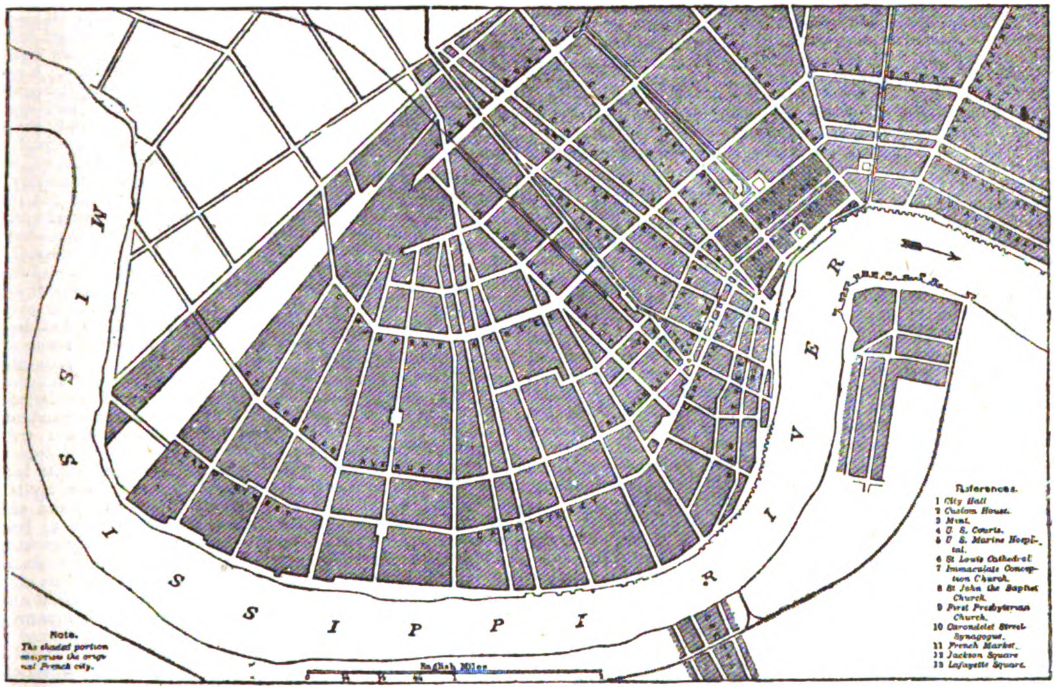
The river at this point varies from 1500 to 3000 feet in width, and its broad channel often stretches almost from shore to shore, with a depth varying frequently at short intervals from 60 to more than 200 feet. Around the margins of this fine harbour a line of steamers and shipping extends for 7 miles on either shore, moored, in the busy season, from two to five abreast, to the outer end of short, broad, unsheltered wooden wharves that rest on piles driven firmly into the tenacious clay of the river's bed. The speed of the current reaches, in times of high water, a rate of 5 miles an hour. Along the immediate front of the city's principal commercial quarter, this current, losing some of its force by change of direction, deposits its alluvium in such quantities as to produce a constant encroachment of the shore upon the harbour. At its widest this new land, or batture, with wharves, streets, and warehouses following eagerly after it, has advanced nearly 1500 feet beyond the water-line of a century and a half ago.



Environs of New Orleans.

New Orleans is emphatically a commercial city. It was its commercial value as the southern gateway of the immense valley behind it, and as the key to the free navigation of that vast natural system of waterways of which the Mississippi is the great main artery that, upon the achievement of American national autonomy, gave a small, poor, and remote Franco-Spanish-American port its political importance, and in 1803 led to its purchase by the United States, and the purchase with it of the entire province of Louisiana, of which it was the capital in embryo; and it is almost solely as the dispenser of the products of this greatest agricultural valley in the world that New Orleans has grown from the wild and indolent little frontier town of 10,000 inhabitants it then was to the dimensions of a great city. Along its winding harbour front one sees, in the season that follows the harvests of the south and west, the energies and activities of an exporting movement not excelled in volume or value on the American continent save by New York. The levée, the wharves, and the contiguous streets teem with strenuous life, and are gorged with the raw staples of the countries far and near that lie about the Mississippi and its greater and lesser tributaries,—sugar, molasses, rice, tobacco, Indian corn, pork, staves, whisky, wheat, oats, flour in immense quantities, and, over and above all else, nearly one-fourth of the world's entire supply of cotton. All other movement is subsidiary or insignificant: the import trade is small;

manufactures are inconsiderable; mining interests are almost unknown. There are no fisheries, no naval construction, no large transit of immigrants, no notable Government establishments except a branch mint and the customhouse. There are no great educational and scientific institutions or important conservatories of art—only the promising germs of such; no famous galleries or museums; no noted monuments; in short, well-nigh none of that multiplicity of pursuits and opportunities that retains and multiplies rapidly a city's wealth, and makes the inspiring tumult of metropolitan life. On any hand it requires but a step or two aside from the current of commercial movement to carry one into the bowery repose of a huge suburb rather than of a city, or, if of a city, a city of villas and cottages, of umbrageous gardens, intersected by 470 miles of unpaved streets shaded by forest trees, haunted by song birds, fragrant with a wealth of flowers that never fails a day in the year, and abundant, in season, with fruit—the fig, the plum, the pomegranate, the orange. No other large city in America is so laid open to the sunshine and the air. Neither St Louis, nor Chicago, nor Philadelphia, nor New York covers so large a site as New Orleans, whose inhabitants, considerably under a quarter of a million in number, have spread out their town over an area of 155 square miles.[1]



Plan of New Orleans.

New Orleans is exceptionally interesting among cities of the United States for the picturesqueness of its older sections, and the language, tastes, and customs of a large portion of its people. Its history is comparatively short; but it is as sombre and unique as the dark, wet cypress forest draped in long, pendent Spanish moss that once occupied its site, and which still encircles its low horizon. It was founded in 1718 by Jean Baptiste Lemoyne de Bienville, a French Canadian, governor of the French colony which nineteen years earlier had been planted by his brother D'Iberville on the neighbouring shores of the Gulf, along the eastern margin of the Bay of Biloxi. A few years after its founding, and while it was still but little more than a squalid village of deported galley-slaves, trappers, and gold hunters, it was made the capital of that vast Louisiana which loosely comprised the whole Mississippi valley to Canada on the north and without boundary on the west, under the commercial domain and monopoly of John Law's scheme, so famed in history under the merited nickname of the Mississippi Bubble. The names remaining in vogue in that part of the city still distinguished as the "vieux carré," or "old French quarter," continue to preserve an interesting record of these humble beginnings. The memory of French Bourbon dominion is retained in the titles, and in the foreign aspect as well, of Toulouse, and Orleans, and Du Maine, and Conti, and Bourbon, and Dauphiné, and Chartres Streets; while even more distinctly the Bourbon of Spain has superimposed his impress on frequent stuccoed wall and iron lattice, huge locks and hinges, arches and gratings, balconies, jalousies, corrugated roofs of tiles, dim corridors, cool pavements, and inner courts brightened with parterres, urns, and basins, statues half hid in roses and vines, and sound of trickling water. There are streets named from his governors, too:—Unzaga, Galvez, Miro, Salcedo, Casa Calvo, Carondelet, and the Baron Carondelet's Baronne. The moated and palisaded boundaries constructed in wild and unsafe days are indicated by the wide, tree-planted, and grassy avenues named respectively from the Canal, the Rampart, and the Esplanade that lay along their course; and the old parade ground in the midst of the early town's river front, now laid off in flower-beds, white-shelled walks, and shaven shrubbery, and known as Jackson Square, still retains, with that official title, its older name of the Place d'Armes. In this quaint, sunny, and dusty old garden, surrounded by an unconscious picturesqueness of architecture not seen elsewhere in America save in one or two remote nooks, by the old cabildo and calaboza, the court-house (once the presbytery of Capuchin friars), the cathedral of St Louis, and the long row of red shops shaded by broad verandas in the streets of St Peter and St Ann,—in this square is commemorated nearly every event in the colonial history of Louisiana. Here in early days were landed those cargoes of French girls supplied each with a chest of clothing by the king, and proudly famed long afterward by their numerous and prosperous descendants as the "filles à la cassette"—the girls with trunks. Here from 1729 to 1739 rallied these motley gatherings of men—white, red, and black—in the buckskin and feathers of the wilderness, the gay colours, gold braid, and ruffles of royal uniforms, and the black nakedness of slavery, that with varying success made ten years' war against Natchez, Yazoo, Choctaw, and Chickasaw savages. Here in 1765 the people welcomed with tears and open arms their exiled brethren from far

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[1] This has not been entirely within the boundaries already described. A modern part of the city, of some extent, lies on the right bank of the harbour, opposite these older portions that occupy the river front where it turns from north to east.

Acadia, as thirty-six years before on the same spot they had received the women and children of Fort Rosalie (Natchez), recaptured from the hands of the savages who had massacred their husbands and fathers. Here in 1768, the town being then a place of about 3200 souls, the people within the walls and from the farms and plantations of the surrounding delta mustered under arms almost to a man, repudiated the cession of Louisiana to Spain, and compelled the holder of the Spanish king's commission to leave their town and return to Havana. Here again, in the following year, Don Alexandro O'Reilly landed from a fleet of twenty-four vessels with 2600 Spanish troops and fifty pieces of artillery, and restored the Spanish power by mere terror of such an overwhelming force. Here stood under Spanish sentence and fell under a volley of Spanish musketry the leaders in this the first attempt made in America to overthrow by force of arms the dominion of a European sovereign. It was here, again, that in 1779 the brilliant young Spanish governor Galvez, laying before the people the proposal to head them in defence of their homes, and intending to lead them against the neighbouring British posts along the shores of the Mississippi and the Gulf of Mexico east of it, was answered by their acclamations, and was followed to repeated and uninterrupted victory. Here, when in 1788 and 1794 the heart of the frail wooden town was plucked out by fire, the houseless sufferers covered the rank sward with booths and tents until that Spanish-American architecture could rise out of the ashes whose brick and stucco and coloured limewashes, and flowery inner courts seen through covered carriage-ways, and overhanging balconies, and confusion of heights and breadths and shapes, with here and there a palm tree lifting its stately top among them, heavy with yellow dates, still offer to the eye a moss-grown and crumbling picture whose variety and poetry tempts description to repeat itself.

On the 30th of November 1803, in the council hall of the old cabildo that still overlooks the square, the aged governor Salcedo handed the keys of the city back to the representatives of the French Government, the marquis of Casa Calvo declared the people of Louisiana absolved from their allegiance to the Spanish king, and on the flagstaff in the open plaza the yellow flag of Spain came down and the tricolor of France arose in its place. And here, at length, only twenty days afterward, with similar ceremonies, the keys of the city passed from the hands of the French colonial prefect to those of the commissioners for the United States, and through their tears the creoles saw the ensign of the French republic sink and the American flag unfurl over what is to-day, as it was then, the least American of all the cities within the bounds of the American States. A bronze equestrian statue of Andrew Jackson stands in the middle of the ground on the spot where, in January 1815, when he had driven back to its ships from the plains just below the city the bleeding remnant of a formidable British invasion, he passed, amid all the evidences of joy that a delivered city could display—cheers and salvos and rolling drums, arms and banners and maidens' garlands—under an arch of triumph and into the cathedral, and so onward in later years to the highest seat in the nation.

At the time (1803) when New Orleans with its 10,000 inhabitants, mostly French creoles and their slaves, passed into the political bond of the United States, the prospect of its future commercial greatness was not only appreciated but was exaggerated even by the most sagacious minds; for they regarded it in the light of its remarkable geographical position, and of those stirrings of revolution which were beginning to promise the birth of other republics round about the broad circuit of the Mexican Gulf, with maritime powers and commercial energies that must give the position of New Orleans an inestimable value. But, as the future gradually unfolded, on the one hand the provinces that did throw off the Spanish yoke failed persistently to establish internal peace and stability or obtain the confidence of the commercial world, and on the other hand the invention of railway transit revolutionized commerce itself and turned its courses across the natural highways and barriers of the continent; and when, moreover, the pestilence of yellow fever, the plague of the Gulf, made New Orleans one of its most famous ambuscades, and the provincialism and lethargy of an isolated and indolent civilization allowed this last unfortunate condition to remain uncorrected, the limitations to the city's commercial grandeur were distinctly drawn around it, and a port that had promised to become one of the greatest in the world became, even while it was expanding to metropolitan dimensions, a monument of golden possibilities dwarfed by unforeseen and overpowering disadvantages.

New Orleans held its highest place on the comparative scale of cities in the United States when, by the census of 1840, only New York, Philadelphia, and Baltimore were greater in population. In the decade that followed, these cities left it far behind and others overtook it and passed it by. In the second decade after the junction of the great west and the Atlantic seaboard by canals and railways many other conditions came in to the great disadvantage of New Orleans. The development of the carrying trade on the lakes of the far north, the adoption by the world's maritime trade of ships and steamers drawing too much water to pass the bars at the mouth of the Mississippi, and in the city the riot made by death, which in three years (1853–55) from a population diminished by flight to barely 145,000 carried off over 35,000 persons,—these things and others combined to impede the town's progress at a period when the growth of American cities was a marvel of the times, and to reduce her comparative importance in population, wealth, enlightenment, and architectural dignity.

However, turning from these comparisons and contrasting the city only with itself, we see the trading post described by the priest-chronicler Charlevoix in 1721 as a place of a hundred wretched hovels in a malarious wet thicket of willows and dwarf palmettos, infested by serpents and alligators, changed in 1860 to a metropolis whose exports, imports, and domestic receipts aggregated $324,000,000. In that year the election of a president from the Republican party was made the occasion of acts that led to war between the Northern and Southern States of the Union. The commerce of New Orleans experienced an early paralysis: the port was soon blockaded by the United States navy; the city fell into the hands of the Federal forces; and its aggrandizement suffered a recoil from which it has taken nearly a quarter of a century to recover. Only in the present year (1883) will its total commerce again distinctly reach the magnitude it enjoyed in 1860. Its wealth in 1882 was $112,000,000. In the present year it is closely estimated that 2,000,000 bales of cotton will be received across its levee for shipment to the world's markets. It appears highly probable that those drawbacks which have been enumerated have at length expended their power, and that New Orleans now looks out upon a future of more genuine promise than ever before. A system of jetties at the mouth of the Mississippi, built by the distinguished engineer Eads in 1879, has opened the city's deep and spacious harbour to the largest ocean craft. Lines of steamers to the great ports of Europe are replacing with their great carrying capacity the light tonnage of other days. An active sanitary system, which grows every year better, gives reasonable promise of immunity from the deadly epidemics of former years; street paving has recommenced; the inadequate and superficial drainage is being improved, under the direction of a sanitary association auxiliary to the board of health, a diligent house-to-house inspection is being performed, and the open gutters that are in all the streets are daily flushed during the warm months with water thrown into them by powerful pumps at the river front. The annual mortality-rate of the three years 1879 to 1881 averaged 26·52 per 1000. The old spirit of dependence upon natural advantages which once deluded the people of the city is yielding to a more energetic acceptance of the principles of modern commerce, and railway connexions, near and remote, are increasing year by year. The immense increase of population and products in that wide south-west that stretches out beyond to the Mexican border offers new accessions of commercial tribute. Mexico holds out fair assurance of a new era of political order and material development; and within the city's immediate bounds both the convictions of her citizens and the movement of capital are recognizing theoretically and practically the necessity and advantage of manufactures. About ten million dollars are at present invested in this direction, and the aggregate is steadily growing.

Within the last two years (1882–83) a new impulse towards architectural improvement has shown itself, and several edifices of comparatively imposing character have been erected. Chief among them is the new Cotton Exchange. The small public squares here and there in the city have been laid out in lawns and adorned with fountains; but, as long as the great body of the people is not subjected to the discomforts of pent-up living, the larger reservations of ground intended for public parks are likely to remain as they are, unimproved. Suburban pleasure resorts are few, the principal being two waterside gardens of moderate pretension on the neighbouring margin of Lake Ponchartrain.

The creoles of New Orleans and the surrounding delta are a handsome, graceful, intelligent race, of a decidedly Gallic type, though softened in features, speech, and carriage, and somewhat relaxed in physical and mental energies by the enervating influences that blow from the West Indies and the Spanish Main. Their better class does not offer to the eye that unpleasing evidence of gross admixture of race which distinguishes those Latin-American communities around the borders of the adjacent seas; and the name they have borrowed from those regions does not necessarily imply, any more than it excludes, a departure from a pure double line of Latin descent. They are brave, proud, courteous, slow to offend, quick to resent, gay, fond of pomp, and display an ardent relish for pageantries of such childish sort as offers a strong hint of their Spanish-American relationship. They are very musical, yet not, as a class, highly trained in music, have some love of the fine arts, but are little acquainted with or interested in its modern developments, and are comparatively unproductive of art work. The famous carnival displays of New Orleans are participated in largely by the "*Americain*," *i.e.*, the Anglo-American; but they mark one of the victories of Spanish-American over North-American tastes, and probably owe mainly to the "*Americain*" their pretentious dignity and to the creole their more legitimate harlequin frivolity. Out of the simple idea of masked revelry in the open streets, as borrowed from the great Italian cities, the American bent for organization appears to have developed, by a natural growth, the costly fashion of gorgeous torch-lighted processions of elaborately equipped masques in tableaux drawn on immense cars by teams of caparisoned mules, and combining to illustrate in a symmetrical whole some theme chosen from the great faiths or literatures of history. This carnival has grown to last two or three days, during which time its extravagances quite engross public attention with an elaborate mock-restoration of the gaudiest Oriental and feudal European life and times; the daily press shows long lists of names of citizens knighted or invested with imaginary dukedoms (at a fixed price); and many thousands of visitors from all parts of America come, or tarry, yearly to see these laborious pomps.

The first settlers of New Orleans were such men as colonies in America were generally made of when planted by royal commercial enterprise, and such wives as could be gathered hap-hazard from the ranks of Indian allies, African slave cargoes, and the inmates of French houses of correction. As time passed, gentler and often better blood was infused by the advent of the filles à la cassette, by victims of lettres-de-cachet, by the cadets of noble families, holding land grants or military commissions, by Spanish officials glad to strengthen their influence in the colony through matrimonial alliances, and by royalists fleeing the terrors of the French Revolution. The creole civilization that grew from these sources acquired two of its strongest characteristics from the facts, first that it developed under the evil reigns of French and Spanish Bourbons, and second that it was founded on the system of African slavery. The influences of the climate and landscape were such as to emphasize rather than counteract the effects of these conditions; and, when in the year 1809 Napoleon's wars caused an exodus of West Indian creoles into New Orleans that immediately doubled the town's population, the place naturally and easily became the one stronghold of Latin-American ideas in the United States, a harbour of contrabandists, Guadeloupian pirates, and Spanish-American revolutionists and filibusters. Under the glacier-like pressure of Anglo-American immigration, capital, enterprise, and education, this creole civilization has slowly and with stubborn reluctance yielded ground, and is at length fairly beginning to amalgamate with the better social system of the American nation. And yet the creole has stamped his initials upon well-nigh every aspect in the life of the city that has broadened out so widely on every side of his antique town. Some effect, of course, is attributable to those natural surroundings that have so qualified the creole's own Gallic energies. Between the two influences the whole life of the place shows an apathy of desire, a langour of performance, and an intolerance of all sorts of rigour, that makes it unlike those sister cities from which it is separated both by the entire breadth and by the peculiar sentiment of that great belt of States which still distinguishes itself, more proudly than profitably, as the South.

Churches, both Catholic and Protestant, are very numerous in New Orleans, though not generally fine or imposing. St Patrick's, however, has a majestic tower; the First Presbyterian church, in Lafayette Square, is a tasteful Gothic structure; and the cathedral of St Louis, the church of the Immaculate Conception, in Baronne Street, and some others have handsome interiors. The number of private charitable institutions is also large, and their management excellent. Those under municipal control are not nearly so good, but are improving. The system of public education is a large and excellent one deserving much praise. It embraces the youth both of the white and of the black and mulatto populations, is carried up through a full high-school grade, and is steadily improving. The police force is small, ill-paid, and inefficient, and the whole police system dilapidated and bad.

The coloured population, notwithstanding the presence among it of that noted free quadroon class which has enjoyed a certain legal freedom for many generations, has not greatly improved since the date of emancipation. A conventional system of caste cuts them off from the stimulating hope of attaining social rank, and confines them closely to servile employments. The probability seems to be that their decided elevation must wait upon their acquisition of material wealth, an achievement which the conditions mentioned and some inherent deficiencies of the race tend to make extremely difficult. Besides the large Anglo-American and creole populations, there are in New Orleans weighty fractions of Irish and Germans and an appreciable number of Italians, Sicilians, and Spaniards. The Babel of tongues in the "French Market" immediately below Jackson Square and at the "Picayune Tier" just adjacent is famed as far as the city of which it is a feature. Another noted feature of New Orleans is its cemeteries. Owing to the undrained condition of the subsoil, burials are made entirely above ground, in tombs of stuccoed brick and of granite and marble. Some of these are very elegant and costly, and many of the burial-grounds, with their long alleys of these tombs of diverse designs deeply shaded by avenues of cedars and the *Magnolia grandiflora*, possess a severe but emphatic beauty.

The climate is not marked by extremes of heat or cold. The wide reaches of water and wet lands that lie about the city on every side temper all airs, and the thermometer rarely passes above 95° or below 27° F. The consequent humidity of the atmosphere, however, gives the climate an enervating quality and an apparent warmth and cold beyond the actual temperature. It is rarely invigorating, and during the long summer between June and October is distinctly though not severely debilitating; but in the absence of epidemic yellow fever, whose visitations are becoming more and more infrequent, there is no "sickly season"; and those who visit the city between the months of November and June, the term in which the commercial movement is at its height, may enjoy from its beginning to its end the delights and beauties of a redundant spring time, and find easy entrance into the social gaieties of a high-spirited pleasure-loving people. (G. W. C.)

NEW PLYMOUTH, a seaport on the west coast of the North Island of New Zealand, is situated about 20 miles to the north-eastward of Cape Egmont, in 39° 4′ S. lat. and 174° 5′ E. long. It is the capital of the provincial district of Taranaki. The position of the town is picturesque, sloping to the ocean in front, and with a background of forest surmounted by the snow-clad cone of Mount Egmont (8000 feet). The settlement was founded in 1841 by the Plymouth Company under the auspices of the New Zealand Company, and chiefly consisted of emigrants from Devonshire and Cornwall. The railway to Wellington is rapidly approaching completion. The town has a hospital, several places of worship, and manufactories for coach-building and painting, for furniture, for rope and twine, for tanning, and for making brick, tile, and pottery. On the beach at New Plymouth there are extensive deposits of ironsand. New Plymouth returns one member to the house of representatives, and is a borough with an elective mayor and municipal council. The population in 1883 was about 4000.

NEWPORT, a municipal and parliamentary borough of Hampshire, and the county town of the Isle of Wight, is situated near the centre of the island, at the head of the navigation of the Medina river, about 7 miles from the sea at Cowes. Three separate railway lines connect it with Cowes, Ryde, and Ventnor. On account of its central position Newport has since the decay of the more ancient town of Carisbrooke absorbed the principal trade of the island. The church of St Thomas of Canterbury, rebuilt in 1854 in the Decorated style, contains many interesting old monuments; and one by Marochetti to the princess Elizabeth, daughter of Charles I., has been erected by Queen Victoria. Carisbrooke castle is about a mile from the town, and Parkhurst barracks are in the immediate neighbourhood. The guildhall, erected in 1816 from the designs of Nash, includes the town-hall in the upper story with the market-place below. The grammar school (the scene of the negotiations between Charles I. and the Parliament) was founded in 1612, and there is a blue-coat school for girls founded in 1761. A considerable trade is carried on in timber, malt, wheat, and flour; and Newport is the commercial centre whence the smaller towns of the island are supplied. The boundary of the borough of Newport was defined and extended by the Newport Borough Act, 1876. The population of the municipal borough (area 501 acres) in 1881 was 9357, and of the parliamentary borough (area 410 acres) 9144.

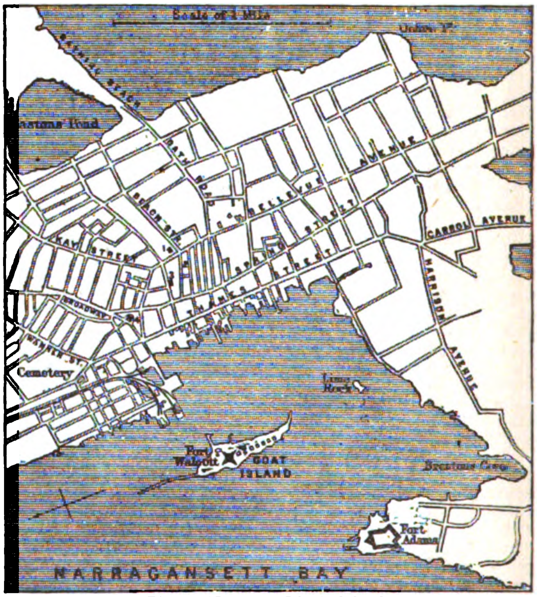
When the lordship of the Isle of Wight passed from the lords of Carisbrooke to Edward I., Newport began to supersede Carisbrooke as the chief town of the island. Camden speaks of it as the principal seaport of the island, "in times past Medena and Novus Burgus de Meden," that is, the new borough of Medina. In the 23d of Edward I. it sent two members to parliament, but not again till the 27th of Elizabeth, from which time it enjoyed the privilege without interruption until 1867, when the number of members was reduced to one. The borough was incorporated by James I.

NEWPORT, a seaport, market-town, and municipal and parliamentary borough of Monmouthshire, is situated on the right bank of the Usk, about 4 miles from its confluence with the Bristol Channel, and 12 miles north-east from Cardiff. On the east, north, and west it is finely sheltered by a line of lofty hills, and the neighbouring scenery is picturesque; but the town is chiefly composed of a mean class of houses, although there are many good villas in the suburbs. The old parish church of St Woollos is one of the most curious churches in England. Originally it consisted only of the present nave,—a fine specimen of grand though perfectly unadorned Romanesque architecture; but a massive square tower (of the time of Henry III.) and a chancel were subsequently added; a large western lady-chapel is interposed between the nave and the tower. The old castle, built about 1130 by Robert earl of Gloucester, was a very extensive structure in the Late Perpendicular. The two towers and the main central mass still remain; a portion has been converted into a brewery. The old monastery of Friars Preachers (Dominicans or Black Friars) has been entirely rebuilt, and is occupied as a private residence. The other principal public buildings are the spacious Victoria Hall, the Albert Hall, the new town-hall, the market-house, the custom-house, the union workhouse, the infirmary, and the free library and school of art. Newport owes its rapid increase to its situation on a deep and spacious tidal river, which renders it a convenient outlet for the trade of a very rich mineral district. It is now supplied with very extensive docks and wharves, to which steamers of the largest size can have access at all tides. The old dock of 4½ acres, opened in 1842, received in 1858 an addition of 7¾ acres; and in 1875 the new Alexandra dock of 25 acres was opened, land being retained surrounding it to the extent of 400 acres, available for the construction of wharves and warehouses, and for extension of the dock area. There is regular steam communication with Bristol, Liverpool, and Ireland. In 1882 the number of vessels in the foreign and colonial trade that entered the port was 1656 of 734,264 tons, the number that cleared 2143 of 1,078,245 tons. In the same year there entered in the coasting trade 8020 vessels of 1,048,626 tons, and cleared 7667 vessels of 700,500 tons. The town possesses large iron foundries and engineering works, and among the other industries the principal are the manufacture of waggons and wheels, patent nails, bolts, and wire. The manufacture of steel in the district is rapidly increasing. Shipbuilding was formerly carried on to a large extent. The building of iron ships has recently been commenced by several firms. The population of the municipal borough, which in 1801 was only 1135, had increased in 1831 to 7062, in 1851 to 20,279, in 1871 to 27,069, and in 1881 to 35,313. The population of the parliamentary borough (area 1690 acres) in 1881 was 38,427.

Newport is called Novus Burgus by Giraldus Cambrensis to distinguish it from the old Roman city of Caerleon about 3 miles distant. The town is nowhere mentioned in history before the beginning of the 10th century. Tradition states that Ethelfleda was killed at a great battle at Castell Newydd (Newport), but according to another account the Saxon sovereign slain was Ethelfred. The town received its first charter from Edward II. It is included in the Monmouth parliamentary district of boroughs.

NEWPORT, a city of the United States, capital of Campbell county, Kentucky, lies on the south bank of the Ohio river, opposite Cincinnati, and separated from Covington by the Licking river. With the larger city it is connected by a road-and-railway pier bridge, and with the lesser by a suspension bridge partly used by a street railway. Practically both Newport and Covington are residental suburbs of Cincinnati, but in the matter of population (20,433 in 1880) Newport ranks third among the cities in the State. The local manufactories comprise rolling-mills, steel-works, iron foundries, watch-case factories, and stove factories. For many years a small garrison of United States soldiers has been stationed here. The first settlement dates from 1791.

NEWPORT a city of the United States, one of the capitals of the State of Rhode Island, and among the most fashionable of American watering-places, is situated on the west coast of the island from which the State derives its name, on the isthmus of the southern peninsula. By rail it is 19 miles south-south-west of Fall River, and by steamer 162 miles from New York. In front lies an excellent harbour opening into Narragansett Bay, with a fine anchorage in 30 feet of water between Fort Adams (a military post of great importance) and Goat Island (headquarters of the torpedo division of the United States navy), and allowing vessels of 18 feet draught to reach the piers at low water. But it is rather the attractions of the east and south coast that have made the fortunes of the modern city:—First or Easton's Beach, one of the safest for surf-bathing; Second or Sachuest Beach, exposed to heavier breakers; Third Beach, more secluded than either; the Hanging Rocks, where Berkeley is said to have composed his *Minute Philosopher*; Lily Pond Beach; and the Spouting Cave, where the water dashes through a hole in the roof to a height at times of 50 feet. These and other points of interest are connected with the city by avenues and drives, many of which are lined in whole or in part with villas and cottages; and in fact Newport as a watering-place may be said to comprise the whole of the southern peninsula. In its narrower limits as a city it is a place of no small interest. In Washington Square, the central point of the old town, stand the State-house (dating from 1742), the city-hall (1763), and the opera-house (1867). Trinity Church has an organ presented by Bishop (then Dean) Berkeley, and the first Baptist church dates from 1638. The synagogue, founded in 1762, is the oldest in the United States; it is still used, though there are few Jews in Newport, endowments for keeping it in repair and maintaining services having been left by the brothers Abraham and Judah Touro, the latter of whom also gave the city $10,000 towards the purchase of Touro Park. The Jewish cemetery is the subject of one of Longfellow's best pieces. Redwood Library, established in 1747, has 27,000 volumes; and there is a free people's library with 15,000. Besides the bronze statue of Commodore M. C. Perry, of Japanese fame, Touro Park con-



Plan of Newport, Rhode Island.

1. Redwood Library.
2. Touro Park.
3. Trinity Church.
4. State-House.

tains an old tower, supported on round arches, which has been one of the greatest antiquarian puzzles in the United States—some considering it a monument of the Norsemen who visited America before Columbus, and others maintaining that it is only an old windmill dating from the 17th century. At one time, previous to the War of Independence, Newport was the seat of great commercial activity, but it now holds a very secondary position both in trade and manufacturing industry. Its exports and imports in 1882 made a total of only $17,513; and one or two cotton-mills and a brass foundry are almost its only public works. The population of the city was 12,521 in 1870, and 15,693 in 1880.

The harbour of Newport was visited by Verezzani in 1524, and the first settlement was made in 1639 by a party under the lead of William Coddington. Rapidly increasing from 4640 inhabitants in 1730 to 12,000 in 1774, the town soon took rank immediately after Boston in the matter of trade. But it suffered severely during the Revolution, being occupied by the British forces from 1776 to 1779, and on their evacuation having its wharves and fortifications destroyed and its library and records carried off. In 1788 Brissot de Warville found houses falling to ruin and grass growing in the public square, and its inhabitants were at that time less than 6000. During the first half of this century the recovery of the city was comparatively slow.

NEW PROVIDENCE. See Bahamas.

NEW ROSS, a market-town and parliamentary borough of Leinster, Ireland, partly in Wexford and partly in Kilkenny, is situated on the acclivity of a hill on the east bank of the Barrow, 2 miles below its junction with the Nore, 85 miles south-south-west of Dublin and 24 west-north-west of Wexford. The Barrow is crossed by an iron bridge, erected at a cost of £50,000, with a swivel pillar in the centre on which a portion of the bridge is turned to admit the passage of vessels. The principal buildings are the tholsel surmounted by turret with clock, the court-house, the fever hospital, Trinity hospital, and the poor-house. There is a brisk trade by means of the Barrow, the principal exports being grain, flour, butter, bacon, and wool. In 1882 the number of vessels that entered the port was 1670 of 260,578 tons, the number that cleared 1635 of 281,101 tons. There is inland communication for ships by the Nore to Inistiogue, and by the Barrow to St Mullins, while barges can proceed as far as Athy, where the Barrow joins the Grand Canal. New Ross possesses breweries and tanyards. There is a salmon fishery above and below the town. The population of New Ross in 1871 was 6772, and in 1881 it was 6626.

It is stated that St Abban built the abbey of Rossmactreoin; which gave rise to an ancient city formerly called Rossglas. According to Camden, New Ross was founded by Isabella, daughter of Strongbow and consort of William le Mareschal, afterwards Earl Pembroke. A charter was granted to it by Roger Bigod in the reign of Edward I., which was extended by James I. and James II. From 1374 it enjoyed the privilege of returning two members to parliament, but at the Union the number was reduced to one. In 1269 the town was surrounded by walls. The fortresses were dismantled by Cromwell, but some of their remains are still extant.

NEWRY, a seaport, market-town, and parliamentary borough, partly in Armagh but chiefly in Down, province of Ulster, Ireland, is situated on the Newry navigation at the head of Carlingford Lough, and on two railway lines, 18 miles south-east of Armagh and 63 north of Dublin. The western part, called Ballybot, is connected with the eastern part or old town in Down, situated on the acclivity of a hill, by four stone bridges and a swivel bridge. The more modern streets are wide and well-paved, and there are many handsome houses and shops. The principal buildings are the infantry barracks, the town-hall, the market-house, the court-house, and the assembly rooms. Newry is one of the most important ports of Ulster, and in connexion with several sub-ports farther down the river is the outlet for the trade of a very extensive district. In 1882 the number of vessels that entered the port was 676 of 80,586 tons burden, the number that cleared 654 of 65,262 tons. The principal exports are grain, provisions, eggs, cattle, linen cloth, and flax, and the imports include timber, manufactures, groceries, and provisions. In the neighbourhood granite of a fine quality is quarried, and the town possesses rope and sail works, breweries, distilleries, flour-mills, and tanneries. The population of Newry in 1861 was 13,108, which had increased in 1871 to 14,158, and in 1881 to 15,085.

Newry is very ancient. In 1175 an abbey was founded there by Maurice M'Loughlin, king of Ireland, which possessed extensive endowments and privileges. The abbey was converted in 1543 into a collegiate church for secular priests, and was dissolved by Edward VI., who granted it to Sir Nicholas Bagnal, marshal of Ireland. He made it his private residence, and by his enterprise and energy laid the foundations of the prosperity of the town. In 1689 Newry was set on fire by the duke of Berwick when in retreat before Schomberg. Charters were granted to the town by James I. and James II. By the charter of James I. it received the privilege of sending two members to parliament, but at the Union it was restricted to one member.

NEW SHOREHAM. See Shoreham.

NEW SOUTH SHETLAND, or simply South Shetland, a group of islands on the borders of the Antarctic polar regions, lying about 600 miles south-south-east of Cape Horn, between 61° and 63° 10′ S. lat. and between 53° and 63° W. long., and separated by Bransfield Strait from the region composed of Palmer Land, Trinity Land, Louis Philippe Land, &c. The more considerable islands are those of Smith (or James), Jameson (or Low), Snow, Livingston, Deception, Greenwich, Nelson, King George, Elephant, and Clarence. Deception Island is particularly remarkable as of purely volcanic origin. On the south-east side an opening 600 feet wide gives entrance to an internal crater-lake (Port Forster) nearly circular, with a diameter of about five miles and a depth of 97 fathoms. Steam still issues from numerous vents, and hot springs bubble up from beneath the snow-clad surface (E. N. Kendall in *Jour. Roy. Geog. Soc.*, 1831). Most of the islands are rocky and mountainous, and some of their peaks are between 6000 and 7000 feet in height. Covered with snow for the greater part of the year, and growing nothing but lichens, mosses, and some scanty grass, the South Shetlands are of interest almost solely as a great haunt of seals, which share possession with albatrosses, penguins, and other sea fowl. The capture of the seals, which began shortly after the islands were rediscovered by Captain William Smith of the brig "William" in 1819, has been carried on to the present time. Dirck Gheritz was probably the first discoverer, in 1598. Edward Bransfield, of the frigate "Andromache," ascertained the extent of the group in 1820; and Captain Weddell (1820–21), D'Urville (1838), and Wilkes (1839) explored the islands in detail. A smaller group of islands—Coronation Island, Laurie Island, &c.—lying 200 miles east of the South Shetlands, bears the name of New or South Orkney.

NEW SOUTH WALES. This was the name given by Captain Cook, in his exploratory voyage in 1770, to the southern portion of the eastern coast of Australia, from some imagined resemblance of its coast-line to that of South Wales. The name was afterwards extended to the eastern half of Australia, but by subsequent subtractions has gradually received a more limited meaning. It is still, however, three times the size of Great Britain and Ireland, and larger than any state in Europe except Russia. The present British colony of New South Wales is bounded by the Pacific Ocean on the E., by Queensland on the N., by South Australia on the W., and by Victoria on the S. It lies between 28° and 38° S. lat., and 141° and 154° E. long., extending over about nine degrees of latitude and about twelve and a half degrees of longitude. The coast-line, which is about 700 miles in length, extends from Cape Howe (37° 30′) at the south-eastern corner of Australia to Point Danger in 28° 7′ S. The colony is approximately rectangular in form, with an average depth from the coast of 650 miles and an average width from north to south of 500 miles. The superficial area is estimated at 310,000 square miles, or about one-tenth of the whole of Australia.

Along the seaboard are twenty-two well-defined headlands or capes and about a score of bays or inlets, to mark which for navigators there are twenty-three lighthouses. There are four very fine natural harbours, viz., Jervis Bay, Port Jackson, Broken Bay, and Port Stephens, and several others of minor importance. Of these, only Port Jackson, on which is situated the city of Sydney, has attained as yet to commercial importance. The port second in commercial importance is Newcastle, at the mouth of the Hunter river, which is the great coal-shipping port of the colony. Secondary harbours, available for coasting steamers, south of Sydney are to be found at Port Hacking, Wollongong, Kiama, Shoalhaven, Bateman's Bay, Ulladulla, Merimbula, and Twofold Bay. To the north of Sydney the secondary ports are at the mouths of the Hawkesbury, the Manning, the Hastings, the Macleay, the Nambucca, the Bellinger, the Clarence, the Richmond, and the Tweed rivers. These are mostly bar harbours, but the Clarence is a noble river, and when the entrance is improved will become a great port.

The characteristic natural feature of New South Wales is the great Cordillera range running north and south. The average elevation of this range is about 2500 feet. The highest point, Mount Kosciusko, reaches, however, a height of 7300 feet, about 700 feet below the theoretical line of perpetual snow, yet snow has never more than once wholly disappeared. None of the interior parts of the colony attain to a similar elevation. This range runs generally parallel to the coast, varying from 30 to 140 miles distant, being nearest at the south and receding the farthest at the sources of the Goulburn river, the main tributary of the Hunter. The crest of this range is in some places narrow; in others it spreads out into a wide table-land. The eastern slopes are somewhat rugged and precipitous, the sandstone especially being deeply fissured by the watercourses; but along the greater part of the coast there is a belt of flat land generally of high fertility. At the outlet of many of the streams descending from the range are large lagoons, sometimes closed against the sea by sandbars, and at other times opened by the force of the outrushing waters. The principal of these are Lake Illawarra and Lake Macquarie, Tuggarah Lake, Lake Myall, Wallis Lake, Watson Taylor Lake, and Queen's Lake. Lake Macquarie, however, is rather a magnificent estuary than a lake, and if the bar at the entrance could be removed would become a commercial port, as the hills at the back are rich in coal. The inland lakes are few and unimportant. They are mostly shallow and occasionally dry. On the western side of the main range the general slope of the country is towards the west, the drainage being into the Murray, the Murrumbidgee, the Lachlan, and the Darling; but the drainage of all of them unites in the Murray, at the town of Wentworth, near the south-western corner of the colony.

Climate.—The rainfall differs very much in different parts of the colony. It is heaviest on the eastern coast, where the easterly gales break against the main range. Here the average is 40 inches on the south to 65 inches on the north. Sydney, with forty-three years' observation, has a mean of 50 inches. In winter the temperature sometimes falls to the freezing point, and it rises in summer to 85° or 90° on very hot days. The mean temperature of Sydney is 62°·5. On the table-lands the rainfall is from 20 to 35 inches. In winter the temperature in extreme cases falls 10° or 15° below the freezing point, and in the height of summer it rises to 100° or 105°. The mean temperature may be found from 50° to 60°. On the great western plains the rainfall is much less, falling rapidly as the high land is left to 18 inches, and in the far west to 8 inches. Here the temperature seldom falls more than 6° or 8° below freezing, but in summer it often rises to 110°, and in extreme cases to 120°; and the mean temperatures range from 60° on the south to 68° on the north. Along the coast-line the air is moist and soft; the temperature is mild, the thermometer ranging from 78° in January to 59° in July, and the mean for the year being about 62½°. The prevailing wind in summer is from the north-east, though occasionally hot, dry winds come from the north-western interior, which are generally followed by a sudden and violent reaction from the south, known as "southerly bursters." On such occasions the thermometer will sometimes suddenly fall in a few hours 20 or 30 degrees. The violent rainstorms generally come from the east, shifting from north-east to south-east; but, as they are mostly accompanied with a high temperature, their origin is to be looked for towards the north. During the winter months the wind blows mostly from the west. It is a dry wind, and the weather is generally clear, bright, and invigorating. On the table-land the air is much drier than on the coast, the winters are longer and colder, and the summer heat, except in the middle of hot days, much below the coast temperature; and this elevated region is much resorted to by the citizens of Sydney as a summer resort. As the country slopes down towards the west the dryness of the climate increases. Though the heat is sometimes oppressive, the climate is not unhealthy; while sheep and cattle are more free from disease here than in moister parts of the colony.

Geology.—The main mountain chain, running north and south, with the eastern portion of the continent generally, must have been submerged during the early Miocene period to the extent of about 4000 feet below its present level, leaving the highest portions of the range standing out as islands, which have probably never wholly been submerged since the commencement of the Mesozoic era, and to this is attributable the survival of the cycads, araucarias, and other ancient vegetable forms which now abound in Australia; the living *Ceratodus forsteri* of Queensland, and the *Marsupialia*, also point to the same conclusion. To the westward it throws out many lateral spurs, diminishing gradually in elevation, and determining the basins of the tributaries of the rivers flowing westward. The most important of these lateral ranges runs north-westward towards the Darling and beyond to the Barrier Ranges in the north-western part of the colony. The summit of this lateral range has been partly denuded, and it dips towards the plain of the Darling where that river cuts through it. This being the only water channel from all the north-western portion of the colony, all the tributaries of the Darling converge into this depression. This range divides the western portion of the colony into two main basins, the northern of which contains all the affluents of the Darling, and the southern is the Murrumbidgee basin, with its affluents the Murray and the Lachlan. These basins consist of a large Cretaceous area, which extends away far beyond the western boundary of the colony. The basis of the mountain system of the colony is granite, and the oldest sedimentary deposit resting on it is the Upper Silurian. In the neighbouring colony of Victoria, Lower Silurian fossils are found over a large area west of Melbourne, but in New South Wales nothing has been definitely determined older than the Upper Silurian. Granite has lifted the superincumbent deposits, penetrated them, and metamorphosed them in various degrees up to a close resemblance to igneous rocks. The great western plains of the interior are characterized by isolated rocks, or short ranges, mostly granite, but occasionally trap, long sand ridges, and clay basins. The sand and clay both result from the disintegration of granite and trap, the sand ridges having been wind-blown, and the clay washed into the lower levels. Many of the wells sunk into the yellow clay furnish an almost undrinkable brackish water, from the salts of soda and iron, and occasionally lime, potash, and magnesia, yielded by the felspars.

The Upper Silurian rocks occur frequently, but chiefly on the western watershed of the great dividing range. They consist of conglomerates, sandstones, slates, mudstones, and limestones, and have a general meridional strike. Devonian rocks are displayed on the western flanks of the Blue Mountains. They include sandstones, conglomerates, limestones, and shales, related by their fossils to the Silurian beds below and to the Carboniferous beds above. The Carboniferous series is very widely developed. The strata are probably not less than 10,000 feet thick, the lower bed containing both plants and marine fauna. The Upper Carboniferous series includes the lower Coal-measures of New South Wales. These are traceable along the coast from 31½° to 35½° S. The coal-seams are visible above the sea-level from Coal Cliff, 20 miles south of Sydney, the seams rising to the southward, and from Lake Macquarie, north of Sydney, the seams rising to the northward. The great coal basin extends westward along what seems to have been a depression between the northern and southern elevated portions of the old main range, and, lying under what is now the Blue Mountains, passes up northwards along the western flank of the main range towards the boundary of Queensland. The western edge of the coal basin is not determined. Overlying the coal basin, to the westward of Sydney, is a Mesozoic sandstone formation, 1000 feet thick, while above this, and also intermixed with it, lies a shale deposit. All these series have been disturbed by dykes of basalt, diabase, and dolerite. Some of the coal-seams have been tilted by this intrusion; in other cases the dip has not been changed; and in some cases the adjacent coal has been charred into coke. Volcanic disturbance seems to have been very active during the Tertiary epoch, and the igneous formations occupy about 40,000 square miles.

Minerals.—Commercial mining is at present limited to gold, silver, copper, tin, coal, and oil shales. The greater portion of the gold hitherto raised has been from alluvial deposits. These are of Permian, Cretaceous, Tertiary, and Quaternary ages, and are derived from the degradation of the older sedimentary rocks of Upper Silurian, Devonian, and Lower Carboniferous ages. The formations in association with which gold has been found are widely scattered over the colony, and are estimated to occupy nearly one-fourth of its area. In the reefs, gold seldom occurs without one or more of the following sulphides:—iron pyrites, galena, mispickel, blende, and copper pyrites. The gold is always more or less alloyed with silver, and there are occasionally traces of copper, iron, osmiridium, and other metals. The greatest depth at which auriferous reefs have been worked is 940 feet at Adelong. The value of the gold raised in the colony up to the end of 1882 was £34,839,847. Silver has been found in several places, but has only been profitably worked at Boorook. The lodes vary in width from 1 to 3 feet, and are situated in belts of felspar porphyry, alternated with beds of fossiliferous shales of the Devonian formation. The value of silver raised to the end of 1882 was £187,429. Copper ore is traceable on the surface in very many places, and the cupriferous formations are already estimated to cover an area equal to 4,300,000 acres. The value of copper exported to the end of 1882 was £3,538,285. Tin has been profitably worked since 1872, and the value exported to the end of 1882 was £5,173,038. It is nearly all taken from alluvial deposits—in the first instance from the beds of existing creeks, but more recently from the beds of old rivers, sometimes covered by basalt. It is all obtained from the Tertiary and Quaternary drifts, composed of the detritus from the stanniferous granite. The area of stanniferous deposits is estimated at 5,440,000 acres, the principal tin-bearing localities being in the high lands of the great dividing chain in the northern and southern districts. The known Coal-measures embrace an area of about 24,000 square miles, the seams varying from 3 feet to 25 feet in thickness. The seams are mostly horizontal. The dip is usually under 5°. The principal collieries are near Newcastle, and on the Illawarra coast, and at the western foot of the Blue Mountains. The seams worked to the south of Sydney are more anthracitic than those worked to the north. The value of the coal raised during 1882 was £944,405. What is called, though erroneously, "kerosene shale" is worked in the west at Hartley and in the south at Joadja Creek. It is really a species of cannel coal. A good illuminating oil is distilled from it, and it is largely shipped for use in gas-works, a moderate percentage of it greatly improving the quality of the gas. The value of this cannel coal raised up to the end of 1882 was £665,160. Iron exists in abundance, and has been worked at Mittagong and Lithgow Valley, but the colonial cost of labour has made it difficult to compete with English imports. Red and brown ore exists in abundance in the sandstone formation. It contains 55 per cent. of metallic iron. Beds of clayband iron ore are found in the Coal-measures, both on the west of the Blue Mountains and on the Illawarra coast. Antimony has been found in several places, and has been slightly worked in the Macleay and Armidale districts, where the lodes traverse sedimentary rocks of the Devonian age. Argentiferous lead is found in many places in the Silurian, Devonian, and granite formations, but hitherto the attempts to work it at a profit have been a failure. Bismuth has been found in the tin-bearing rocks, and asbestos in veins in serpentines; chromic iron and manganese ore have also been found in considerable quantities. The tin-bearing drifts in the river gravels contain precious stones,—the diamond, sapphire, emerald, ruby, opal, amethyst, garnet, chrysolite, topaz, cairngorm, and onyx having all been found. The colony is well supplied with building stone, granite, sandstone, flagging, marble, limestone, slate, and fire-clay; and brick and pottery clays occur in abundance.

Agriculture.—The fertile soils consist chiefly of the alluvial deposits on the banks of the rivers and the detritus of the igneous rocks. On the rich flats on the banks of the river Hunter, mostly devoted to the growing of lucerne for hay, six cuttings are generally taken off in the year. To the southward of Sydney the coast land is very largely devoted to dairy-farming, the herbage being rich and sweet, especially in localities where there has been any basaltic overflow. The principal supply of butter and cheese for the Sydney market comes from this district. Along the coast to the northward of Port Stephens maize is very largely cultivated for horse-food. The yield in an average season is about 50 bushels per acre. Sugar has not been commercially successful south of Clarence. But on that river, and on the Richmond, and all the way to the border of Queensland, it has proved profitable, and is rapidly extending. Oranges are not cultivated to advantage south of Sydney, but anywhere to the northward along the eastern slopes they grow freely. Nearly every description of European fruit is cultivated without difficulty. Tobacco is increasingly grown both on the coast and on the alluvial flats of the western waters. In earlier days wheat was very largely grown upon the coast, but in consequence of the rust this crop has been driven inland on to basaltic areas. The production of wine is limited only by the demand. Hitherto the principal seats of this industry have been in the Hunter river district, where many varieties of light wine are produced, and in the district round Albury, where, in a dry, warm climate, and from a rich volcanic soil, a strong, full-bodied wine is obtained.

Grazing was the beginning of the industrial life of Australia, and it is still the great source of its wealth. The mildness of the winter allows stock to be pastured out of doors all the year round, and supersedes the necessity of artificial food. The consequence is that the country has been easily and rapidly overspread with sheep and cattle farms, the only natural check being the want of water in the remote parts and the occasional discouragement of poor markets. The speciality of the Australian wool is its fineness, and the small merino sheep are found to be the best-suited to the pasture and the climate. The stock which is now most appreciated is that of Australian breeders who have kept their flocks free from intermixture for a long period. The Australian merino has established for itself a separate type. Sheep as a rule are remarkably healthy in the Australian climate. In wet seasons and on stiff land they are liable to fluke and to foot-rot. Scab has occasionally appeared; but the precautions taken against it now are very strict, and it has not prevailed in the colony since it was stamped out in 1866. Cattle are liable to pleuro-pneumonia, which is sometimes very destructive.

Flora.—The flora of New South Wales, which comprises about 3000 species of plants, exclusive of mosses, lichens, fungi, and sea-weeds, is characterized by many peculiar forms. The great orders of dicotyledonous plants on the eastern side of the dividing range are respectively *Leguminosæ*, *Compositæ*, *Myrtaceæ*, *Proteaceæ*, *Epacrideæ*, and *Rutaceæ*, three of which (the *Myrtaceæ*, *Proteaceæ*, and *Epacrideæ*) include the great majority of the trees and shrubs which differ so essentially from the ordinary European types.

Amongst the *Myrtaceæ* (containing some 140 species) there are plants ranging from the minute *Bæckia* to the gigantic *Eucalyptus*. These, for the most part, have valuable resins and oils, and possess astringent and antiscorbutic properties; the foliage is evergreen, and the flowers vary from white and yellow to purple and crimson. The forests are principally myrtaceous, some species yielding esculent fruits, while the wood and bark of many are becoming known throughout the world. While in point of utility the *Myrtaceæ* stand unrivalled, the *Proteaceæ*, by their various flowers, curiously shaped fruits, and harsh foliage, arrest the attention of the observer. The far-famed "wooden pear" (*Xylomelum pyriforme*), the gorgeous "waratah" (*Telopea speciosissima*), and species of the hard-fruited *Hakea* and the variously coloured *Grevillea* represent this order in the vicinity of Port Jackson. In New South Wales there is only one heath correctly so termed (*Gaultheria hispida*), and that only on the summits of snowy mountains near the Bellinger, or on the Australian Alps; but the lovely epacrids, which are abundant near Sydney, take the place of heaths, and two of them (*E. purpurascens* and *E. microphylla*), as if to increase the beauty of their inflorescence, are sometimes found double even in a wild state. In each region, whether alpine, littoral, or beyond the dividing range, epacrids occur in a greater or less degree. The *Leguminosæ* and *Compositæ*, though nearly cosmopolitan, attain a comparative maximum in New South Wales, the species of the former being over 300 and of the latter 250. Of leguminous plants, the species of *Acacia* are the most numerous (about 100), scattered in some places amongst the trees of the forest, and in others forming dense scrubs. Those remarkable for their scented and useful wood (such as *A. pendula* and *A. homalophylla*—the "myalls" of the natives) are highly valued. Sturt's desert pea (*Clianthus Dampieri*), the Moreton Bay chestnut (*Castanospermum australe*), and the genus *Swainsona* have acquired a reputation amongst horticulturists. Many of the composites, the largest of which is the musk-tree (*Aster argophyllus*), are found not only near the coast but on the arid plains of the interior. Although from the frequent occurrence of certain orders, the flora of New South Wales is somewhat monotonous, yet the vegetation of the southern mountains, of the north-east portion of the colony, and of moist gullies is wonderfully diversified. The alpine plants of the south, occurring at an elevation of from 4000 to 6000 feet above the level of the sea, show an affinity for the flora of Tasmania, many plants being common to both colonies, whilst ten species at least are identical with those of Europe. In the northern parts of the colony the character of the vegetation is semi-tropical, similar in some respects to that of India. And then, again, in moist and shady gullies, or on the ranges of the mountains, tree-ferns rising to 50 feet, large climbers of the *Vitis* or *Lyonsia* genus, orchids of singular forms and various habits, and mosses, lichens, and fungi may be found in great profusion. In good seasons the interior is well supplied with splendid grasses, but when droughts prevail and the usual pasture fails, sheep and cattle find sustenance in salsolaceous bushes, the hardy composites, and plants of the geranium or umbelliferous kind. The *Casuarinas*, which prevail more or less from the coast to the far interior, are almost exclusively Australasian, some rising to be lofty trees, and others forming brushes on the mountains. Here there is a genus differing from others in the strangely-jointed stems of the species, their minute whorled leaves, and the peculiar growth of their wood; and there, again, is the perplexing tree *Alchornea ilicifolia*, celebrated as having reproduced itself for many generations from female plants alone. In the northern specimens male flowers have been found, but not so in those near Sydney. *Exocarpus cupressiformis*, or the "native cherry," is another anomalous shrub, having, as it is said, its fruit outside, or more properly raised on an obconical pedicel, which becomes thick, red, and esculent. In most countries the labiates are herbs or undershrubs, but in New South Wales there is a large genus of the order (*Prostanthera*) which has species of considerable size, abounding in scented and volatile oils, and adorned with a profusion of elegant flowers. The *Stylideæ* are not largely represented in Eastern Australia, but the species are very singular. The column in which the stamens and style are blended is remarkable for its irritability, and is scarcely like anything in the vegetable kingdom, excepting perhaps some of the orchids. So also in the *Goodeniaceæ*, which number nearly 50 species, there is a peculiar covering on the stigma, the object of which is yet a mystery. The monocotyledonous plants are between 600 and 700, and of these the *Cyperaceæ*, *Graminaceæ*, and *Orchidaceæ* are the most abundant. Some of the orchids are highly prized for the singularity of their structure and the elegance of their flowers, whilst the gigantic lily (*Doryanthes excelsa*) has been an object of interest from the earliest days of the colony. Of the palms, five species extend to New South Wales. The walking-stick palm (*Kentia monostachya*) occurs in the north, and *Ptychosperma Cunninghami* and *Livistona australis* extend to Illawarra.

Fauna.—As New South Wales has no natural boundary except the Pacific, there are no organic types which characterize this colony in the same degree as the marsupials, proteads, eucalypts, and acacias distinguish the Australian region as a whole. In this respect neither do its northern districts differ from South Queensland nor its southern from north-east Victoria, while its west is uniform with the rest of the great continental plain. With this proviso, New South Wales may be justly regarded as the typical region of East Australia. It is made up of three strips, each a subregion in itself—the coast, the dividing range and its plateaus, and the lower western plains. The coast ranges, bathed by a heated oceanic current, shelter a warm and moist sea margin, in which as far as 34° 40′ S. lat. we find jungles of palms, figs, nettle-trees, and a host of other sub-tropical plants, haunted by talegallas, fruit pigeons, flying foxes, &c.; the table-lands enjoy an essentially temperate climate; and in the plains of the interior the scanty rainfall imposes further restrictions on animal and vegetable life.

The indigenous mammals are all marsupial, with the exception of a few bats and rodents, and even among these *Hydromys* is peculiar. This indicates permanent isolation since Mesozoic time. The dingo was doubtless introduced by man, while whales and seals belong to no coast in particular. The dugong (*Halicore*) is not found south of Moreton Bay. Many extinct marsupials, belonging to Australian types, but of gigantic size, as *Diprotodon*, *Nototherium*, *Thylacoleo*, with huge kangaroos, are found in Pleistocene deposits. With them are associated *Thylacinus* and *Sarcophilus*, now restricted to Tasmania. No *Didelphys* occurs, fossil or recent. *Cuscus* is tropical only. Nor is the singular *Dendrolagus*, akin to the phalangers rather than the kangaroos, found in Australia. All other genera of marsupials are represented in New South Wales. The flying 'possum (*Petaurista*), tiger cat (*Dasyurus maculatus*), wallaroo (*Macropus robustus*), &c., are confined to the eastern, and *Myrmecobius*, *Chœropus*, and *Peragalea* to the western districts. Of these *Thylacoleo* is related to the Jurassic *Plagiaulax*, *Myrmecobius* to *Amphitherium*, &c., the oldest mammals known to palæontology.—Among birds, woodpeckers, vultures, and many other families are unknown; while honeysuckers (*Melliphaga*), lyre birds (*Menura*), cockatoos, rosellas (*Platycercus*), brush-tongued lories (*Trichoglossus*), brush turkeys (*Megapodius*), emus, jackasses (*Dacelo*), moreporks (*Podargus*), magpies (*Gymnorhina*), wood swallows (*Artamus*), crested pigeons, bower birds, and plain turkeys (bustards) give a most distinct character to the avifauna.—Of reptiles, the luth (*Dermatochelys*) is not uncommon on the coast, while long-necked tortoises (*Chelodina*) frequent all inland waters. Lizards of the skink, gecko, and agama families are numerous, as *Hinulia*, sleeping lizards (*Cyclodus*), rock scorpions (*Phyllurus*), Jew lizards (*Grammatophora*), and, in the west, stump-tails (*Trachydosaurus*), which Dampier declared the ugliest animals on earth. The monitors are represented by the (so-called) iguanas (*Hydrosaurus*). Crocodiles are absent. Of snakes, the *Crotalidæ* are unknown. The *Viperidæ* appear by the death adder (*Acanthophis*). Sea snakes, as *Platurus* and *Pelamis*, occur upon the coast. The harmless colubrines—*Tropidonotus*, *Dendrophis*, *Dipsas*—are known by single species; but the *Elapidæ*, as *Diemenia*, the black snake (*Pseudechis*), and several species of *Hoplocephalus*, are common and dangerous. *Morelia spilotes*, the diamond snake, peculiar to the coast, and *M. variegata*, the carpet snake, belong to the pythons. No tailed batrachians occur, but there are a few species of frogs, mainly of the genera *Limnodynastes*, *Pseudophryne*, *Pelodryas*, and *Hyla* (tree-frog).—As to marine fishes and invertebrates, the region is naturally intermediate between the Indo-Pacific and South Australian districts, partly limited indeed on the south by the cold waters of Bass's Straits, but quite open to the north; hence the fauna is rich and various.—The number and variety of the insects of New South Wales is well known. The most distinct types are probably in the *Coleoptera*, where *Carenum*, *Anoplognathus*, *Stigmodera*, and *Amycterus* form very important groups in the *Carabidæ*, *Lamellicornes*, *Buprestidæ*, and *Curculionidæ* respectively. So also *Thynnus* among the *Hymenoptera*. *Lepidoptera* alone are comparatively few, restricted to the coast, and of Indian types. In like manner the land and freshwater molluscs, numerous to the north and east, become rarer towards the south and west.

Fisheries.—Up to the present time but little enterprise has been displayed in developing the extensive sea-fisheries of the colony. The fish as a rule are shore-fish, and are not commonly met at a greater distance from the coast than 3 or 4 leagues, or in a greater depth of water than 40 fathoms. The line-fish, such as schnappers, teraglin, king-fish, rock cod, morwong, and other forms, are generally found in the neighbourhood of reefs, or rocky patches off headlands and in offings; while the net-fish, such as mullet (of various kinds), black and silver bream (or tarwhine), whiting, black-fish, gar-fish, flounders, flathead, tailors, and travally, are obtained on inshore beaches or flats of the many inlets and rivers which break the coast-line. No gadoids or codfish have as yet been found, nor any larger flat fish than flounders and soles. The chief freshwater fish are the Murray cod and the golden and common river perch. Freshwater herrings abound in the eastern rivers, also eels, but they are not much sought after. Oysters abound in all tidal waters. There appear to be three varieties, the mud oyster, the drift, and the rock or foreshore oyster. The drift and rock oyster are in season all the year round in some fisheries, and in quality almost, if not quite, equal the "natives" of Whitstable. Lobsters also abound on the coast, especially where there is good cover afforded by kelpy rocks. Shrimps are not found, but prawns of large size and excellent quality are abundant.

Commerce.—Sydney, the capital, seated on the magnificent harbour of Port Jackson, is well posted to gather the commerce of the Southern Pacific, its position corresponding with that of San Francisco on the opposite coast of the Northern Pacific. The fiscal policy of the colony has been generally, though not rigidly, one of free trade, and this has greatly helped to make Sydney the chief emporium of Australasia. The total value of the trade in 1882 was very nearly £38,000,000, the imports exceeding the exports by £4,500,000. The intercolonial trade accounts for about one-third of the imports, and that with the United Kingdom for nearly one-half, the import from foreign states being about one-tenth. The export trade with foreign states is below one-thirteenth of the whole. The great items of export consist of wool, skins, leather, hides, and tallow. To the neighbouring colony of Victoria there is a very large export of sheep and cattle. Next to the produce of the pastoral industry comes the produce of the mining industry, consisting of gold, coin, tin, copper, and coal. Other articles are of minor importance.

Railways.—These, with one small and detached exception, are entirely in the hands of the Government, and nearly all the capital has been raised in England. They are under the management of a commissioner, subject to the general superintendence of the minister for public works. The whole system is divided into three groups, the southern, the western, and the northern, with their respective branches.

Telegraph and Postal Service.—The telegraph and postal systems are entirely in the hands of the Government. Every important place in the colony is within the range of both services, and New South Wales unites with New Zealand in subsidizing the mail route between Sydney and San Francisco.

Banks.—There are thirteen joint-stock banks, five of them being Anglo-Australian, four intercolonial, with their headquarters in Sydney, three branches of intercolonial banks, having their headquarters elsewhere, and two belonging exclusively to the colony. In 1882 the average note circulation was about £1,500,000, and the coin and bullion held about £8,000,000. There is a savings bank with its branches, under Government management, besides a savings bank department attached to the post-office, and the total deposits in 1882 amounted to £2,600,000, the depositors numbering over 70,000.

Shipping.—The coasting and intercolonial trade sustains a dozen steamship companies, and the trade of nearly all the great ocean lines of steamers converges at Sydney, where the convenience for coaling is greatest. Mort's Dock is capable of accommodating most of the large steamers that visit the port. The Government possesses another dock of equal size at Biloela, and is constructing another capable of taking in the largest ironclad. There are several private slips, and repairs of any kind can be executed. The headquarters of the imperial navy are in Port Jackson, where the admiralty has a depôt.

Administration.—The political constitution of New South Wales is that of a self-governing British colony, and rests on the provisions of the Constitution Act. The governor is appointed by the crown, the term of office being generally for five years, and the salary £7000. The governor is the official medium of communication between the colonial Government and the secretary for the colonies, but at the same time the colony maintains its own agent-general in London, who not only sees to all its commercial business, but communicates with the colonial office. In the legislative assembly there are more than one hundred members. The number is not fixed, because the Electoral Act provides that electorates in which the votes have increased beyond a stipulated number shall be permanently entitled to additional representation. The principle adopted in distributing the representation is that of equal electoral districts, modified, however, by a preference given to the distant and rural constituencies at the cost of the metropolitan electorates. The suffrage qualification is a residence of six months, or the possession of a small landed property. The upper house or legislative council consists exclusively of persons nominated for life by the governor, with the advice of the executive council. The number is not fixed, but it is understood that, except in cases of emergency, the number shall not exceed one-half of that of the legislative assembly, and that no appointments shall be made during the sitting of parliament. The parliaments are triennial.

Revenue.—The revenue is officially classed under three principal heads, as derived from taxation, from public services, and from land, of which the first yields the least. This is nearly all derived from the custom-house, and principally from the duties on alcoholic liquors, tobacco in its various forms, and groceries. Stamps and licences are the only form of direct taxation. The municipal system, being of voluntary adoption, has been only partially applied, a very large proportion of works of improvement being executed by the general Government. The receipts from land are large; the policy which should regulate the alienation of land is a standing subject of political controversy. At the end of 1882 nearly 36,000,000 acres had been alienated, the unsold portion being leased by the Government to graziers.

Education.—The educational system was originally that of subsidizing the four principal churches, to which were made grants of land for school purposes, as well as annual endowments. Subsequently a national system in imitation of the Irish system was established, and the two were separately worked by a national board and a denominational board respectively. These two boards were abolished in 1866, and a public school board appointed to superintend all schools, both national and denominational. Finally this board was abolished, and in 1880 all primary schools were placed under the immediate control of a minister for education, and it was arranged that grants to denominational schools should cease at the end of the year 1882. There is one grammar school for boys only in Sydney, sustained by the state, but by a recent Act high schools for both sexes are to be established all over the colony. The university, which was built by the state, and which receives an endowment of £10,000 a year, gives lectures and confers degrees in arts, laws, medicine, and science. Adjoining the university is the Prince Alfred Hospital, the medical teaching in which is partly under the control of the university senate. Attached to the university are three affiliated colleges, one belonging to the Church of England, one to the Church of Rome, and one to the Presbyterian Church. In addition to the examinations for degrees, the senate holds a senior and a junior examination each year for the use of schools for both sexes. Private munificence has supplied many bursaries and scholarships. Mechanics' institutes and schools of art receive an annual subsidy in proportion to their subscriptions, and an extensive scheme for technical classes is being organized.

Population.—The official estimate of the population at the close of 1882 was 817,000. The previous census was taken on April 3, 1881, and the population was then 751,468 (411,149 males and 340,319 females),—an increase since 1871 of 247,487, or 48 per cent. The persons born in the colony numbered 465,559, while 208,512 had come from Great Britain, Ireland, and other British possessions. The Catholics were about two-sevenths of the population, being 207,606 as against 516,512 Protestants. Nearly every religious sect is represented, and the estimated attendance at public worship on Sunday was 221,031. There is no state church.

History.—The early history of New South Wales was for many years that of Australasia, and it has little more interest than what pertains to the philosophy of penal settlements. It was a distant prison maintained at the imperial cost. The commercial epoch began when Captain Macarthur found that the climate was suited to the growth of fine wool. The first sheep came from the Cape, mixed with a few from India. He got together a flock of 1000, and noticed that even in his mongrel flock careful culling and breeding led to a great improvement in the wool, and this set him on considering the importance of having good rams. The fortunate arrival in the colony from the Cape of some fine-woolled sheep of the Escurial breed gave him the opportunity of adding three rams and five ewes to his flock, which he subsequently further improved on a visit to England, by purchasing some of King George III.'s stock at Kew. The stud flock he thus formed, and which was kept at Camden for fifty years, laid the basis of an expansive industry. From that time the colony had an export. The growth of live stock quickly overtook the demands of the local population for meat, and then another colonist, Mr O'Brien, made the discovery that if sheep were worth nothing for meat they were worth something for tallow, and boiling down became the destiny of all the surplus stock. This waste of meat was suddenly stopped when the next great epoch in the history of the colony was opened up by the discovery of gold. Victoria soon outstripped the mother-colony by its superior attractions in this respect, but New South Wales gained the enormous advantage of having its pastoral industry stimulated and made more profitable. The unoccupied country became worth taking up, till every portion of the territory that was at all occupiable was leased. The political government was at first necessarily a strictly military one, but as the number of the freed men and their children increased, and the number of free settlers increased also, the demand for some form of representative government arose, and became irresistible. A legislative council was established, partly nominative and partly elective. Coincidently with this grew up a demand that transportation should cease, and the agitation on this question has been the only serious conflict between the colony and the mother-country. It was ended by the mother-country yielding, and transportation was somewhat reluctantly abolished in 1853. At about the same time the mixed legislative council was superseded by the existing parliamentary system of two houses and responsible government, under which the colony has prospered contentedly ever since. (A. GA.)

NEWSPAPERS

THE authenticated history of newspapers begins in Germany. The earliest plainly *periodical* collection of the "news of the day," as distinguished from the isolated news-pamphlets (of which there is at least one example of as early a date as 1498, and in Germany alone about eight hundred examples, all dating before 1610, still to be found in existing libraries), is the *Frankfurter Journal*, a weekly publication started by Egenolph Emmel in 1615. Antwerp follows, with its *Nieuwe Tijdinghen* of 1616. Six years later came the establishment in London, by Nathaniel Butter and his partners, of a like paper, under the title of *The Weekly News*. All of these were the enterprises of "stationers," undertaken in the ordinary way of their trade, and hawked about the streets by itinerating "mercuries." The foundation in Paris, in 1631, of a journal which eventually attained fame as the *Gazette de France*, and which still exists, had a very different origin and different aims. The scheme of Théophraste Renaudot, a busy projector, unconnected with trade, who in certain points of his character and talent may be described as a born publicist, it appeared under the patronage of Richelieu, in the shape and with the limitations which it pleased the chief statesman of the day to mark out for it.

The history of the "leading article," as a great factor in the shaping of public opinion, begins with Swift, Defoe, Bolingbroke, and Pulteney, in the many newspapers, from *The Review* and *The Examiner* to *The Craftsman*, by which was waged the keen political strife of the years 1704–40. There is no counterpart to it in France until the Revolution of 1789, nor in Germany until 1796 or 1798. It was a Frenchman who wrote—"Suffer yourself to be blamed, imprisoned, condemned; suffer yourself even to be hanged; but publish your opinions. It is not a right; it is a duty." It was in England that the course so pithily described was actually taken, in the face of fine, imprisonment, and pillory, at a time when in France the public had to depend upon foreign journals illicitly circulated, when its own chief writers resorted to clandestine presses, to paltry disguises, and to very poor subterfuges to escape the responsibilities of avowed authorship, and when in Germany there was no political publicity worthy to be named.

When the *Mercure de France*, after a long period of mediocrity, came into the hands of men of large intellectual faculty, they had the most cogent reasons for exerting their powers upon topics of literature rather than upon themes of politics. True political journalism dates only from the Revolution, and it then had a very brief existence. It occupied a cluster of writers, some of whom have left an enduring mark upon French literature. A term of high aspiration was followed quickly by a much longer term of frantic licence and of literary infamy. Then came the long rule of a despotic censorship; and cycles of licence followed by cycles of repression have revolved, with varying periodicity, from that day to this. Germany has to some extent its parallelisms; but German journalism, if it never soared so high, never sank so low. Journalism in Germany has made steady advances onward; and in one grand feature—that of far-gathered information from foreign countries, not merely of incidents, but of the growth of opinion and the state of social life—the leading newspapers of Germany keep much ahead of their best French contemporaries. In France, too often, the journals that gain the largest circulation are precisely those of most conspicuous frivolity. Sometimes they are much worse than frivolous. In 1871 newspapers issued from Parisian presses which were as base and as brutal as those of 1794. In 1870 the democratic Government at Bordeaux issued against journals of high aims and of unspotted integrity, but opposed to its pretensions, edicts as arbitrary as the worst acts in that kind of Napoleon I., and unparalleled in the whole course of the government of Napoleon III.

In all the other countries of Europe political journalism, in any characteristic sense, is a thing of the present century, —somewhat earlier in the century in northern Europe, somewhat later in southern. The *Ordinarie Post-Tidende* of Stockholm dates indeed from 1643, but until very recent times it was a mere news-letter. Denmark had no sort of journal worth remark until the foundation, in 1749, of the *Berlingske Tidende*, and that too attained to no political rank. The *Gazette* of St Petersburg—the patriarch of Russian newspapers—dates from 16th December 1702, is a Government organ, and nearly synchronizes with the first successful attempt at a newspaper in the British colonies in America. But the *Boston Gazette* was, in its degree, a better journal in the last century than the *Wiedomosti* now.

Journalism in Italy begins with the *Diario di Roma* in 1716, but in politics the press remained a nullity—for all practical purposes—until nearly the middle of the present century, when the newspapers of Sardinia, at the impulse of Cavour, began to foreshadow the approach of the influential Italian press of the present day. In Spain no rudiments of a newspaper press can be found until the last century. As late as in 1826 an inquisitive American traveller records his inability to lay his hands, during his Peninsular tour, upon more than two Spanish newspapers.

It may be useful to bring these chronological notes of the origin of journalism into view, at a glance, conjointly with the dates of some of the chief existing journals of Europe, by tabulating them thus:—

Year.	Place.	Name.	Remarks.
1615	Frankfort-on-Main..........	Frankfurter Journal.......	Existing in 1883.
1616	Antwerp........	Nieuwe Tijdinghen.........	......
1622	London (1).....	Weekly News..............	......
1631	Paris (1)........	Gazette [de France].........	Existing in 1883.
1643	Stockholm......	Post [och Inrikes] Tidende	Do. do.
1660	Edinburgh (1)	Mercurius Caledonius......	Ten numbers only published.
1665	London (2).....	London Gazette............ [Temporarily at Oxford]	Existing in 1883.
1672	Paris (2)........	Mercure [de France]........	Continued till 1853
1690	Worcester	Berrow's Worcester Jour.	Existing in 1883.
1695	London (3).....	The Postboy................	First London daily paper
1699	Edinburgh (2)	Edinburgh Gazette	Existing in 1883.
1702	London (4).....	Daily Courant..............	First successful London daily.
1702	St Petersburg	St Petersburg Wiedomosti	Existing in 1883.
1704	London (5).....	Defoe's Review of the Affairs of State	Continued till June 1713.
1704	Boston, Massachusetts...	Boston News-Letter..	Continued until loss of Boston by the British.
1705	Edinburgh (3).	Edinburgh Courant.........	Existing in 1883.
1711	Dublin (1)......	Dublin Gazette.............	Do. do.
1712	Hamburg.......	Hamburg Correspondent..	Do. do.
1716	Rome............	Diario di Roma.............	Continued for nearly 90 years.
1726?	Madrid (1)	Gaceta de Madrid...........	Continued until about 1850.
1763	Dublin (2)......	Freeman's Journal..........	Earliest Irish daily paper.
1772	London (6).....	The Morning Post	Existing in 1883.
1782	Glasgow (1)...	Glasgow Herald	Do. do
1785	London (7).....	The Times	Known until 1788 as Universal Daily Register
1789	Paris (3)........	Moniteur Universel.........	Existing in 1883.
1789	Paris (4)........	Journal des Débats.........	Do. do.
1792	London (8).....	The Observer...............	Do. do. (weekly).
1792	London (9).....	The Courier	Long the leading London newspaper.
1798	Leipsic	Allgemeine Zeitung........	Existing in 1883.
1817	Edinburgh (4)	The Scotsman..............	Daily from 1855.
1827	London (10)...	The Standard	Morning paper from 1857.
1842	Madrid (2).....	Heraldo....................	Chief Spanish journal for many years.
1846	London (11)...	The Daily News............	Existing in 1883.
1847	Turin...........	Il Risorgimento............	Edited by Cavour.
1847	Florence........	L'Opinione.................	Existing in 1883.
1847	Glasgow (2) ...	North British Daily Mail..	Do. do.
1849	Berlin..........	Volkszeitung	Reputed to have the largest circulation in Germany.
1855	London (12) ...	The Daily Telegraph	Existing in 1883.

The development of the modern newspaper is due to a union of causes that may well be termed marvellous. A machine that from a web of paper 3 or 4 miles long can, in one hour, print, fold, cut, and deliver 24,000 or 25,000 perfected broadsheets is after all not so great a marvel as is the organizing skill which centralizes in a London office telegraphic communications from every important town in Europe, Asia, America, and Australia, and which then (whilst re-transmitting thither the news of London) distributes those communications—directly or indirectly—to thousands of recipients simultaneously, by day and by night, throughout all Britain. And but for unusual mental gifts, conjoined with high culture and with great "staying-power," in the editorial rooms, all these marvels of ingenuity—which now combine to develop public opinion on great public interests, and to guide it—would be nothing better than a vast mechanism for making money out of man's natural aptitude to spend his time either in telling or in hearing some new thing.

Julius Reuter's enterprise grew immediately out of the thoughts of an observant Prussian Government-messenger on the extraordinary excitement of this natural aptitude which he witnessed as caused by the revolutionary movements of 1848. In 1849 he established a news-transmitting agency in Paris, with all the appliances that were then available. Between Brussels and Aix-la-Chapelle he formed a pigeon-service, connecting it with Paris and with Berlin by telegraph. As the wires extended, he quickly followed them with agency-offices in many parts of the Continent. When he came to London, his progress was for a moment held in check. The editor of *The Times* listened very courteously to his proposals, but (on that first occasion) ended their interview by saying, "We generally find that we can do our own business better than anybody else can." He went to the office of *The Morning Advertiser*, which had then the next largest circulation to that of *The Times*, and had better success.[1] He entered into an agreement with that and afterwards with other London journals, including *The Times*, and also with many commercial corporations and firms.

The newspapers, of course, continued to employ their own wires and to extend them, but they found great advantage in the use of Reuter's telegrams as supplementary. His enterprise grew apace. Within a few years it is said to have yielded the founder some £25,000 a year. In 1865 it was transferred to a limited company. In 1868 the London Press Association was formed. It contracted with Reuter's company to supply their telegrams exclusively throughout the United Kingdom, London only excepted. The cost yearly to those newspaper proprietors who are members of the association is £294, to non-members £323. In connexion with the intelligence department of the post-office, the Press Association supplies parliamentary, juridical, and market news. The office of the Association is kept open during twenty-one hours of the twenty-four. The enterprise was organized by Mr John Lovell, now editor of *The Liverpool Mercury*. London has now at least nine other press and telegraphic associations; Paris probably has almost as many.

The Newspapers of the United Kingdom.

The first English journalists were the writers of "news-letters," originally the dependants of great men, each employed in keeping his own master or patron well-informed, during his absence from court, of all that transpired there. The duty grew at length into a calling. The writer had his periodical subscription list, and instead of writing a single letter wrote as many letters as he had customers. Then one more enterprising than the rest established an "intelligence office," with a staff of clerks, such as Ben Jonson's Cymbal depicts from the life in *The Staple of News*, acted in 1625:—

> "This is the outer room where my clerks sit,
> And keep their sides, the register in the midst;
> The examiner, he sits private there within;
> And here I have my several rolls and files
> Of news by the alphabet, and all put up
> Under their heads."

Of the earlier news-letters good examples may be seen in Sir John Fenn's collection of *Paston Letters*, and in Arthur Collins's *Letters and Memorials of State* (better known, perhaps, as the *Sydney Papers*). Of those of later date specimens will be found in Knowler's *Letters and Despatches of Strafford*, and in other well-known books. Still later examples, and such as have a very high historical interest, may be seen in abundance amongst the papers collected by the historian Thomas Carte, now preserved in the Bodleian Library at Oxford. Of these, several series were addressed to the first duke of Ormond, partly by correspondents in England and Ireland, partly by correspondents in Paris; others were addressed to successive earls of Huntingdon; others, again, to various members of the family of Wharton. And like valuable collections are to be seen in the library of the British Museum, and in the English Public Record Office. In Edinburgh, the Advocates' Library possesses a series of the 16th century, written by Richard Scudamore to Sir Philip Hoby during his embassy to Vienna.

The MS. news-letters—some of them proceeding from writers of marked ability who had access to official information, and were able to write with greater freedom and independence of tone than the compilers of the printed news—held their ground, although within narrowing limits, until nearly the middle of the last century. Some of the collections of these "gazettes à-la-main" have for the historian a greater value than any existing printed series of a contemporary gazetteer.

By the pains and critical acumen of the late Mr Thomas Watts, of the British Museum, the obstinate fiction that "for the first printed newspaper mankind are indebted to the wisdom of Elizabeth and the prudence of Burghley" is at length gradually disappearing from current literature, although the old story of the *English Mercurie* of the Armada year has been many times repeated (even in the latest works on English journalism) since the first publication of his able pamphlet.[2] In a later publication,[3] the same learned bibliographer traced, not less conclusively, this curious fabrication to its author, the second earl of Hardwicke.

Although no genuine newspaper of the 16th century can be produced, English pamphlets, as well as French, Italian, and German, occur with such titles as *Newes from Spaine*, and the like. In the early years of the 17th century they became very numerous. In 1614 we find Burton (the author of the *Anatomy of Melancholy*) pointing a sarcasm against the non-reading habits of "the major part" by adding, "if they read a book at any time . . . 'tis an English chronicle, Sir Huon of Bordeaux, Amadis de Gaul, &c., a play-book, or *some pamphlet of news*." The most eminent purveyors of reading of this sort were Nathaniel Butter, Nicholas Bourne, and Thomas Archer; and by them was issued, in May 1622, the first authentic English *periodical* newspaper now known to exist. When these news-pamphlets began to be periodicals their periods were at first irregular. Thus on the 1st of June 1619 Ralph Rounthwaite entered at Stationers' Hall *A Relation of all matters done in Bohemia, Austria, Poland, Sletia, France, &c., that is worthy of relating, since the 2 of March 1618* [1619 N.S.] *until the 4th of May.*[1] Again, at the beginning of November 1621, Bartholomew Downes and another entered in like manner *The certaine and true newes from all parts of Germany and Poland, to this present 20 of October 1621.*[2] No copy of either of these papers is now, we believe, known to exist. Nor is any copy known of *The Courant, or Weekly Newes from foreign parts*, of October 9, 1621, mentioned by Mr Nichols.[3] But in May 1622 we arrive at a weekly newspaper which may still be seen in the British Museum. It is entitled "The 23d of May—*The Weekly News from Italy, Germany*, &c., London, printed by J. D. for Nicholas Bourne and Thomas Archer." Nathaniel Butter's name does not occur on this number, but on many subsequent numbers it appears in connexion sometimes with Bourne's and sometimes with Archer's name; so that there was probably an eventual partnership in the new undertaking. Butter had published *Newes from Spaine* in 1611, and he continued to be a publisher of news until 1641, if not later.[4]

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[1] Mr James Grant has put on record, word for word, the curious conversation that occurred (*Hist. of Newspaper Press*, ii. 328 *sq.*).

[2] *Letter to Antonio Panizzi, on the Reputed Earliest Printed Newspaper, "The English Mercurie" of* 1588, London, 1839, 8vo.

[3] "Authorship of the fabricated 'Earliest English Newspaper,'" *Gent. Mag.*, n.s., xxxiii. 485-491, 1850.

In *The Certain Newes of this Present Week*, ending 23d August 1622, the publisher inserted this advertisement:—"If any gentleman or other accustomed to buy the weekly relations of newes be desirous to continue the same, let them know that the writer, or transcriber rather, of this newes hath published two former newes; the one dated the second, the other the thirteenth of August, all which do carry a like title, and have dependence one upon another; which manner of writing and printing he doth propose to continue weekly, by God's assistance, from the best and most certain intelligence." November 1641 is especially noticeable for the publication, in the form of a newspaper, of the earliest authentic report of the proceedings of parliament. *Diurnal Occurrences, or the Heads of several Proceedings in both Houses of Parliament*, was usually, notwithstanding its title, a weekly periodical, and it sometimes contained ordinary news in addition to its staple matter. This was followed, within five years, by a long train of newspapers, most of which were published weekly. Those which stand out most saliently from the rest are the *Mercurius Britannicus*, *M. Pragmaticus*, and *M. Politicus* of Marchmont Nedham, and the *Mercurius Aulicus* of John Birkenhead. Nedham was perhaps both the ablest and the readiest man that had yet tried his hand at a newspaper. He commenced the *M. Britannicus* on August 22, 1643, zealously advocated in it the cause of the Parliament, and continued its publication until 1647. At that period he changed sides, and began to write *Mercurius Pragmaticus*,

> "which, being very witty, satirical against the Presbyterians, and full of loyalty, made him known to, and admired by, the bravadoes and wits of those times. . . . At length . . . Lenthall and Bradshaw . . . persuaded him to change his style once more [in favour of] the Independents, then carrying all before them. So that, being bought over, he wrote *Mercurius Politicus*, so extreme contrary to the former that the generality for a long time . . . could not believe that that 'intelligence' could possibly be written by the same hand that wrote the *M. Pragmaticus*. . . . The last [*i.e.*, the *Pragmatici*] were endeavoured by the parliamenteers to be stifled, but the former, the *Politici*, which came out by authority, and flew every week into all parts of the nation for more than ten years, had very great influence. . . . He was then [after a fourth 'change of style'] the Goliath of the Philistines, the great champion of the late usurper, whose pen, in comparison of others, was like a weaver's beam."[5]

Birkenhead's *M. Aulicus* was also begun in 1643, and continued, although irregularly, until nearly the close of the civil war. According to Wood, Charles I. "appointed him to write the *Mercurii Aulici*, which being very pleasing to the loyal party, His Majesty recommended him to the [university] electors that they would choose him moral philosophy reader," which was done accordingly. He was assisted in the composition of *Aulicus* by George Lord Digby (secretary of state, and afterwards earl of Bristol) and by Dr Peter Heylin. Sir John Birkenhead had considerable powers of satire, after a coarse fashion, and was one of the few rough-weather royalists who were permitted to bask in the sunshine of the Restoration.

Under Cromwell, the chief papers were *M. Politicus* and *The Public Intelligencer* (of which the first number appeared on the 8th October 1655). These publications were issued on different days of the week, and at length they became conjointly the foundation of the present *London Gazette*. Even at their origin they were in some degree official papers. In 1659 the council of state caused the following announcement to be published:—"Whereas Marchmont Nedham, the author of the weekly news-books called *Mercurius Politicus* and *The Publique Intelligencer*, is, by order of the council of state, discharged from writing or publishing any publique intelligence; the reader is desired to take notice that, by order of the said council, Giles Dury and Henry Muddiman are authorized henceforth to write and publish the said intelligence, the one upon the Thursday and the other upon the Monday, which they do intend to set out under the titles of *The Parliamentary Intelligencer* and of *Mercurius Publicus*." After the Restoration, an office of surveyor of the press was instituted, to which Roger L'Estrange was appointed. The story of his administration of it—for which there are ample materials in the State Papers[6]—would be well worth the telling in a befitting place. On him was also conferred, by royal grant—and, as it proved, for only a short period,—"all the sole privilege of writing, printing, and publishing all narratives, advertisements, mercuries, intelligencers, diurnals, and other books of public intelligence; . . . with power to search for and seize unlicensed and treasonable schismatical and scandalous books and papers." L'Estrange continued the papers above mentioned, but changed their titles to *The Intelligencer* and *The News*.

Joseph Williamson (afterwards secretary of state) was for a time L'Estrange's assistant in the compilation of *The Intelligencer*,[7] from which he soon withdrew. He organized for himself a far-spread foreign correspondence, and carried on the business of a news-letter writer on a larger scale than had till then been known. Presently L'Estrange found his own sources of information much abridged. To his application for renewed assistance Williamson replies that he cannot give it, but "will procure for L'Estrange a salary of £100 a year if he will give up his right in the news-book."[8] *The Intelligencer* appeals to Lord Arlington, and assures him that the charge of "entertaining spies for information was £500 in the first year."[9] But he has

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[1] *Registers of the Stationers' Company*, as printed by Mr Edward Arber, iii. 302.

[2] *Ibid.*, iv. 23.

[3] *Literary Anecdotes*, iv. 38.

[4] It is to him that a passage in Fletcher's *Fair Maid of the Inn* (act iv. sc. 2) obviously refers:—"It shall be the ghost of some lying stationer. A spirit shall look as if *butter* would not melt in his mouth; a new *Mercurius Gallo-Belgicus*."

[5] Wood, *Athenæ Oxonienses* (by Bliss), iii. 1182. A new *Mercurius Britannicus* appeared in June 1647, but did not long continue. Another, entitled *M. Britannicus again Alive*, was published in May 1648, and the title was often subsequently revived.

[6] These materials begin in *Domestic Correspondence, Charles II.*, xxxix. 92–95 (Rolls House), and continue at intervals in several succeeding volumes.

[7] This help seems to have been given at the request of Arlington (then Sir H. Bennet) in 1663, *State Papers, Domestic, Charles II.*, lxxix. 112, 113.

[8] *State Papers, Domestic, Charles II.*, cxxxiv. 103 (Rolls House).

[9] *Ibid.*, 117.

"doubled the size and price of the book, and has brought the profit from £200 to £400 or £500 a year."[1] The appeal was in vain. It was resolved to suppress *The Intelligencer*, and to establish a court newspaper under a new title and new editorship.

At that time the great plague had driven the court to Oxford. The first number of *The Oxford Gazette* was published on the 14th of November 1665. With the publication of the twenty-fourth number it became *The London Gazette*. Williamson had the general control of it. For a considerable time Charles Perrot, a member of Oriel College, was the acting editor.[2] For several years the *Gazette* was regularly translated into French by one Moranville. During the Stuart reigns generally, its contents were very meagre, although in the reign of Anne some improvement is already visible. More than a century after the establishment of the *Gazette*, we find Secretary Lord Weymouth addressing a circular[3] to the several secretaries of legation and the British consuls abroad, in which he says, "The writer of the *Gazette* has represented that the reputation of that paper is greatly lessened, and the sale diminished, from the small portion of foreign news with which it is supplied." He desires that each of them will send regularly all such articles of foreign intelligence as may appear proper for that paper, "taking particular care,—as the *Gazette* is the only paper of authority printed in this country,—never to send anything concerning the authenticity of which there is the smallest doubt." From such humble beginnings has arisen the great repertory of State Papers, now so valuable to the writers and to the students of English history. It has appeared twice a week, in a continuous series, for nearly two hundred and twenty years.[4] The *Gazette* brings to the public an income exceeding £20,000 a year. The editorship is of course a Government appointment, and it has a salary of £800. The office is now commonly given in reward of distinguished service upon the ordinary newspaper press.

In November 1675 L'Estrange—not yet tired of journalism—commenced *The City Mercury, or Advertisements concerning Trade*. This he followed up in 1679 by *Domestick Intelligence, published gratis for the promoting of Trade*.

The very day after the departure of James II. was marked by the appearance of three newspapers—*The Universal Intelligence*, *The English Courant*, and *The London Courant*. Within a few days more these were followed by *The London Mercury*, *The Orange Gazette*, *The London Intelligence*, *The Harlem Currant*, and others. The Licensing Act, which was in force at the date of the Revolution, expired in 1692, but was continued for a year, after which it finally ceased. On the appearance of a paragraph in *The Flying Post* of 1st April 1697, which appeared to the House of Commons to attack the credit of the Exchequer Bills, leave was given to bring in a Bill "to prevent the writing, printing, or publishing of any news without licence"; but the Bill was thrown out in an early stage of its progress. That *Flying Post* which gave occasion to this attempt was also noticeable for a new method of printing, which it thus announced to its customers,—"If any gentleman has a mind to oblige his country friend or correspondent with this account of public affairs, he can have it for twopence . . . . on a sheet of fine paper, half of which being left blank, he may thereon write his own affairs, *or the material news of the day*."

In 1696 Edward Lloyd—the virtual founder of the world-famous "Lloyd's" of commerce—started a thrice-a-week paper, *Lloyd's News*, which had but a brief existence in its first shape, but was the precursor of the *Lloyd's List* of the present day. No. 76 of the original paper contained a paragraph referring to the House of Lords, for the appearance of which a public apology must, the publisher was told, be made. He preferred to discontinue his publication (February 1697). Nearly thirty years afterwards he in part revived it, under the title of *Lloyd's List*,—published at first weekly, afterwards twice a week.[5] This dates from 1726. It is now published daily.

It was in the reign of Queen Anne that the newspaper press first became really eminent for the amount of intellectual power and of versatile talent which was employed upon it. It was also in that reign that the press was first fettered by the newspaper stamp. The accession of Anne was quickly followed by the appearance of the first successful London daily newspaper, *The Daily Courant* (1703). Seven years earlier, in 1695, *The Postboy* had been started as a daily paper, but only four numbers appeared. The *Courant* was published and edited by the well-known and learned printer Samuel Buckley, who explained to the public that "the author has taken care to be duly furnished with all that comes from abroad, in any language. . . . . At the beginning of each article he will quote the foreign paper from which it is taken, that the public, seeing from what country a piece of news comes, with the allowance of that Government, may be better able to judge of the credibility and fairness of the relation. Nor will he take upon himself to give any comments, ... supposing other people to have sense enough to make reflexions for themselves." Then came, in rapid succession, a crowd of new competitors for public favour, of less frequent publication. The first number of one of these, *The Country Gentleman's Courant* (1706), was given away gratuitously, and made a special claim to public favour on the ground that "here the reader is not only diverted with a faithful register of the most remarkable and momentary [*i.e.*, momentous] transactions at home and abroad, ... but also with a geographical description of the most material places mentioned in every article of news, whereby he is freed the trouble of looking into maps."

On the 19th of February 1704, whilst still imprisoned in Newgate for a political offence, Defoe began his famous paper *The Review* (see DEFOE). At the outset it was published weekly, afterwards twice, and at length three times a week. It continued substantially in its first form until July 29, 1712; and a complete set is of extreme rarity. From the first page to the last it is characterized by the manly boldness and persistent tenacity with which the almost unaided author utters and defends his opinions on public affairs against a host of able and bitter assailants. Some of the numbers were written during travel, some in Edinburgh. But *The Review* appeared regularly. When interrupted by the pressure of the Stamp Act, the writer modified the form of his paper, and began a new series (August 2, 1712, to June 11, 1713). In those early and monthly supplements of his paper which he entitled "Advice from the Scandalous Club," and set apart for the discussion of questions of literature and manners, and sometimes of topics of a graver kind, Defoe to some extent anticipated the *Tatler* and *Spectator*. In 1705 he severed those supplements from his chief newspaper, and published them twice a week as *The Little Review*. But they soon ceased to appear. Not again to revert to Defoe as an

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[1] *State Papers, Domestic, Charles II.*, cxxxv. 24.

[2] Anthony Wood, *Athenæ Oxonienses*, sect. "Perrot."

[3] *Calendar of Home-Office Papers*, 1766–69, p. 483 (1879).

[4] A complete set exceeds four hundred volumes, with four volumes of index, and is now of extreme rarity.

[5] Frederick Martin, *History of Lloyd's*, 66–77 and 107–120. The great collection of newspapers in the British Museum contains only one number of *Lloyd's News*; but sixty-nine numbers may be seen in the Bodleian Library. Of the *List*, also, no complete series is known to exist; that in the library of Lloyd's begins with 1740.

English journalist, it may here be added that in May 1716 he began a new monthly paper under an old title, *Mercurius Politicus*, ... "by a lover of old England." This journal continued to appear until September 1720.

The year 1710 was marked by the appearance oi *The Examiner, or Remarks upon Papers and Occurrences* (No. 1, August 3), of which thirteen numbers appeared by the co-operation of Bolingbroke, Prior, Freind, and King before it was placed under the sole control of Swift. *The Whig Examiner*, avowedly intended "to censure the writings of others, and to give all persons a rehearing who had suffered under any unjust sentence of *The Examiner*," followed on the 1st September, and *The Medley* three weeks afterwards.

This increasing popularity and influence of the newspaper press could not fail to be distasteful to the Government of the day. Prosecutions were multiplied, but with small success. At length some busy projector hit upon the expedient of a newspaper tax. The paper which seems to contain the first germ of the plan is still preserved amongst the Treasury papers. It is anonymous and undated, but probably belongs to the year 1711. "There are published weekly," says the writer, "about 44,000 newspapers, viz., *Daily Courant, London Post, English Post, London Gazette, Postman, Postboy, Flying Post, Review*, and *Observator*." [1]

The duty eventually imposed was a halfpenny on papers of half a sheet or less, and a penny on such as ranged from half a sheet to a single sheet (10 Anne, c. xix. § 101), and it came into force on the 19th July 1712. The first results of the tax cannot be more succinctly or more vividly described than in the following characteristic passage of the *Journal to Stella* (August 7, 1712): "Do you know that Grub Street is dead and gone last week? No more ghosts or murders now for love or money. I plied it close the last fortnight, and published at least seven papers of my own, besides some of other people's; but now every single half-sheet pays a halfpenny to the queen. The *Observator* is fallen; the *Medleys* are jumbled together with the *Flying Post*; the *Examiner* is deadly sick; the *Spectator* keeps up, and doubles its price—I know not how long it will hold. Have you seen the *red stamp* the papers are marked with? *Methinks the stamping is worth a halfpenny.*"

Swift's doubt as to the ability of the *Spectator* to hold out against the tax was justified by its discontinuance in the following year. But the impost which was thus fruitful in mischief, by suppressing much good literature, wholly failed in keeping out bad. Some of the worst journals that were already in existence kept their ground, and the number of such ere long increased.[2] An enumeration of the London papers of 1714 comprises *The Daily Courant, The Examiner, The British Merchant, The Lover, The Patriot, The Monitor, The Flying Post, The Postboy, Mercator, The Weekly Pacquet*, and *Dunton's Ghost*. Another enumeration in 1733 includes *The Daily Courant, The Craftsman, Fog's Journal, Mist's Journal, The London Journal, The Free Briton, The Grub Street Journal, The Weekly Register, The Universal Spectator, The Auditor, The Weekly Miscellany, The London Crier, Read's Journal, Œdipus or the Postman Remounted, The St James's Post, The London Evening Post*, and *The London Daily Post*. Twenty years later the last-named publication became the well-known *Public Advertiser*. Part of this increase may fairly be ascribed to political corruption. In 1742 the committee of the House of Commons appointed to inquire into the political conduct of the earl of Orford reported to the House that during the last ten years of the Walpole ministry there was paid, out of public money, no "less a sum than £50,077, 18s. to authors and printers of newspapers, such as the *Free Briton, Daily Courant, Gazetteer*, and other political papers."[3] But some part of the payment may well have been made for advertisements. Towards the middle of the century the provisions and the penalties of the Stamp Act were made more stringent. Yet the number of newspapers continued to rise. Johnson, writing in 1758, bears testimony to the still growing thirst for news: "Journals are daily multiplied, without increase of knowledge. The tale of the morning paper is told in the evening, and the narratives of the evening are bought again in the morning. These repetitions, indeed, waste time, but they do not shorten it. The most eager peruser of news is tired before he has completed his labour; and many a man who enters the coffee-house in his nightgown and slippers is called away to his shop or his dinner before he has well considered the state of Europe." Five years before this remark appeared in *The Idler* the aggregate number of copies of newspapers annually sold in England, on an average of three years, amounted to 7,411,757. In 1760 it had risen to 9,464,790, and in 1767 to 11,300,980. In 1776 the number of newspapers published in London alone had increased to fifty-three.

When Johnson wrote his sarcastic strictures on the newspapers that were the contemporaries and, in a sense, the rivals of *The Idler*, the newswriters had fallen below the standard of an earlier day. A generation before, the newspaper was often much mor of a political organ than of an industrial venture. All of the many enterprises of Defoe in this field of journalism united indeed both characteristics. But if he was a keen tradesman, he was also a passionate politician. And not a few of his fellow-workers in that field were conspicuous as statesmen no less than as journalists. Even less than twenty years before the appearance of Johnson's remarks, men of the mental calibre of Henry Fielding were still to be found amongst the editors and writers of newspapers. The task had fallen to a different class of men in 1750.

The history of newspapers during the long reign of George III. is a history of criminal prosecutions, in which individual writers and editors were repeatedly defeated and severely punished, whilst the press itself derived new strength from the protracted conflict, and turned ignominious penalties into signal triumphs. From the days of *The North Briton* to those of *The Examiner*, every conspicuous newspaper prosecution gave tenfold currency to the doctrines that were assailed. In the earlier part of this period men who were mere traders in politics—whose motives were obviously base and their lives contemptible—became for a time powers in the state, able to brave king, legislature, and law courts, by virtue of the simple truth that a free people must have a free press. Yet the policy that had failed in 1763 continued to be clung to in 1819.

One of the minor incidents of the *North Briton* excitement led indirectly to valuable results with reference to the much-vexed question of parliamentary reporting. During the discussions respecting the Middlesex election, Almon, a bookseller, collected from members of the House of Commons some particulars of the debates, and published them in *The London Evening Post*. The success which attended these reports induced the proprietors of *The St James's Chronicle* to employ a reporter to collect notes in the lobby and at the coffee-houses. This repeated infraction of the privilege of secret legislation led to the memorable proceedings of the House of Commons in 1771, with their fierce debates, angry resolutions, and arbitrary imprisonments,—all resulting, at length, in that tacit concession of publicity of discussion which in the main, with brief occasional exceptions, has ever since prevailed.

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[1] "A Proposition to Increase the Revenue of the Stamp-Office," Redington, *Calendar of Treasury Papers*, 1708–14, p. 235. The stamp-office dated from 1694, when the earliest duties on paper and parchment were enacted.

[2] See the Burney collection of newspapers in the British Museum; and Nichols, *Literary Anecdotes of the Eighteenth Century* iv. 33–97.

[3] "Fourth Report of the Committee of Secrecy," &c., in Hansard's *Parliamentary History*, xii. 814.

The three metropolitan newspapers which at different periods of this reign stood pre-eminent amongst their competitors were *The Public Advertiser*, *The Morning Post*, and *The Morning Chronicle*. The first-named paper owed much of its popularity to the letters of Junius. The *Post* and the *Chronicle* were mainly indebted for their success to the personal qualities of individual editors, combined, in both cases, although in very different degree, with a staff of writers endowed with exceptional literary power and marked versatility of talents. The *Public Advertiser* was first published in 1726, under the title *London Daily Post and General Advertiser*. In 1738 the first part of the title was dropped, and in 1752 *General Advertiser* was altered into the name which the letters of Junius made so famous. Many of these had appeared before the smallest perceptible effect was produced on the circulation of the paper; but when the "Letter to the King" came out (19th December 1769, almost a year from the beginning of the series) it caused an addition of 1750 copies to the ordinary impression. The effect of subsequent letters was variable; but when Junius ceased to write the monthly sale of the paper had risen to 83,950. This was in December 1771. Seven years earlier the monthly sale had been but 47,515.[1] It now became so valuable a property that shares in it were sold, according to John Nichols, "as regularly as those of the New River Company."[2] But the fortunes of the *Advertiser* declined almost as rapidly as they had risen. It continued to appear until 1798, and then seems to have been amalgamated with the commercial paper called *The Public Ledger* (dating from 1759), which still exists as a London daily journal. Actions for libel were brought against the paper by Edmund Burke in 1784, and by William Pitt in 1785, and in both suits damages were given. *The Morning Chronicle* was begun in 1769. William Woodfall was its printer, reporter, and editor, and continued to conduct it until 1789. James Perry succeeded him as editor, and so continued, with an interval during which the editorship was in the hands of the late Mr Sergeant Spankie, until his death in 1821. Perry's editorial functions were occasionally discharged in Newgate in consequence of repeated prosecutions for political libel. In 1819 the daily sale reached nearly 4000. It was sold in 1823 to Mr Clement, the purchase-money. amounting to £42,000. Mr Clement held it for about eleven years, and then sold it to Sir John Easthope for £16,000. It was then, and until 1843, edited by John Black, who numbered amongst his staff Albany Fonblanque, Charles Dickens, and John Payne Collier. The paper continued to be distinguished by much literary ability, but not by commercial prosperity. In 1849 it became the joint property of the duke of Newcastle, Mr Gladstone, and some of their political friends; and by them, in 1854, it was sold, conditionally, to Mr Serjeant Glover, under whose management it became eventually the subject of a memorable public scandal in the law courts of France. At length the affairs of the *Chronicle* were wound up in the Bankruptcy Court of London, after an existence of more than ninety years.

The Morning Post dates from 1772. For some years it was in the hands of Henry Bate (afterwards known as Sir Henry Bate Dudley), and it attained some degree of temporary popularity, though of no very enviable sort. In 1795 the entire copyright, with house and printing materials, was sold for £600 to Peter and Daniel Stuart, who quickly raised the position of the *Post* by enlisting Mackintosh and Coleridge in its service, and also by giving unremitting attention to advertisements and to the copious supply of incidental news and amusing paragraphs. There has been much controversy about the share which Coleridge had in elevating the *Post* from obscurity to eminence. That he greatly promoted this result there can be no doubt. His famous "Character of Pitt," published in 1800, was especially successful, and created a demand for the particular number in which it appeared that lasted for weeks, a thing almost without precedent. Coleridge wrote for this paper from 1795 until 1802, and during that period its circulation in ordinary rose from 350 copies, on the average, to 4500. Whatever the amount of rhetorical hyperbole in Fox's saying,—recorded as spoken in the House of Commons,—"Mr Coleridge's essays in *The Morning Post* led to the rupture of the treaty of Amiens," it is none the less a striking testimony, not only to Coleridge's powers as a publicist, but to the position which the newspaper press had won, in spite of innumerable obstacles, eighty years ago. The list of his fellow-workers in the *Post* is a most brilliant and varied one. Besides Mackintosh, Southey, and Arthur Young, it included a galaxy of poets. Many of the lyrics of Moore, many of the social verses of Mackworth Praed, some of the noblest sonnets of Wordsworth, were first published in the columns of the *Post*. And the story of the paper, in its early days, had tragic as well as poetic episodes. In consequence of offence taken at some of its articles, the editor and proprietor, Nicholas Byrne (who succeeded Daniel Stuart), was assaulted and murdered whilst sitting in his office. In later days, but long prior to those of the submarine cable, the *Post* for a time eclipsed most of its rivals by means of the skilful organization which Lieutenant Waghorn—the pioneer of the overland route to India—gave to its agencies for foreign intelligence.

The Times is usually dated from the 1st of January 1788, but was really commenced on the 18th January 1785, under the title of *The London Daily Universal Register, printed logographically*. This "word-printing" process had been invented by a printer named Henry Johnson several years before, and found a warm advocate in John Walter, who expounded its peculiarities at great length in No. 510 of his *Daily Universal Register*. In a later number he stated, very amusingly, his reasons for adopting that altered title which the enterprise and the ability of his successors have made world-famous.

Within two years Walter had his share in the Georgian persecutions of the press, by successive sentences to three fines and to three several imprisonments in Newgate, chiefly for having stated that the prince of Wales and the dukes of York and Clarence had so misconducted themselves "as to incur the just disapprobation of his Majesty." In 1803 he transferred the management (together with the joint proprietorship) of the journal to his son, by whom it was carried on with remarkable energy and consummate tact. To Lord Sidmouth's Government he gave a general but independent support. That of Pitt he opposed, especially on the questions of the Catamaran expedition and the malversations of Lord Melville. This opposition was resented by depriving the elder Walter of the printing for the customs department, by the withdrawal of Government advertisements from *The Times*, and also, it is said, by the systematic detention at the outports of the foreign intelligence addressed to its editor. Walter, however, was strong and resolute enough to brave the Government. He organized a better system of news transmission than had ever before existed. He introduced steam-printing, and repeatedly improved its mechanism; and, although machines which print 22,000 sheets in the hour may now seem to thrust into insignificance a press of which it was at first announced as a notable triumph that the new machine performed its task "with such a velocity and simultaneousness of movement that no less than 1100 sheets are impressed in one hour," yet Walter's assertion was none the less true, that *The Times* of 29th November 1814 "presented to the public the practical result of the greatest improvement connected with printing since the discovery of the art itself."

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[1] These are the figures of Mr W. S. Woodfall, the editor.

[2] *Literary Anecdotes of the Eighteenth Century.*

The effort to secure for *The Times* the best attainable literary talent in all departments kept at least an equal pace with those which were directed towards the improvement of its mechanical resources. And thus it came to pass that a circulation which did not, even in 1815, exceed on the average 5000 copies became, in 1834, 10,000; in 1844, 23,000; in 1851, 40,000; and in 1854, 51,648. In the year last named the average circulation of the other London dailies was—*Morning Advertiser*, 7644; *Daily News*, 4160; *Morning Herald*, 3712; *Morning Chronicle*, 2800; *Morning Post*, 2667.

Sir John Stoddart, afterwards governor of Malta, edited *The Times* for several years prior to 1816. He was succeeded by Thomas Barnes, under whose management the great journal became famous for munificent reward of every kind of efficient service. The energy shown of late in the use of the railway and the telegraphic cable is no more marvellous than was the bringing of important news to London in 1834, at the rate of 15 miles an hour, for 400 miles. Unlike his most distinguished successor in the editorship, Barnes for many years wrote largely in his paper. When his health began to fail the largest share of the editorial work came into the hands of Captain Edward Sterling,—the contributor about a quarter of a century earlier of a noteworthy series of political letters signed "Vetus," the Paris correspondent of *The Times* in 1814 and subsequent eventful years, and afterwards for many years the most conspicuous among its leader-writers.[1] From 1841 to 1877 the chief editor was John Thaddeus Delane. It is known, on the best authority, that "he never was a writer; he never even attempted to write anything, except what he wrote better than most writers could do—reports and letters."[2] But without writing, in the literary sense, a wonderful life's work was crowded into those six and thirty years. The result of that labour, combined with the labour of a most brilliant staff of contributors, was to make what already had grown to be the "favourite broadsheet" of the English public into that which is now wont to be described as the "leading journal of the world." Everything that is used in the production of *The Times*, except the printing paper, is made in its offices. Not only its own "Walter machines"—able to print and perfect from 22,000 to 24,000 sheets in the hour—but those also which have been supplied to *The Scotsman*, *The Daily News*, *The Liverpool Post*, and *The New York Times* have been manufactured there. The editor's office in Printing-House Square is now in direct communication by special wires with his branch offices both in Paris and in Berlin. The parliamentary reports are sent to the office from the Houses through the telephone. The shorthand writer extends his notes in the usual way, and reads off the manuscript through the instrument. The recipient dictates the reports to the type setters. The manuscript follows the telephonic report, and the proofs are read by it. These several mechanical triumphs, in their varied stages of development, must have occasioned a preliminary outlay of at least £100,000. And that such experiments, on any like scale, became possible is due to the growth of advertisements. Of these, the first number of *The Times* contained fifty-seven, all brief ones. In recent days a number of *The Times* has occasionally contained sixty columns—in one instance, at least, sixty-seven—of advertisements. The rates of charge vary, but upon a rough average it seems probable that the annual revenue from this source alone may considerably exceed £400,000. With such a fund in reserve—apart from the direct product by sale—it becomes easy to understand the otherwise amazing items of outlay known to have been incurred for telegrams, as, for instance, of £800 for reports of the results of the congress of Berlin, when *The Times* achieved the publication of the treaty almost at the instant of its signature. What the sale of the paper was upon that occasion is not publicly recorded. But when, in December 1861, it published a memoir of the lamented Prince Consort, 91,000 copies were sold. On occasion of the marriage of the prince of Wales a sale of 110,000 copies (at 4½d.) was attained.

Of the many curious episodical incidents which occur in the public history of *The Times*, one only can here be mentioned. In 1840 the Paris correspondent of the paper (Mr O'Reilly) obtained information respecting a gigantic scheme of forgery which had been planned in France, together with particulars of the examination at Antwerp of a minor agent in the conspiracy, who had been there, almost by chance, arrested. All that he could collect on the subject, including the names of the chief conspirators, was published by *The Times* on the 26th of May in that year, under the heading "Extraordinary and Extensive Forgery and Swindling Conspiracy on the Continent (Private Correspondence)." The project contemplated the almost simultaneous presentation at the chief banking-houses throughout the Continent of forged letters of credit, purporting to be those of Glyn & Company, to a very large amount; and its failure appears to have been in a great degree owing to the exertions made, and the responsibility assumed, by *The Times*. One of the persons implicated brought an action for libel against the printer, which was tried at Croydon in August 1841, with a verdict for the plaintiff, *one farthing damages*. A subscription towards defraying the heavy expenses (amounting to more than £5000) which *The Times* had incurred was speedily opened, but the proprietors declined to profit by it; and the sum which had been raised was devoted to the foundation of two "*Times* scholarships," in connexion with Christ's Hospital and the City of London School. Three years afterwards *The Times* rendered noble public service in a different direction. It used its vast power with vigour—at the expense of materially checking the growth of its own advertisement fund—by denouncing the fraudulent schemes which underlay the "railway mania" of 1845.

For a long period after the establishment of *The Times*, no effort to found a new daily London morning newspaper was ever conspicuously successful. As time went on, many endeavours were made, at an aggregate cost, as respects those only that entirely failed, of at least £80,000.[3] A measure of success followed the establishment

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[1] See *Life of John Sterling*, by Carlyle, who says of him at this time—"The emphatic, big-voiced, always influential and often strongly unreasonable *Times* newspaper was the express emblem of Edward Sterling. He, more than any other man, . . . was *The Times*, and thundered through it, to the shaking of the spheres."

[2] *The Times*, 25th November 1879.

[3] Conspicuous among these unfruitful attempts were—(1) *The New Times*, started by Dr (afterwards Sir John) Stoddart, upon his departure from Printing-House Square; (2) *The Representative*, established by John Murray, under circumstances which seemed at the outset exceptionally promising; (3) *The Constitutional*, begun in 1836 and carried on for eight months by a joint-stock company, exceptionally favoured in having for editor and sub-editor Laman Blanchard and Thornton Hunt, with a staff of contributors which included Thackeray, Douglas Jerrold, and Bulwer; (4) *The Morning Star*, founded in 1856, and kept afloat at a cost (it is credibly reported) of,

(1794) of *The Morning Advertiser*, under special circumstances. It was the joint-stock venture of a large society of licensed victuallers, amongst whom subscription to the paper was the condition of membership. For nearly sixty years its circulation lay almost entirely in public-houses and coffee-houses, but amongst them it sold nearly 5000 copies daily, and it yielded a steady profit of about £6000 a year. Then, by the ability and enterprise of an experienced editor (James Grant), it was within four years raised to a circulation of nearly 8000, and to an aggregate profit of £12,000 a year.

Setting aside mere class-journals like *The Financier* and *The Sportsman*, the only existing London morning newspapers which have been founded during the present century are *The Daily News* (21st January 1846), *The Daily Telegraph* (29th June 1855), and *The Standard* (29th June 1857). The lowest of the three in the point of circulation has attained an average issue of 170,000 copies; the highest has reached (by notarial certificate) to an average of about 242,000. In 1856 no London newspaper of any kind was recorded to have reached a higher average circulation than 109,106 copies (attained in 1854 by the weekly *News of the World*); no daily newspaper had exceeded an average of 51,648 copies (attained in the same year by *The Times*), its next highest competitor, *The Morning Advertiser*, reaching an average sale of only 7644 copies.

The Daily News became a penny paper in 1868. The great stride in its circulation did not come until 1870, when lavish use of the electric telegraph, combined with the great powers of a brilliant war correspondent, are said to have lifted the sale in a week from 50,000 copies to 150,000.[1]

Originally an evening paper, established in 1827 as the express organ of the opponents of the measure for the removal of the Roman Catholic disabilities, *The Standard* was at first edited by Dr Gifford. From the beginning it showed marked literary ability, but its commercial success was small. When sold to James Johnson its fortunes rapidly improved. He made it both a morning and evening journal, reduced its price to a penny, and gave it a thoroughly good organization. Occasionally, in 1870, the evening sale reached 100,000 copies. In 1882 the aggregate circulation, morning and evening, was certified to average 242,062 copies.

The Daily Telegraph was originally founded by Colonel Sleigh, and for a few and unprosperous years was edited by Henry Barnett. It attained no success until a change of ownership placed it under the editorial care of Edward Lawson. In 1882 its certified average daily circulation exceeded 241,900 copies.

London possessed no daily evening paper until 1788, nor did any evening paper attain an important position until the period of the war with Napoleon, when *The Courier* (established in 1792) became the newspaper of the day. For a few years its circulation exceeded that of *The Times*. The average amounted during the last three years of the war to 10,000 copies daily, a circulation not till then known to have been attained by any daily paper. Mackintosh, Coleridge, and Wordsworth were amongst its stated contributors. Out of an article in *The Courier*, from the pen of the last-named, grew the famous pamphlet on the convention of Cintra. Among the successive editors of *The Courier* were Daniel Stuart, William Mudford, Eugenius Roche, John Galt, James Stuart, and Laman Blanchard. In 1827 one twenty-fourth share in the property is said to have brought 5000 guineas. But changes of editorship and keen competition were fatal to a paper that had rendered brilliant public service in its day, and for a time had headed the newspaper press of London.

The metropolis has now seven evening papers, one of which—*The Shipping and Mercantile Gazette*—is exclusively commercial. Whilst, of the distinctively political morning journals, four are Liberal and only two Conservative, of the six political evening ones, four are Conservative (*Globe*, dating from 1803; *Evening Standard*, 1827; *St James's Gazette*, 1880; *Evening News*, 1881) and two are Liberal (*Pall Mall Gazette*, 1865; and *The Echo*, 1868). The last-named was the first London newspaper published at a halfpenny.

The London weekly press has always worn a motley garb. Weekly publication facilitates the individuality of a journal, both as respects its editorship and as respects the class of readers to which it more especially addresses itself. From the days of Daniel Defoe to those of Albany Fonblanque and Robert Rintoul there have always been newspapers bearing the unmistakable impress of an individual and powerful mind. When to great force of character in the writer and its natural result, an almost personal intimacy between writer and reader, Governments have been unwise enough to add the strength which inevitably grows out of persecution, the combination might well prove a formidable one. Cobbett's *Weekly Register* affords perhaps as striking an illustration of journalism in its greatness and in its meanness as could be found throughout its entire annals. And Cobbett's paper has had many successors, some of which, profiting by the marvellous mechanical appliances of the present day, have attained a far wider popular influence than was possessed by the *Weekly Register* in its most prosperous days.

The Observer dates from 1792, and was conducted by one editor—Mr Doxat—for more than fifty years. It early distanced its competitors; its expenditure was lavish, and its profits large. There is record that the issue of *The Observer* which contained a report of the coronation of George IV. (published in two parts, each of them with a fourpenny stamp) attained a circulation of 60,000 copies, and that there was paid to the Government for that week's issue about £3000 of stamp duty.[2]

The late well-known *Examiner* was founded in 1808, and had a career as one of the most prominent organs of the Liberals of nearly seventy years. That its literary reputation was great resulted naturally from a succession of such editors as Leigh Hunt, Albany Fonblanque, John Forster, and Professor Henry Morley. It had in its later days a distinguished competitor in the *Spectator*, founded (July 1828) and for more than thirty years edited by Robert Rintoul.

Strikingly in contrast with newspapers of this class stand two which have much in common besides their identity of title and their extraordinary circulation—*Lloyd's Weekly Newspaper* and *Reynolds's Weekly Newspaper*. The former started as an unstamped illustrated journal at a penny in September 1842. In 1848 it was enlarged in size, and the price raised to threepence. Curious ingenuity was shown in advertising it by all sorts of expedients. Amongst others, all the pennies its proprietor could lay his hands on were embossed, by a cleverly constructed machine, with the title and price of the new journal. *The Times* soon drew attention to this defacement of the queen's coin, and so gave a better advertisement still. From a weekly sale of 33,000 in 1848 it rose to 170,000 in 1861. In anticipation of the abolition of the paper duty, the price was then reduced to a penny. The circulation became 347,000 in 1863; in 1865 it rose to 412,080. The skill of the American machine-makers was now put to a test which produced for this paper Hoe's first great web-machine,—adopted immediately afterwards by *The Daily Telegraph* and *The Standard*. In 1879 the weekly sale of *Lloyd's Newspaper* was certified to average 612,902 copies. *Reynolds's Weekly Newspaper*, which has also a large circulation, dates from May 1850.

Of the illustrated papers *The Illustrated London News* is the oldest, and has the largest circulation (about 95,000). Besides its pictorial merits, it has long been notable for its obituary notices and its abstracts of wills. It was founded in May 1842. *The Graphic* (commenced in December 1869) has attained considerable reputation for its literature as well as for its engravings. *The Pictorial World* dates from March 1874

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from first to last, some £80,000, until 1870, when it merged in *The Daily News*; (5) in 1867, *The Day*, which lived only six weeks; (6) in 1873, *The Hour*, which had an existence of three years; (7) in 1878, *The Daily Express*, an almost instant failure, although edited with much ability. Against these seven disastrous ventures, extending over nearly the whole of the present century, there are to be set but three successful ones,—disregarding papers of a strictly commercial sort, and also, of course, those teeming local and suburban journals which are chiefly advertising organs, and of which only one, *The Clerkenwell Daily Chronicle*, has succeeded in establishing itself as a London morning paper of the usual type.

[1] Hatton, *Journalistic London*, 1881.

[2] "The Newspaper Press," in *Quarterly Review*, October 1880.

Nearly thirty years ago (in 1855) the total number of London daily newspapers was 15; it is still (in 1883) only 18. The total number of London newspapers of all kinds increased from 89 in 1855 to 386 in 1883. In 1855 the total number of provincial newspapers published throughout the United Kingdom was 560; in 1883 it was 1576. The whole number of daily newspapers in the provinces at the former date was but 13; at the latter it was 162. This vast growth is due in the main to altered legislation rather than to altered economic conditions. Some account must now be given of the Government restrictions on the British newspaper press, commencing with the Stamp Act of 1712.

In 1756 an additional halfpenny was added to the tax of 1712. In 1765 and in 1773 various restrictive regulations were imposed (5 Geo. III. c. 46, and 13 Geo. III. c. 65). In 1789 the three-halfpence was increased to twopence (29 Geo. III. c. 50), in 1797 to twopence-halfpenny (37 Geo. III. c. 90), in 1804 to threepence-halfpenny (44 Geo. III. c. 98), and in 1815 to fourpence, less a discount of 20 per cent. Penalties of all kinds were also increased, and obstructive regulations were multiplied. In the course of the struggle between this constantly enhanced taxation and the irrepressible desire for cheap newspapers, more than seven hundred prosecutions for publishing unstamped journals were instituted, and more than five hundred persons were imprisoned, sometimes for considerable periods. As the prosecutions multiplied and the penalties became more severe, *Poor Man's Guardians*, *Democrats*, *Destructives*, and their congeners multiplied also, and their revolutionary tendencies increased in a still greater ratio. Blasphemy was added to sedition. Penny and halfpenny journals were established which dealt exclusively with narratives of gross vice and crime, and which vied with each other in every kind of artifice to make vice and crime attractive. Between the years 1831 and 1835 many scores of unstamped newspapers made their appearance. Papers such as those enumerated above swarmed from presses that seemed to rival, in their mysterious itinerancy and sudden vanishings, the famous Marprelate press of the 16th century. The political tone of most of them was fiercely revolutionary. Prosecution followed prosecution; but all failed to suppress the obnoxious publications.

To the late Lord Lytton is due the credit of grappling with this question in the House of Commons in a manner which secured the speedy reduction of the tax from fourpence to a penny, and paved the way for its subsequent though long-delayed abolition. The reduction to a penny took effect on the 15th September 1836. At that date the number of newspapers stamped in Great Britain and Ireland was about 36,000,000 in the year, and the gross amount of duty upwards of £553,000. Of this sum English newspapers paid £473,910, Scottish newspapers £47,999, Irish newspapers £31,287. In the year ending 9th January 1838—the first complete year of the reduced duty—the number of stamps issued was 53,897,926. The gross amount of duty was reduced to £228,425 (English, £182,998; Scottish, £18,671; Irish, £21,756).

The results of the reduction surpassed all that had been predicted by its promoters. Yet the total abolition came only in 1855. In the year ending 5th January 1855 the number of penny stamps issued to newspapers was 107,052,053, and the gross amount of duty £446,050. The details are as follows:—

	Number of Newspapers Stamped.	Penny Stamps issued to Newspapers.	Gross Amount of Duty thereon.		
England	412	87,930,085	£366,375	7	1
Wales	21	1,107,434	4,614	6	2
Scotland	102	9,112,245	37,967	18	9
Ireland	108	8,902,289	37,092	17	5
Total	643	107,052,053	£446,050	4	5

At the same date the following newspapers (all weekly except *The Times* and *Advertiser*) stood highest as regards circulation and consumption of stamps:—

Name and Date of Establishment.	Penny Stamps issued.	Average Circulation.
Times (1785)	15,975,739	51,648
News of the World (1843)	5,673,525	109,106
Illustrated London News (1842)	5,627,866	108,228
Lloyd's Weekly Newspaper (1842)	5,572,897	107,171
Weekly Times (1847)	3,902,169	75,041
Reynolds's Weekly Newspaper (1850)	2,496,256	48,005
Morning Advertiser (1794)	2,392,780	7,644
Weekly Dispatch (1801)	1,982,933	38,133

The measure for the final abolition of the stamp tax was substantially prepared by Mr Gladstone during his chancellorship of the exchequer in 1854, but was introduced into the House of Commons by his successor in 1855. The second reading was carried by a majority of 215 to 161. In the House of Lords no division took place. To enable the reader to appreciate the legislation of June 1855, we give here the aggregate circulation of newspapers, as shown by the number of stamps issued and as compared with the growth of population, at various periods during the century preceding the abolition of the stamp duty, and also the figures for the first year after the abolition took effect.

Tabular View of the Aggregate Issue of Stamped Newspapers from 1753 *to* 1854.

	Population.		Chief Political Events or Topics of the Year.	Number of Stamps Issued.		Rate of Duty (Net).
1753	England	6,186,366	... ...	England	7,411,757	1½d.
1760	Do.	6,479,730	... ...		9,464,790	,,
1790	Do.	8,540,738	French Revolution		14,035,639	2d.
1801	Great Britain	10,942,646	War with Napoleon	Great Britain	16,085,085	,,
1806	...	...	Do.		20,532,793	3d.
1811	Great Britain	12,596,803	Do.		24,424,713	,,
1814	...	...	Defeat of Napoleon		26,308,003	,,
1815	...	...	Waterloo campaign		24,385,508	3½d
1816	...	...	Congress of Vienna	Great Britain and Ireland.	22,050,354	,,
1820	United Kingdom	21,272,187	Trial of Queen Caroline		29,387,843	,,
1825	...	...	Catholic Association		30,451,176	,,
1830	...	...	French Revolution of July		34,540,496	,,
1831	United Kingdom	24,392,485	Reform Bill agitation		37,713,068	,,
1832	...	...			37,210,691	,,
1834	...	...	... ...		34,748,922	,,
1835	...	...	... ...		35,823,859	,,
1836	...	...	Stamp Duty reduced to One Penny		39,423,200	Part of the year, 3½d. From Sept. 15, 1d.
1837	...	...	First Year of Penny Stamp		53,897,926	,,
1838	...	...	... ...		53,680,880	,,
1839	...	...	Chartist agitation		58,981,078	,,
1841	United Kingdom	27,036,450	... ...		60,759,392	,,
1843	...	...	Corn Law agitation		65,074,219	,,
1845	...	...			78,586,650	,,
1846	...	...	Repeal of the Corn Laws		83,074,638	,,
1847	...	...	Famine in Ireland		82,380,875	,,
1848	...	...	European insurrections		86,465,684	,,
1849	...	...	... ...		84,069,472	,,
1851	United Kingdom	27,724,849	... ...		91,600,000	,,
1854	...	...	War with Russia		122,178,501[1]	,,
1856	...	...	... ...		39,184,474	Optional Stamp.

[1] Inclusive of prices current, trade lists, &c., and of halfpenny stamps for supplements.

It will be observed that for several years in the earlier part of this century the aggregate circulation remained very steady—almost stationary—at about 24,000,000 copies, and that, after a gradual increase within a few years to 30,000,000, the political excitements of the years 1830–32 raised the aggregate to very nearly 38,000,000.[1] Making allowance for the mere trade-lists, this number came to be more than tripled in 1854.

The number of newspapers established from the early part of 1855, when the repeal of the duty had become a certainty, and continuing in existence at the beginning of 1857, amounted to 107,—80 started in 1855, and 27 in 1856; 26 were metropolitan, and 81 provincial. Of the latter, the majority belonged to towns which possessed no newspaper whatever under the Stamp Acts, and the price of nearly one-third of them was but a penny. In some cases, however, a portion of these new cheap papers of 1857 was printed in London, usually with pictorial illustrations, and to this was added a local supplement containing the news of the district.

The total number of the newspapers published throughout the United Kingdom at the beginning of 1857 was 711. They may be classified as follows:—

Newspapers of	England.		Wales.	Scotland.	Ireland.	Isle of Man and Channel Islands.	Total.
	Metropolitan.	Provincial.					
Liberal politics.........	40	134	7	66	38	4	289
Democratic ,, ...	3	...	...	...	...	...	3
Conservative,, ...	20	90	5	16	38	4	173
Neutral ,, ...	38	131	7	30	35	5	246
Total number......	101	355	19	112	111	13	711

If these newspapers be classified according to their dates of first publication, the enumeration will run thus:—

Date of First Publication.	England.		Wales.	Scotland.	Ireland.	Smaller Isles.	Total.
	Metropolitan.	Provincial.					
Prior to 1700...............	1	1	...	2	...	...	4
Between 1701 and 1750	...	17	...	2	3	...	22
,, 1751 ,, 1760	1	2	...	...	1	...	4
,, 1761 ,, 1770	2	5	...	1	3	...	11
,, 1771 ,, 1780	1	6	...	...	4	...	11
,, 1781 ,, 1790	3	9	...	...	...	1	13
,, 1791 ,, 1800	6	9	...	3	...	...	18
,, 1801 ,, 1810	3	14	3	6	6	...	32
,, 1811 ,, 1820	2	17	...	6	4	4	33
,, 1821 ,, 1830	7	20	1	5	13	3	49
,, 1831 ,, 1840	13	50	2	16	19	1	101
,, 1841 ,, 1850	27	47	4	29	27	...	134
,, 1851 ,, 1854	10	76	3	14	12	1	116
In 1855	13	67	4	21	9	2	116
,, 1856	12	15	2	7	3	1	40
Uncertain..................	...	...	...	...	7	...	7
Total number......	101	355	19	112	111	13	711

The decrease in the number of newspapers which passed through the post-office in the year 1855 (during exactly one-half of which the compulsory stamp had been abolished) amounted to about one-fourth of the aggregate number which had been posted in the preceding year. During the six months of the optional stamp the money received for impressed stamps was about £93,000, and that for postage stamps affixed on newspapers about £25,000. In the year 1856 the number of newspapers which passed through the post-office was nearly 71,000,000,—about three-fourths bearing the impressed stamp and one-fourth franked by the ordinary postage stamps. The total gross revenue was therefore about £295,833. Prior to the abolition of the compulsory stamp the average weight of the newspapers passing through the post-office was three ounces and a half; in 1857 the average weight fell to about two ounces and three quarters. The reduction was due to the increase of the small and cheap papers. It was understood that *The Times*, at that date, stamped about 40 per cent. of its entire impression, the daily average of which then exceeded 60,000.

Amongst the earliest results of the change in newspaper law made in 1855 was the establishment in quick succession of a series of penny metropolitan local papers, chiefly suburban, of a kind very different from their unstamped forerunners. They spread rapidly, and attained considerable success, chiefly as advertising sheets, and as sometimes the organs, more often the critics, of the local vestries and other administrations. There are now (1883) 128 of these local papers. One of them, *The Clerkenwell News and Daily Chronicle*, so prospered in the commercial sense, being crowded with advertisements, that it sold for £30,000, and was then transformed into the *London Daily Chronicle* (28th May 1877). In the hands of its new owner—the proprietor of *Lloyd's Weekly News*—its circulation increased fivefold within a year. Another conspicuous result of the legislation of 1855 was an enormous increase in the number and influence of what are known as "class papers," and as professional and trade papers.

The history of the provincial press of England begins with the year 1690, and with a weekly newspaper which still exists, *The Worcester Postman*, now known as *Berrow's Worcester Journal*. But the real development of provincial journalism, as a power co-ordinate with that of London, dates only from 1855; although there were many newspapers issuing from country presses here and there—at least from the later years of the last century—which were marked by originality of character and by considerable literary skill. Worcester has now four weekly and two daily newspapers. Stamford followed next after Worcester by the establishment of its *Mercury* in 1695. This also is still published under the title of *The Lincoln, Rutland, and Stamford Mercury*. Next to *The Stamford Mercury* came *The Norwich Postman*, first published in 1706 in small quarto, and of meagre contents. The stated price of this paper was a penny, but its proprietor notified to the public that "a halfpenny is not refused." Two other papers were started in Norwich within a few years afterwards,—*The Courant* in 1712, and *The Weekly Mercury or Protestant's Packet* (which still exists) in 1720. Norwich has now seven other weekly and, in addition, two daily papers. Nottingham follows in 1710 with its *Courant*, now *The Nottingham Journal*, and a daily paper. Nottingham has now in all four daily and three weekly newspapers. *The Newcastle Courant* followed in 1711; Newcastle has now five weekly and five daily journals. *The Courant* continues to be the farmers' paper of the north; for almost a hundred and eighty years it has had but seven successive proprietors; in politics it is independent. *The Daily Journal* is an organ of the Conservative party, dating as a weekly paper from 1832, as a daily one from 1861. *The Chronicle* holds a like position on the Liberal side. *The Liverpool Courant* dates from May 1712. It lasted a very short time, and had no successor until May 1756, when *The Liverpool Advertiser* appeared; *Gore's General Advertiser* followed in 1765, and continued until 1870. Liverpool has now (1883) eight daily and five weekly journals. There are, besides, commercial gazettes and a *European Times* published irregularly. *The Hereford Journal* dates from 1713, is of Conservative politics, and is noted for its fulness of local reports. *The Hereford Times* was established in 1832, and claims to be "the largest newspaper in the world," containing regularly 112 columns, with frequent supplements. Its merits are such that it holds its ground at the price of 3½d. against a competitor at 2d. and two at 1d. The four papers of Hereford are all weekly.

The Salisbury Postman was the first newspaper started in that city. It appeared in 1715, and its first number was the earliest first number of a provincial newspaper that the researches of the committee of the Caxton Centenary of 1877 enabled them to exhibit at South Kensington. It was followed by *The Salisbury Journal* of 1729, which continues to appear. Bristol journalism began with *Felix Farley's Journal* in 1715, which merged into *The Bristol Times* (1735), and both were conjoined with *The Bristol Mirror* (weekly from 1773) to form *The Daily Bristol Times and Mirror* of January 1865. In journalism as in much else Bristol contrasts curiously with its northern rival. Liverpool had no really established newspaper until 1756. It now (in 1883) publishes seventeen papers (reckoning those which are printed to accompany the outgoing mails), while Bristol has only seven, including the little visitors' paper of Clifton.

The Kentish Gazette dates from 1717, but was first published under the title of *Kentish Post*. Canterbury has now seven papers, one of which appears twice a week; the others are of weekly issue.

The Leeds Mercury was established in 1718, and, for the purpose of evading the Stamp Act, was made to extend to twelve pages small quarto (or a sheet and a half,—the stamp being then levied only on papers not exceeding a single sheet). Like its contemporaries it was published weekly, and its price was three-halfpence. In 1729 it was reduced to four pages of larger size, and sold, with a stamp, at twopence. From 1755 to 1766 its publication was suspended, but was resumed in January 1767, under the management of James Bowley, who continued to conduct it for twenty-seven years, and raised it to a circulation of 3000. Its price at this time was fourpence. The increase of the stamp duty in 1797 altered its price to sixpence, and the circulation sank from 3000 to 800. It was purchased in 1801 by Edward Baines, who first began the insertion of "leaders." It took him three years to obtain a circulation of 1500; but the *Mercury* afterwards made rapid progress, and became one of the most important and valuable of the country papers. It is now published both as a daily and as a weekly paper. Leeds has now four dailies and six weeklies.

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[1] The figures in the table are from the parliamentary returns. Mr Grant (*History of the Newspaper Press*, vol. ii. p. 321) states the circulation for 1831 at 38,649,314 copies, founding upon figures quoted in the House of Commons in 1864 by Mr Edward Baines.

Journalism in Exeter began in the same year as in Leeds, and, somewhat singularly, with three newspapers, all of which in the first year of existence became the subject of debate in parliament. The western capital was then fiercely political. Its journals took the freedom of commenting on proceedings in parliament, and the three editors—those of *The Exeter Mercury, The Protestant Mercury*, and *The Postmaster or Loyal Mercury*—were all summoned to the bar of the House of Commons.[1] The incident is curious as showing that each of the three represented a rival MS. news-letter writer in London.

The following year (1719) saw the beginnings of journalism in Manchester, originating with *The Manchester Weekly Journal. The Manchester Gazette* followed in 1730, and lasted until 1760. Then, in 1762, came Joseph Harrop's *Manchester Mercury*, which had a stormy life, but continued to appear until 1830. In 1867 Manchester had three daily papers and four weekly ones; now it has six dailies (two Conservative, two Liberal, and two neutral) and seven weeklies.

The earliest of the Birmingham newspapers dates from 1741, when *Aris's Gazette* (still in course of publication) began its career. It seems to have had no competitor, of any lengthened existence, until the establishment in 1836 of *The Midland Counties Herald.* The daily press of Birmingham begins with the year 1857, and with *The Birmingham Post.* There are now three daily papers and nine weeklies, exclusive of *The Midland Sporting News*, published twice a day, but relating only to its special subject. Of the other papers six are neutral, four Liberal, two Conservative.

The newspapers of Cambridge begin with the *Chronicle* of 1744, still extant. The Radical *Intelligencer* of the later years of the last century, conducted by Benjamin Flower, and notable in the history of press prosecutions, is said to have been the first provincial paper in England for which original leading articles on the political topics of the day were written. But it would need a far-reaching examination of scattered collections and files of newspapers preserved in editorial offices—the collection, large as it is, in the British Museum is quite inadequate to the inquiry—to warrant any absolute assertion on that point. Cambridge has now three weekly newspapers (one Liberal, one Conservative, one neutral), exclusive of those university organs which appear only during term. Oxford journalism begins, strictly speaking, with *Mercurius Aulicus*[2] (1643, see p. 414, above), but the earliest really local newspaper is *The Oxford Journal* of 1753, still in existence. The city has in all (exclusive, as above, of university ones) four weekly papers, three of which are Conservative organs.

The earliest existing newspaper of Wales is *The North Wales Chronicle*, published at Bangor, which began to appear in 1807. The entire newspaper press of the principality numbered in 1850 nine journals, in 1873 sixty, in 1883 seventy-five. Of these eleven are printed in Welsh; one of them, *Y Llan a'r Dywysogaeth* describes itself as "the only" church and state Welsh newspaper. Of the English-printed papers, thirteen are described as Conservative, twenty-seven as Liberal, the remainder as being either "neutral" or "independent" in respect of politics.

The aggregate number of provincial newspapers in England and Wales was in the year 1782, 50; in 1795, 72; in 1846, 228; in 1866, 773; in 1868, 797; in 1870, 848; in 1872, 948; in 1874, 973; in 1876, 1047; in 1878, 1075; in 1879, 1088; in 1880, 1130; in 1881, 1163; in 1883, 1219. In respect of political character the 1163 papers of 1881 have been approximately classified thus:—Liberal, 385; Conservative, 302; neutral or independent, 476.

The first newspaper purporting by its title to be Scottish (*The Scotch Intelligencer*,[3] 7th September 1643) and the first newspaper actually printed in Scotland (*Mercurius Politicus*, published at Leith in October 1653) were both of English manufacture,—the one being intended to communicate more particularly the affairs of Scotland to the Londoners, the other to keep Cromwell's army well acquainted with the London news. The reprinting of the *Politicus* was transferred to Edinburgh in November 1654, and it continued to appear (under the altered title *Mercurius Publicus* subsequently to April 1660) until the beginning of 1663. Meanwhile an attempt by Thomas Sydserfe to establish a really Scottish newspaper, *Mercurius Caledonius*, had failed after the appearance of ten numbers, the first of which had been published at Edinburgh on the 8th of January 1660. It was not until March 1699 that a Scottish newspaper was firmly established, under the title of *The Edinburgh Gazette*, by James Watson, a printer of eminent skill in his art.[4] Before the close of the year *The Gazette* was transferred to John Reid, by whose family it long continued to be printed. In February 1705 Watson started *The Edinburgh Courant*, of which he only published fifty-five numbers. He states it to be his plan to give "most of the remarkable foreign news from their prints, and also the home news from the ports of this kingdom, ... now altogether neglected." The *Courant* appeared thrice a week. Upon complaint being made to the privy council concerning an advertisement inserted after the transfer of the paper to Adam Boig, the new printer presented a supplication to the council in which he expressed his willingness "that in all time coming no inland news or advertisements shall be put into the *Courant*, but at the sight and allowance of the clerks of council." In 1710 the town council authorized Mr Daniel Defoe to print *The Edinburgh Courant* in the place of the deceased Adam Boig. Four years earlier the indefatigable pioneer of the Scottish press, James Watson, had begun the *Scots Courant*, which he continued to print until after the year 1718. To these papers were added in October 1708 *The Edinburgh Flying Post* and in August 1709 *The Scots Postman.* Five years later this paper appears to have been incorporated with *The Edinburgh Gazette*, and the publication appeared twice a week, as it still continues to do in 1883, as the Government gazette for Scotland. *The Caledonian Mercury* began April 28, 1720. At one period it was published thrice and afterwards twice a week. Its first proprietor was William Rolland, an advocate, and its first editor Thomas Ruddiman. The property passed to Ruddiman on Rolland's death in 1729, and remained — his family until 1772. It is curious to notice that in his initiatory number of April 1720, Rolland claimed a right to identify his *Mercury* with that of 1660. This journal, he said in his preface to the public, "is the oldest [existing] in Great Britain." And his successor of the year 1860 followed suit by celebrating the "second centenary" of *The Caledonian Mercury.* He brought out a facsimile of No. 1 of *Mercurius Caledonius* (January 1660), in its eight pages of small quarto, curiously contrasting with the great double sheet of the day. But sixty years is a long period of suspended animation, and the connexion of the two newspapers cannot be proved to be more than nominal. *The Caledonian Mercury* was the first of Scottish journals to give conspicuous place to literature—foreign as well as Scottish. In "the '45" one of its editors, Thomas Ruddiman, junior, virtually sacrificed his life,[5] and the other, James Grant, went into exile, for the expression of conscientious political opinion. Its publication ceased after an existence of more than one hundred and forty years.

Notwithstanding the positive assertion[6] that *The Edinburgh Courant* and *The Edinburgh Evening Courant* "were entirely different journals, and never had any connexion whatever with each other," the proprietors of the existing *Courant* assert a substantial identity, and obviously upon better grounds than those for which identity used to be claimed for *The Caledonian Mercury* with *Mercurius Caledonius.* The grant by the town council of Edinburgh in December 1718 of a licence to James M'Ewan to print an *Evening Courant* three times a week appears to have been really a revival, in altered form, of the original *Courant*, repeatedly referred to in earlier, but not much earlier, records of the same corporation. So revived, *The Evening Courant* was the first Scottish paper to give foreign intelligence from original sources, instead of repeating the advices sent to London. In 1780 David Ramsay became its proprietor. Under his management it is said to have attained the largest Scottish circulation of its day. It was then of neutral politics. Of late years, returning to its original title, and appearing as a daily morning paper, it has ranked as the senior organ of the Conservative party in Scotland.

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[1] *Journals of the House of Commons*, xix. 30, 48, 1718.

[2] Mr Grant (*Newspaper Press*, vol. iii. p. 193) says, very singularly:—"Though printed in Birkenhead, the *Mercurius Aulicus* was not published there. It was avowedly printed for a bookseller near Queen's College, Oxford. . . . Unfortunately there are no copies in the British Museum." The set of *Mercurius Aulicus* in the British Museum is, however, very complete, and has some useful MS. notes of dates, but no mention of any "Birkenhead," except the stout old cavalier Sir John.

[3] This was followed by *The Scotch Dove*, the first number of which is dated "September 30 to October 20, 1643," and by *The Scottish Mercury* (No. 1, October 5, 1643). In 1648 a *Mercurius Scoticus* and a *Mercurius Caledonius* were published in London. *The Scotch Dove* was the only one of these which attained a lengthened existence.

[4] Watson was the printer and editor, but the person licensed was James Donaldson, merchant in Edinburgh ("Act in favors of James Donaldson for printing the *Gazette*," March 10, 1699, published in *Miscellany of the Maitland Club*, ii. 232 *sq.*). Arnot, in his *History of Edinburgh*, mentions as the second of Edinburgh newspapers—intervening between *Mercurius Caledonius* and the *Gazette*—a *Kingdom's Intelligencer.* But this was a London newspaper, dating from 1662, which may occasionally have been reprinted in Scotland; no such copies, however, are now known to exist. In like manner *The Scottish Mercury*, No. 1, May 8, 1692, appears to have been a London newspaper based upon Scottish news-letters, although in an article written in 1848, in the *Scottish Journal of Topography*, vol. ii. p. 303, it is mentioned as an Edinburgh newspaper.

[5] During an imprisonment of six weeks in the Tolbooth of Edinburgh his health suffered so severely that he died very shortly after his release.

[6] Grant, *History of the Newspaper Press*, 1873, iii. 412.

The Edinburgh Weekly Journal dates from 1744, but it only attained celebrity when, almost seventy years afterwards, it became the joint property of Sir Walter Scott and of James Ballantyne. Scott wrote in its columns many characteristic articles. Ballantyne edited it until his death in 1833, and was succeeded in the editorship by Thomas Moir. The paper was discontinued about 1840.

The Scotsman was established as a twice-a-week paper in January 1817, and became a daily in June 1855. It has always ranked as the chief organ of the Liberal party in Scotland. The proprietorship continues to be in the family of William Ritchie, by whom, in conjunction with Charles Maclaren, the paper was founded. For a short period it was edited by J. R. M'Culloch, the eminent political economist. He was succeeded by Maclaren, who edited the paper until 1845, and he in turn by Alexander Russel, who continued to conduct it with great ability until 1876. In 1854 its average circulation was 3451 copies. In 1859 the first of Hoe's rotary machines brought into Scotland was erected for *The Scotsman*, and the productive power was raised from 1500 in the hour to 7500.

The North British Advertiser, founded in 1826, had in 1854 an average circulation of 15,423 copies,—the greater part of the issue distributed gratuitously. *The Witness* began in 1840 as the avowed organ of what speedily became the Free Church party in Scotland. In its first prospectus it calls itself *The Old Whig*. The paper appeared twice a week, and its editor, Hugh Miller, very soon made it famous. In the course of less than sixteen years he wrote about a thousand articles and papers, conspicuous for literary ability, still more so for a wide range of acquirement and of original thought, most of all for deep conscientiousness. It survived its first editor's lamented death (1856) only a few years. Edinburgh has now five daily and six weekly papers.

In Glasgow the lead is taken by the *Glasgow Herald* (Independent), the greatest advertising medium in Scotland. Founded in 1782, it has risen gradually to the level of the great metropolitan newspapers. *The North British Daily Mail* (Liberal), the oldest daily in Scotland, was established in April 1847. George Troup, its first editor, made it specially famous for the organizing skill with which he brought his intelligence at an unprecedented rate of speed from Carlisle, the nearest point then connected with London by railway.[1] Glasgow has now six daily newspapers and thirteen of weekly issue.

The earliest in date of the provincial newspapers of Scotland is *The Aberdeen Journal* (Conservative), founded as a weekly paper in 1748, and a daily from 1876. *The Aberdeen Daily Free Press* (Liberal), originally a weekly, dates from 1853. *The Dundee Advertiser* (Liberal) was established in 1801.

The aggregate number of Scottish journals—metropolitan and provincial together—79 in 1846, had grown in 1866 to 138, in 1876 to 164, and in 1883 to 184. Taken as a whole—in regard as well to literary character and scope as to the specially industrial characteristics of journalism—they occupy at least an equal rank with the best journals of the leading provincial towns of England, whilst the metropolitan press of Scotland ranks exceptionally high. A very large number of the men who have distinguished themselves by their labours on the great newspapers of London, and several who rank as founders of these, began their career, and have left their mark, on the newspapers of Scotland.

Ireland's True Diurnal (1642), *Mercurius Hibernicus* (1644), *The Irish Courant* (1690), are all of them London newspapers containing Irish news. The newspaper press of Ireland begins with *The Dublin News-Letter* of 1685, just at the close of the lieutenancy of the illustrious duke of Ormond.[2] Five years later appeared the *Dublin Intelligencer* (No. 1, September 30, 1690). Both of those were short-lived. *Pue's Occurrences* followed in 1700, and lasted for more than fifty years, as the pioneer of the daily press of Ireland. In 1710 or in 1711 (there is some doubt as to the date of the earliest number) *The Dublin Gazette* began to appear, and it continues still (1883) as the official organ of the vice-regal government. *Falkener's Journal* was established in 1728, and also appeared daily. *Esdaile's News-Letter* began in 1744, took the title of *Saunders's News-Letter* in 1754 (when it appeared three times a week), and became a daily newspaper in 1777. It long possessed the largest circulation ever attained by an Irish daily paper.

The famous *Freeman's Journal* was long pre-eminent amongst the Dublin papers for ability and vigour. It was established as a daily paper by a committee of the first society of "United Irishmen" in 1763, and its first editor was Dr Lucas. Flood and Grattan were at one time numbered amongst its contributors; although the latter, at a subsequent period, is reported to have exclaimed in his place in the Irish parliament, "the *Freeman's Journal* is a liar, ... a public, pitiful liar."[3] The relations between the journalism and the oratory of Ireland have been not unfrequently of this stormy character. Dublin has now six daily papers and fifteen others, mostly appearing once or twice a week. It had in 1875 eight dailies and seventeen weeklies.

Waterford possessed a newspaper as early as 1729, entitled *The Waterford Flying Post*. It professed to contain "the most material news both foreign and domestic," was printed on common writing paper, and published twice a week at the price of a halfpenny. The paper of earliest origin now published in Waterford is *The Waterford Chronicle*, which dates from 1766. *The Belfast News-Letter* was started in 1737, and still flourishes.

In all Ireland the number of daily papers was 19 in 1875, and in 1883 only 16. The number issued once or twice a week was in the former year 118, in the latter 131. There are five other newspapers of varying periodicity, making an aggregate, in 1883, of 152. The total increase since 1862 is 18, the increase in Scotland during the same period having been 45.

The newspaper press of the Isle of Man dates only from 1821. The island possesses six journals in 1883, one of which, *The Mona Daily News*, appears daily from July to September.

The *Gazette de Guernsey*—earliest of existing Channel Island newspapers—dates from 1788; the *Chronique de Jersey* from 1814 Guernsey has in all seven papers, and Jersey eight.

An Act of Parliament of 1869 (32 & 33 Vict. c. 24), entitled An Act to Repeal certain Enactments relating to Newspapers," simplified the process for discovering the names of proprietors and publishers, but until the year next following (1870) the establishment of a newspaper still required compliance with most of the regulations of the 6 & 7 Will. IV. c. 76. In that year, by the Act 33 & 34 Vict. c. 32, the (until then optional) stamp duties on newspapers were wholly repealed, and their postal transmission became subject only to the regulations of the post-office. It is now subject, under the Post-Office Act of 1870, to an annual registration with a fee of five shillings, and without such annual registration a newspaper can pass through the post only at the book rate of postage. In 1881 the registration of newspapers in order to the enforcement of responsibility for libel passed to the office of the registrar of joint-stock companies (44 & 45 Vict. c. 60).

Authorities.—Miscellaneous newspapers in the Burney, Stamp-Office, and other collections of the British Museum, and in the Hope collection and miscellaneous collection of the Bodleian at Oxford; Nichols, *Literary Anecdotes of the Eighteenth Century*, iv. 33–97; *Returns relating to Newspaper Stamps*, 1836–54; *Report of the Select Committee on Newspaper Stamps*, 1850; Hansard, *Parliamentary History of England*, 1712–1742, and *Debates*, Sessions 1835, 1836, 1853, 1854, 1855, 1881, and 1882; *First Report of the Commissioners on the Inland Revenue*, 1857, 28, cxxiv; Andrews, *History of British Journalism*, 2 vols., 1860; Hunt, *The Fourth Estate*; Grant, *The Newspaper Press*, 3 vols., 1871–73; Wm. Lee, *Life and Newly Discovered Writings of Daniel Defoe*, 3 vols., 1869; Coleridge, *Biographia Literaria*, Supp., 392–395; *Life of Edward Baines*, 346 *sq.*; Mitchell, *The Newspaper Press Directory*, 1846, 1857, 1859 to 1883 inclusive, 26 vols.; Plummer, "The British Newspaper Press," *Companion to the Almanac*, 1876; *Second, Third, and Twenty-eighth Reports of the Postmaster-General*, 1856, p. 19, 1857, p. 10 *sq.*, 1882; Scott *Memoirs of Swift*, 130 *sq.*; Alex. Chalmers, articles "Amhurst," "Birkenhead," "Heylyn," "Johnson," "Needham," &c., in *General Biographical Dictionary* 1812–17; *Gentleman's Magazine*, vol. vii.; "The Newspaper Press," *Quarterl Review*, cl. 498–537, October 1880; Hatton, *Journalistic London*, 1882; Georg Chalmers, *Life of Ruddiman*, part 2, 1794; Bayne, *Life and Letters of Hug Miller*, vol. ii.; H. G. Graham, "Russel of the *Scotsman*," *Fraser's Magazine* n.s., xxii. 301-317, 1880. Information concerning North of England newspaper has been contributed by Mr W. Hill, Newcastle-upon-Tyne.

NEWSPAPERS OF FRANCE.

The annals of French journalism begin with the *Gazette*, established by Théophraste Renaudot in 1631, under the patronage of Richelieu, and with his active co-operation. Much of its earliest foreign news came direct from the minister, and not seldom in his own hand. Louis XIII. took a keen, perhaps a somewhat childish, interest in the progress of the infant *Gazette*, and was a frequent contributor, now and then taking his little paragraphs to the printing office himself, and seeing them put into type. Renaudot was born at Loudun in 1584, studied medicine in Paris and at Montpellier, established himself in the capital in 1612, and soon became conspicuous both within and beyond the limits of his profession. Endowed by nature with great energy and versatility, he seems at an early period of his career to have attracted the attention of the great cardinal, and to have obtained permission to establish a sort of general agency office, under the designation of "Bureau d'Adresses et de Rencontre." An enterprise like this would, perhaps, naturally suggest to such a mind as Renaudot's the advantage of following it up by the foundation of a newspaper. According to some French writers, however, the project was formed by Pierre d'Hozier, the genealogist, who carried on an extensive correspondence both at home and abroad, and was thus in a position to give valuable help; according to others by Richelieu himself. Be this as it may, Renaudot put his hand zealously to the work, and brought out his first weekly number in May 1631. So much, at least, may be inferred from the date (4th July 1631) of the sixth number, which was the first *dated* publication, the five preceding numbers being marked by "signatures" only—A to E. Each number consists of a single sheet (eight pages) in small quarto, and is divided into two parts—the first simply entitled *Gazette*, the second *Nouvelles Ordinaires de Divers Endroits*. For this division the author assigns two reasons—(1) that two persons may thus read his journal at the same time, and (2) that it facilitates a division of the subject-matter—the *Nouvelles* containing usually intelligence from the northern and western countries, the *Gazette* from the southern and eastern. He commonly begins with foreign and ends with home news, a method which was long and generally followed, and which still obtains. Once a month he published a supplement, under the title of *Relation des Nouvelles du Monde, reçues dans tout le mois*. In October 1631 Renaudot obtained letters-patent to himself and his heirs, conferring the exclusive privilege of printing and selling, where and how they might please, "the gazettes, news, and narratives of all that has passed or may pass within and without the kingdom." His assailants were numerous, but he steadily pursued his course, and at his death in October 1653 left the *Gazette* to his sons in flourishing circumstances. In 1752 the title *Gazette de France* was first used. Under this designation it continued to appear until the 24th August 1848. During the five days which followed that date it was suspended; on the 30th it was resumed as *Le Peuple Français, Journal de l'Appel à la Nation*, and again modified on the 14th September to *L'Étoile de la France, Journal des Droits de Tous*. On the 25th October it became *Gazette de France, Journal de l'Appel à la Nation*; and under this title it still continues to appear. A complete set extends to upwards of 300 volumes, of which 189 are in quarto and the rest in folio. It scarcely need be added that such a set forms a collection of great value, not only for the history of France, but for that of Europe generally.

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[1] See *Notes and Queries*, 5th series, vii. 45, viii. 205.

[2] The appearance of the earliest of Irish newspapers during the very last year in which that great statesman was in Ireland made it a matter of special interest to the present writer to ascertain if Ormond —who had a keen zest for literature as well as for field sports—had in any way patronized or noticed the new literary venture. But a perusal of some scores of his original letters (now in Oxford), dated in that year, finds no mention of *The Dublin News-Letter*. Ormond's own collection of "news-letters" in MS. is, it may be added one of the finest known to exist in the kingdom.

[3] *Debates of the Irish House of Commons*, 3d March 1789.

Not the least curious nor the least instructive incident in the history of the *Gazette de France*—a history which abounds both with curiosity and with instruction—is the endeavour which was made by a great French minister, more than a hundred years ago, to make the envoys and consuls of France at foreign courts official members of its literary staff, by calling on them for periodical accounts of the progress of letters and science and of literary and scientific institutions in the several countries to which they were respectively accredited. The approach of 1789 obstructed the good effect of this pregnant scheme.

Loret's rhymed *Gazette* (1650 to March 1665) will always have interest in the eyes of students who care less for the "dignity" of history than for the fidelity of its local colouring and the animation of its backgrounds. It were vain to look there for any deep appreciation of the events of those stormy times. But it abounds in vivid portraits of the men and manners of the day. It paints rudely, yet to the life, the Paris of the Fronde, with all its effervescence and depression, its versatility and fickleness, its cowardice and its courage.

Of the *Mercure Galant*, established by Donneau de Visé in 1672, with Thomas Corneille for its sub-editor, it may be said that it sought to combine the qualities of the *Gazettes*, both grave and gay. Like the former, it contained the permitted state news and court circulars of the day. Like the latter, it amused its readers with satirical verses, and with sketches of men and manners, which, if not always true, were at least well invented. Reviews and sermons, law pleas and street airs, the last reception at the Academy and the last new fashion of the milliners, all found their place. De Visé carried on his enterprise for more than thirty years, and at his death it was continued by Rivière du Fresny. The next editor, Lefèvre de Fontenay, altered the title to *Nouveau Mercure*, which in 1728 was altered to *Mercure de France*, a designation retained, with slight modification, until 1853. The *Mercure* passed through many hands before it came into those of Panckoucke, at the eve of the Revolution. Amongst its more conspicuous writers, immediately before this change, had been Raynal and Marmontel. The latter, indeed, had for many years been its principal editor, and in his *Mémoires* has left us a very interesting record of the views and aims which governed him in the performance of an arduous task. And he there narrates the curious fact that it was Madame de Pompadour who contrived the plan of giving pensions to eminent men of letters out of the profits of the *Mercure*. To one of Marmontel's predecessors the "privilege," or patent, had been worth more than £1000 sterling annually. This revenue was now to be shared amongst several, and to become a means of extending royal "patronage" of literature at a cheap rate. It is to this pension-scheme, too, that we owe the *Contes Moraux*. Marmontel, who had long before lost his "patent" by an act of high-minded generosity, continued to share in the composition of the literary articles with Chamfort and La Harpe, whilst Mallet du Pan, a far abler writer than either, became the most prominent of the political writers in the *Mercure*. In 1789 he contributed a series of remarkable articles on the well-known book of De Lolme; and in the same year he penned some comments on the "Declaration of the Rights of Man," very distasteful to violent men of all parties, but which forcibly illustrate the pregnant truth they begin with:—"The gospel has given the simplest, the shortest, and the most comprehensive 'Declaration of the Rights of Man,' in saying, 'Do unto others as you would that they should do unto you.' All politics hinge upon this."

In 1790 the sale of the *Mercure* rose very rapidly. It attained for a time a circulation of 13,000 copies. Mirabeau styled it in debate "the most able of the newspapers." Great pains were taken for the collection of statistics and state papers, the absence of which from the French newspaper press had helped to depress its credit as compared with the political journalism of England and to some extent of Germany. But, as the Revolution marched on towards a destructive democracy, Mallet du Pan evinced more and more unmistakably his rooted attachment to a constitutional monarchy. And, like so many of his compatriots, he soon found the tide too strong for him. The political part of the *Mercure* changed hands, and after the 10th August 1792 its publication was suspended.

All this time the *Moniteur* (*Gazette Nationale, ou le Moniteur Universel*) was under the same general management as the *Mercure Français* (so the title had been altered in 1791). The first idea, indeed, of this famous official journal appears to have been Panckoucke's, but it did not firmly establish itself until he had purchased the *Journal de l'Assemblée Nationale*, and so secured the best report of the debates. The *Moniteur*, however, kept step with the majority of the assembly, the *Mercure* with the minority. So marked a contrast between two journals, with one proprietor, gave too favourable a leverage to the republican wits not to be turned to good account. Camille Desmoulins depicted him as Janus,—one face radiant at the blessings of coming liberty, the other plunged in grief for the epoch that was rapidly disappearing.

When resumed, after a very brief interval, the *Mercure Français* became again *Mercure de France*,—its political importance diminished, whilst its literary worth was enhanced. During the later days of the Revolution, and under the imperial rule, its roll of contributors included the names of Geoffroy, Ginguené, Morellet, Lacretelle, Fontanes, and Chateaubriand. The statesman last named brought upon the *Mercure* another temporary suppression in June 1807 (at which date he was its sole proprietor), by words in true unison with the noblest deed of his chequered career—his retirement, namely, from the imperial service on the day that the news of the execution of the duke of Enghien reached him, being the day after he had been appointed by Napoleon a minister plenipotentiary.

Thus it chanced that alike under the brilliant despotism of Napoleon and under the crapulous malversation of Louis XV. the management of the *Mercure* was revolutionized for protests which conferred honour upon the journal no less than upon the individual writers who made them. Resumed by other hands, the *Mercure* continued to appear until January 1820, when it was again suspended. In the following year it reappeared as *Le Mercure de France, au dix-neuvième siècle*, and in February 1853 it finally ceased. A complete set extends to no fewer than 1611 volumes.

The only other newspaper of a date anterior to the Revolution which needs to be noticed here is the *Journal de Paris*, which was commenced on New Year's Day of 1777. It had but a feeble infancy, yet lived for half a century. Its early volumes appear so insipid to a 19th-century reader that he wonders what can have been the cause of its occasional bickerings with the police. Its tameness, however, did not save it from sharing in the "suspensions" of its predecessors. After the Revolution such men as Garat, Condorcet, and Regnaud de St Jean d'Angély appear amongst its contributors, but those of earlier date were obscure. Its period of highest prosperity may be dated about 1792, when its circulation is said to have exceeded 20,000.

The police adventures of the writers of the MS. news-letters, or *Nouvelles à la Main*, were still more numerous, and, if we may judge from the copious specimens of these epistles which yet survive, must also not unfrequently have arisen from lack of official employment, rather than from substantial provocation. Madame Doublet de Persan, the widow of a member of the French board of trade, was a conspicuous purveyor of news of this sort. For nearly forty years daily meetings were held in her house at which the gossip and table-talk of the town were systematically (and literally) *registered*; and weekly abstracts or epitomes were sent into the country by post. Piron, Mirabaud, Falconet, D'Argental, and, above all, Bachaumont, were prominent members of the "society," and each of them is said to have had his assigned seat beneath his own portrait. The lady's valet-de-chambre appears to have been editor *ex officio*; and as he occasionally suffered imprisonment, when offensive news-letters had been seized by the police, so responsible a duty was doubtless "considered in the wages." News and anecdotes of all kinds—political and literary, grave, gay, or merely scandalous—were all admitted into the *Nouvelles à la Main*; and their contents, during a long series of years, form the staple of those *Mémoires Secrets pour servir à l'Histoire de la République des Lettres* which extend to thirty-six volumes, have been frequently printed (at first with the false imprint "Londres: John Adamson, 1777–89"), and are usually referred to by French writers as the *Mémoires de Bachaumont*.

The journalism of the first Revolution has been the theme of many bulky volumes, and their number is still on the increase. The recital of the mere titles of the newspapers which then appeared throughout France fills more than forty pages of larger dimensions than those which the reader has now before him. It is obvious, therefore, that a very casual glance at this part of our subject is all that can be given to it here.

When at least one half of the French people was in a ferment of hope or of fear at the approaching convocation of the states-general, most of the existing newspapers were still in a state of torpor. Long paragraphs, for example, about a terrible "wild beast of the Gevaudan"—whether wolf or bear, or as yet nondescript, was uncertain—were still current in the Paris journals at this momentous juncture. Mirabeau was among the foremost to supply the popular want. His *Lettres à ses Commettants* began on the 2d May 1789, and with the twenty-first number became the *Courrier de Provence*. Within a week Maret (afterwards duke of Bassano) followed with the *Bulletin des Séances de l'Assemblée Nationale*, and Lehodey with the *Journal des États Généraux*. In June Brissot de Warville began his *Patriote Français*. Gorsas published the first number of his *Courrier de Versailles* in the following month, from which also dates the famous periodical of Prudhomme, Loustalot, and Tournon, entitled *Révolutions de Paris*, with its characteristic motto,—"Les grands ne nous paraissent grands que parce que nous sommes à genoux; levons nous!" In August 1789 Baudouin began the *Journal des Débats* (edited in 1792 by Louvet) and Marat the *Ami du Peuple* (which at first was called *Le Publiciste Parisien*). The *Moniteur Universel* (of which we have spoken already) was first published on the 24th November, although numbers were afterwards printed bearing date from the 5th May, the day on which the states-general first assembled. Camille Desmoulins also commenced his *Révolutions de France et de Brabant* in November 1789. The *Ami du Roi* was first published in June 1790, *La Quotidienne* in September 1792.

Of all these prominent journals the *Moniteur* and the *Débats* alone have survived until now. A few of them lasted until 1794 or 1795; one continued until recently; but most of them expired either in the autumn of 1792 or with the fall of the party of the Gironde in September 1793. In some of these papers the energy for good and for evil of a whole lifetime seems to be compressed into the fugitive writings of a few months. Even the satirical journals which combated the Revolution with shafts of ridicule and wit, keen enough after their kind, but too light to do much damage to men terribly in earnest, abound with matter well deserving the attention of all students desirous of a thorough knowledge of the period.[1]

The consular Government began its dealings with the press by reducing the number of political papers to thirteen. At this period the number of daily journals had been nineteen, and their aggregate provincial circulation, apart from the Paris sale, 49,313, an average of 2600 each.

Under Napoleon the *Moniteur* was the only political paper that was really regarded with an eye of favour. Even as respects the nation at large, the monstrous excesses into which the Revolutionary press had plunged left an enduring stigma on the class. When Bertin acquired the *Journal des Débats* from Baudouin, the printer, for 20,000 francs, he had to vanquish popular indifference on the one hand, as well as imperial mistrust on the other. The men he called to his aid were Geoffroy and Fievée; and by the brilliancy of their talents and the keenness of his own judgment he converted the *Débats* into a paper having 32,000 subscribers, and producing a profit of 200,000 francs a year. When the imposition of a special censorship was threatened in 1805, at the instance of Fouché, a remarkable correspondence took place between Fievée and Napoleon himself, in the course of which the emperor wrote that the only means of preserving a newspaper from suspension was "to avoid the publication of any news unfavourable to the Government, until the truth of it is so well established that the publication becomes needless." The censorship was avoided, but Fievée had to become the responsible editor, and the title was altered to *Journal de l'Empire*—the imperial critic taking exception to the word *Débats* as "inconvenient." The old title was resumed in August 1815. The revolution of July did but enhance the power and the profit of the paper. It has held its course with uniform dignity, as well as with splendid ability, amidst recent perils, and may still be said, in the words which Lamartine applied to it in an earlier day, to have "made itself part of French history."

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[1] We make these remarks after an actual examination—volume by volume—of many hundreds of these ephemeral productions, reckoning those of all kinds, belonging to the Revolutionary period.

Shortly before the *Journal de l'Empire* became again the *Journal des Débats* (in 1815), a severance occurred amidst both the writers and subscribers. It led to the foundation of the *Constitutionnel*, which at first and for a short time bore the title of *L'Indépendant*. The former became, for a time, the organ of the royalists *par excellence*, the latter the leader of the opposition. In 1824, however, both were in conflict with the Government of the day. At that date, in a secret report addressed to the ministry, the aggregate circulation of the opposition press of Paris was stated at 41,330,[1] while that of the Government press amounted only to 14,344.[2]

The rapid rise of the *Constitutionnel* was due partly to the great ability and influence of Jay, of Étienne, of Béranger, and of Saint Albin (who had been secretary to Carnot in his ministry of 1815), all of whom co-operated in its early editorship, and partly to its sympathy with the popular reverence for the memory of Napoleon, as well as to the vigorous share it took in the famous literary quarrel between the classicists and romanticists (although in that quarrel it took what may now be called the side of the vanquished). Its part in bringing about the revolution of 1830 raised it to the zenith of its fortunes. For a brief period it could boast of 23,000 subscribers at 80 francs a year. But the invasion of cheap newspapers, and that temporary lack of enterprise which so often follows a brilliant success, lowered it with still greater rapidity. When the author of the *Mémoires d'un Bourgeois*, Dr Véron, purchased it, the sale had sunk to 3000. Véron gave 100,000 francs for the *Juif Errant* of Sue, and the Sue fever rewarded him for a while with more than the old circulation. Afterwards the paper passed under the editorship of Césena, Granier de Cassagnac, and La Guéronnière.

The cheap journalism of Paris began in 1836 (1st July) with the journal of Girardin, *La Presse*, followed instantly by *Le Siècle*, under the management of Dutacq, to whom, it is said—not incredibly—the original idea was really due. The first-named journal attained a circulation of 10,000 copies within three months of its commencement, and soon doubled that number. The *Siècle* prospered even more strikingly, and in a few years had reached a circulation (then without precedent in France) of 38,000 copies.

The rapid growth of the newspaper press of Paris under Louis-Philippe will be best appreciated from the fact that, while in 1828 the number of stamps issued was 28 millions, in 1836, 1843, 1845, and 1846 the figures were 42, 61, 65, and 79 millions respectively. At the last-mentioned date the papers with a circulation of upwards of 10,000 were (besides the *Moniteur*, of which the circulation was chiefly official and gratuitous) as follows:—*Le Siècle*, 31,000; *La Presse* and *Le Constitutionnel*, between 20,000 and 25,000; *Journal des Débats* and *L'Époque*, between 10,000 and 15,000.

If we now cast a retrospective glance at the general characteristics (1) of the newspaper press of France, and (2) of the legislation concerning it, between the respective periods of the devastating revolution of 1793–94 and the scarcely less destructive revolution of 1848, it will be found that the years 1819, 1828, 1830 (July), and 1835 (September) mark epochs full of pregnant teaching upon our subject. We pass over, as already sufficiently indicated, the newspaper licence of the first-named years (1793–94), carried to a pitch which became a disgrace to civilization, and the stern Napoleonic censorship which followed it,—also carried to an excess, disgraceful, not, indeed, to civilization, but to the splendid intellect which had once given utterance to the words, "Physical discovery is a grand faculty of the human mind, but literature is the mind itself."

The year 1819 is marked by a virtual cessation of the arbitrary power of suppression lodged till then in the Government, and by the substitution of a graduated system of preliminary bonds and suretyships ("cautionnements") on the one hand, and of strict penalties for convicted press-offences on the other. This initiatory amelioration of 1819 became, in 1828, a measure of substantial yet regulated freedom, which for two years worked, in the main, alike with equity towards the just claims of journalism as a profession and with steady development towards the public of its capabilities as a great factor in the growth of civilization. Those two years were followed by a widely-contrasted period of five years. That was a term of entire liberty often grossly abused, and fitly ending with the just and necessary restrictions of September 1835. But that period of 1830–35 was also signalized by some noble attempts to use the powers of the newspaper press for promoting the highest and the enduring interests of France. Not least memorable amongst these was the joint enterprise of Montalembert and Lamennais—soon to be aided by Lacordaire,—when, by the establishment (October 1830) of the newspaper *L'Avenir*, they claimed for the church of France "her just part in the liberties acquired by the country," and asserted for the sacred symbols of Christianity their lawful place, alike above the tricolor and above the lilies. "Dieu et la liberté" was the motto which Montalembert chose for his newspaper, as he had chosen it long before for the guiding star of his youthful aspirations. *L'Avenir* existed only for one year and one month. It came to its early end from no lack of energy and patience in its writers, but in part from that mission of the editors to Rome (November 1831) which, at least for a time, necessitated the discontinuance of their newspaper. Human regrets had higher than human consolations. "Our labours" on *L'Avenir*, wrote Montalembert with simple truth, "decided the attitude of Catholics in France and elsewhere, from the time of the July revolution to the time of the second empire."

There were many other papers, at this time and afterwards, which, like *L'Avenir*, were, in their degree, organs of ideas, not speculations of trade. But they cannot be even enumerated here. No very notable specially religious paper succeeded *L'Avenir* until the foundation in 1843—under widely different auspices, although twice at the outset the editorship was offered to Lacordaire—of *L'Univers Religieux*. That journal was edited, at first, by De Coux, then by Louis Veuillot; it underwent innumerable lawsuits, "warnings," suppressions, and interdicts, for causes very diverse. Several prelates suppressed *L'Univers Religieux* in their respective dioceses, amongst them the great bishop Dupanloup in that of Orleans (1853): Napoleon III. suppressed it in 1861, permitted it to reappear as *Le Monde*, and suspended it many times afterwards; but it has survived all its misfortunes and still exists, under its new title. *Le Monde* had the curious fate, at one time, of being conducted jointly by the first editor of *L'Avenir*, Lamennais, and by George Sand, who had previously figured in the newspaper annals of France as co-foundress of *L'Éclaireur de l'Indre*, a journal published at Orleans. The account given by that brilliant writer of her adventures in what was then to her a new department of activity is an instructive one. With that breadth of sympathy which was so characteristic of her, she strove to interest all her friends (however varied in character, as in rank) in the enterprise. There is, perhaps, scarcely anything more amusing in French journalistic annals than is her (contemporary) account of the first meeting of the shareholders—at which, she tells us, about five hundred resolutions were moved for the guidance of the editor at his desk. *L'Éclaireur* did not shed its lustre on the department of the Indre for much length of time. In later days *Le Monde*, under very various editorships, has amply vindicated the change in its title.

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[1] *Le Constitutionnel*, 16,250; *Journal des Débats*, 13,000; *La Quotidienne*, 5800; *Le Courrier Français*, 2975; *Journal de Commerce*, 2380; *L'Aristarque*, 925.

[2] *Journal de Paris*, 4175; *L'Étoile*, 2749; *Gazette de France*, 2370; *Le Moniteur*, 2250; *Le Drapeau Blanc*, 1900; *Le Pilote*, 900.

The impulse given to the growth of advertisements in the days which followed July 1830, although trivial in comparison with what British newspaper readers are daily familiar with, became, as the years rolled on, sufficiently developed to induce the formation of a company—in which one of the Lafittes took part—to farm them,[1] at a yearly rent of £12,000 sterling (300,000 francs), so far (at first) as regarded the four leading journals (*Débats*, *Constitutionnel*, *Siècle*, *Presse*), to which were afterwards added two others (*Le Pays* and *La Patrie*). The combination greatly embarrassed advertisers, first, since its great aim was to force them either to advertise in all, whether addressing the classes intended to be canvassed or not, or else to pay for each advertisement in a selected newspaper the price of many proffered advertisements in all the papers collectively, and, secondly, because by many repetitions in certain newspapers no additional publicity was really gained, two or three of the favoured journals circulating for the main amongst the same class of buyers. *La France* was then the newspaper of the Conservative aristocracy of the nation; *Le Monde* and the *Union* more especially addressed the clergy; the *Débats* and the *Temps* were the journals of the upper mercantile class, the *Siècle* and *L'Opinion* of the lower or shopkeeping class. A man who asked to advertise briefly, in the *Siècle*, for example, alone, was charged 2 francs for each several insertion. If he went the round of the six, his advertisement cost him only 75 centimes per journal, for ten successive insertions in each of them, all round.

To a great extent, the inundation of newspapers which followed the revolution of February 1848 was but a parody on the revolutionary press of 1793. Most of them, of course, had very short lives. When Cavaignac took the helm he suppressed eleven journals, including *La Presse* and *L'Assemblée Nationale*. The former had at this period a circulation of nearly 70,000, and its proprietor, in a petition to the National Assembly, declared that it gave subsistence to more than one thousand persons, and was worth in the market at least 1,500,000 francs. In August the system of sureties was restored. On the 13th June 1849 the president of the republic suspended *Le Peuple*, *La Révolution Démocratique et Sociale*, *La Vraie République*, *La Démocratie Pacifique*, *La Réforme*, and *La Tribune des Peuples*. On July 16, 1850, the assembly passed what is called the "Loi Tinguy," by which the author of every newspaper article on any subject, political, philosophical, or religious, was bound to affix his name to it, on penalty of a fine of 500 francs for the first offence, and of 1000 francs for its repetition. Every false or feigned signature was to be punished by a fine of 1000 francs, "together with six months' imprisonment, both for the author and the editor." The practical working of this law lay in the creation of a new functionary in the more important newspaper offices, who was called "secrétaire de la rédaction," and was, in fact, the scapegoat *ex officio*. In February 1852 all the press laws were incorporated, with increased stringency, into a "Décret organique sur la presse." The stamp duty for each sheet was fixed at 6 centimes, within certain dimensions, and a proportional increase in case of excess.

In 1858 the order of the six leading Parisian papers in point of circulation was—(1) *Siècle*, (2) *Presse*, (3) *Constitutionnel*, (4) *Patrie*, (5) *Débats*, (6) *Assemblée Nationale*. The number of provincial papers exceeded five hundred. "Newspapers, nowadays," wrote a keenly observant publicist in that year, "are almanacs, bulletins, advertising mediums, rather than the guides and the centres of opinion." In 1866 the change had become more marked still. The monetary success of Girardin's many commercial speculations in this branch of commerce greatly increased the number of Parisian journals, whilst lowering the status of those of established rank. The aggregate daily issue of the Parisian "dailies" had increased to about 850,000 copies, but the evening paper, *Le Petit Moniteur*, alone issued nearly 180,000 of these. The average circulation of *Le Siècle* had fallen from 55,000 to 45,000 copies; that of *La Patrie* was reduced by one-half (32,000 to 16,000); that of *Le Constitutionnel* from 24,000 to 13,000; of *L'Opinion Nationale* from 18,000 to 15,000; whilst the chief journal of all,—with grand antecedents, and with a brilliant history of public service rendered,—had for a time descended, it is said, from 12,000 copies to 9000. And yet almost over the whole of this very period the brilliant "Lundis" of Sainte-Beuve were making their punctual appearance in *Le Constitutionnel*, to be presently continued in *Le Moniteur* and in *Le Temps*; and writers like St Marc Girardin, Cuvillier-Fleury, and Prévost-Paradol were constantly writing in the *Journal des Débats*. Meanwhile, Villemessant and his colleagues were making their fortunes out of *Figaro*, and helping to make frivolous petty "paragraphs" on matters of literature almost everywhere take the place of able and well-elaborated articles. Well might Albert Sorel say,[2] "Our trumpery newspapers are the newspapers that pay." And the descent in the sterling characteristics of journalism continued at an increased speed. In 1872 the circulation of *Le Petit Journal* was 212,500; in June 1877 it reached nearly to 500,000.

No incident in recent newspaper history made more temporary noise than did the strange charges brought in 1867 against the *Débats*, the *Siècle*, and *L'Opinion Nationale*, by M. Kerveguen, member for Toulon, in the French assembly. He charged them collectively with receiving bribes, both from the Government of Prussia and from that of Italy,—upon the faith, as it afterwards appeared, of statements made by another newspaper, not of France but of Belgium, *La Finance*. An elaborate inquiry, presided over by M. Berryer, pronounced the accusation to be absolutely groundless. Yet it was soon revived by *Le Pays*, in the shape of a specific charge against an individual editor of *Le Siècle*,—La Varenne. All that was eventually proved, in due course of law, was merely the agency in Paris of La Varenne for the Italian Government, at a time prior to the events of 1866.

In 1874 an elaborate return showed that in thirty-five principal towns of France, comprising a population of 2,566,000, their respective journals had an aggregate weekly issue of 2,800,000 copies. The details in round numbers are as follows:—

	Copies of Newspapers issued weekly.	Approximate Population in 1874.		Copies of Newspapers issued weekly.	Approximate Population in 1874.
Lyons	426,000	325,000	Orléans	45,500	50,000
Marseilles	327,000	315,000	Angoulême	44,000	25,000
Bordeaux	247,000	200,000	Amiens	42,000	65,000
Lille	188,600	158,000	Châlons	41,500	13,000
Montpellier	142,500	57,000	Besançon	40,500	49,000
Toulouse	135,000	127,000	Arras	37,000	26,000
Poitiers	121,500	31,000	Laon	36,500	10,000
Rouen	98,500	100,000	Perpignan	35,000	27,000
Dijon	87,500	42,000	Troyes	34,000	38,000
Havre	80,000	87,000	St Étienne	34,000	111,000
Caen	78,500	42,000	Nice	33,500	52,000
Nancy	71,500	53,000	Rennes	33,500	52,000?
Nantes	70,000	118,000	Rheims	29,500	72,000
Tours	61,000	43,000	Evreux	29,500	12,000
Le Mans	57,000	47,000	Beauvais	28,500	15,000
Clermont-Ferrand	54,000	37,000	Perigueux	26,000	22,000
			Toulon	17,000	70,000
Angers	45,500	58,000	Avesnes	13,000	3,000

In 1878 the total number of journals of all kinds published in France was 2200. Of these 150 were political, strictly speaking, of which Paris published 49. Of Parisian journals other than political there were 1141 (including 71 religious, 104 legal, 153 commercial, 134 technological, 98 scientific and medical, 59 artistic). At that date *Figaro* had a circulation of about 70,000, *Le Petit Journal* (at a halfpenny) one of about 650,000.[3] At the great show of newspapers of all countries held that year at the International Exhibition of Prague the French newspapers were conspicuous.

The principal Parisian newspapers in 1883 may be classified thus:—

a. Organs of the Legitimists and of the Church of France:—*Gazette de France*, *Le Monde*, *L'Union*, *La Defense*, *La Civilisation*, *L'Univers*.

b. Orleanist organs:—*Le Moniteur Universel*, *Le Constitutionnel*, *Le Français* (under the auspices of the Duc de Broglie), *Le Soleil*.

c. Bonapartist organ:—*Le Pays* (edited at one time by Lamartine).

d. Republican organs:—*Journal des Débats*, *Le Temps* (the paper of the republican middle classes, and read largely by Protestants), *Le Siècle* (now of declining importance, Voltairean in tone), *Le XIX. Siècle* (also Voltairean), *Le Paix* (M. Grévy's paper), *La Justice*, *Paris*, *La Republique Française* (founded in 1871 by Gambetta), *Le Parlement* (founded by Dufaure; circulation less than that of *La Republique*, but political weight considerable).

The law concerning the liberty of the press, of July 29, 1881, abolished suretyship for newspapers, and transferred their registration from the ministry of justice at Paris to the local representative of the attorney-general (*le parquet*) in each town respectively. It made the establishment of a newspaper virtually free, upon legal deposit of two copies, and upon due registration of each newspaper under the simple guarantee of a registered director, French by birth, responsible in case of libel. And it took away the former discretionary power, lodged in the home office, of interdicting the circulation in France of foreign journals. The home minister may still prohibit a single number of a newspaper; only the whole council of ministers, duly convened, can prohibit the circulation of a foreign newspaper absolutely.[1]

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[1] Or, to speak more precisely, to farm a certain conspicuous page of each newspaper, in perpetuity.

[2] When comparing the French newspaper press as it stood in 1878 with that of Germany, in the *Revue des deux Mondes*, article "La Presse Allemande," vol. ii. of 1873, p. 715.

[3] It is curious to notice the comparatively small sale of the French illustrated papers. In 1880 the sale of *L'Illustration* was only about 15,000 copies, and that of *Le Journal Amusant* about twice that number. At the same date the *Illustrated London News* sold 95,000, and the *Illustrirte Welt* of Stuttgart 107,000.

Authorities.—Hatin, *Histoire de la Presse en France*, 8 vols., 1860-61; Jules Evrard, "Origines de la Presse en France," in *Revue Moderne*, i. 721-741, 1869; Gallois, *Histoire des Journaux et Journalistes de la Révolution*, 2 vols.; Marmontel, *Mémoires*, i. 277-291; Morellet, *Éloge de Marmontel*, ii, 12; Chateaubriand, *Mémoires d'outre Tombe*, iii. § 1, 24 *sq.*, v. 95, and vi. 403, 407; *Mémoires de Mallet du Pan*, i. 29 *sq.*; Montalembert, *Le Père Lacordaire*, ii. 81, 1831; articles "Bachaumont," "Bertin," "Donneau," "Doublet," "Garat," "Loret," "Panckoucke," "Renaudot," in *Biographie Universelle*; *Bulletin du Bibliophile*, new series, vii. 855-866; Ste Beuve, *Chateaubriand et son Groupe Littéraire*, &c., ii. 100; Id., *Portraits Littéraires*, v. 147 *sq.*; Lamartine, *Histoire de la Révolution de 1848*; Hatin, *Manuel de la liberté de la Presse*, 1868, and *Nomenclature des Journaux*; *Bibliothèque Impériale—Catalogue de l'Histoire de France*, iv. 345-569, 1857; Victor Gébé, *Catalogue des Journaux*, 1875; "Journalism in France," *Quarterly Review*, lxv. 422-468, March 1840; *Annuaire Encyclopédique*, 1868, 706-709; Cochin, *Le Comte de Montalembert*, 1870; *Bibliographie de la France*, "Chronique" (1875, 96; 1876, 74, 75; and 1881, 7); *Journal Général de l'Imprimerie*, 1881, part ii. 201 *sq.*; Amédée Breton, "Les droits de la Presse," in *Revue Moderne*, xiii. 721-741, 1867; Vapereau, articles "De Champagny," "De Coux," "De Falloux," "E. de Girardin," "Galignani," "J. Lemoinne," "De Montalembert," "Jules Ferry," "Alphonse Karr," "G. Sand," "Veuillot," &c., in *Dictionnaire des Contemporains*, various editions; H. Rigault, "Observations sur les Journaux," in *Jour. des Débats*, October 26, 1858; G. Sand, *Correspondance*, ii. 288-311, 1882; Sayous, *Mémoires et Correspondance de Mallet du Pan*, i. 32-35, 84, 86, ii. 368-448; Reinach, "Parisian Newspapers," *Nineteenth Century*, xii. 347 *sq.*; various French newspapers, from 1789 onwards, in the library of the Taylor Institution at Oxford.[2]

NEWSPAPERS OF GERMANY.

Printed newspapers in Germany begin with the *Frankfurter Journal*, established in the year 1615, by Egenolph Emmel, a bookseller of Frankfort-on-Main. In the following year his example was imitated, doubtless with some improvement, by the foundation of the *Frankfurter Oberpostamtszeitung*,—continued until the year 1866 as *Frankfurter Postzeitung*. Fulda appears to have been the next German town to possess a newspaper, then Hildesheim (1619) and Herford (1630). In the course of the century almost all German cities of the first rank possessed their respective journals. The earliest in Leipsic bears the date 1660. The *Rostocker Zeitung* was founded in 1710. The *Hamburgischer Correspondent* dates from 1714, but was originally published under the name of *Holsteinische Zeitungs-Correspondenz*, two years earlier, and was almost the only German newspaper which really drew its foreign news from "our own correspondent." Berlin had two papers, those of Voss and of Spener, both of which are still published. They possessed in their earlier career some literary value, but were politically null. Some half-dozen papers which glimmered in the surrounding darkness were the reservoirs whence the rest replenished their little lamps. On the whole, it may be said that the German newspapers were of very small account until after the outbreak of the French Revolution. Meanwhile the MS. news-letters, as in earlier days, continued to enjoy a large circulation in Germany. Many came from London. The correspondence, for instance, known under the name of "Mary Pinearis,"—that, apparently, of a French refugee settled in London,—had a great German circulation between 1725 and 1735. Another series was edited by the Cologne gazetteer, Jean Ignace de Rodérique, also a French refugee, and remembered as the subject of a characteristic despatch from Frederick II. of Prussia to his envoy in that city, enclosing 100 ducats to be expended in hiring a stout fellow with a cudgel to give a beating to the gazetteer as the punishment of an offensive paragraph.[3] The money, it seems, was earned, for Rodérique was well-nigh killed. At Berlin itself, Franz Hermann Ortgies carried on a brisk trade in these news-letters (1728-35), until he too came under displeasure on account of them, was kept in prison several months, and then exiled for life.[4] Nor, indeed, can any journal of a high order be mentioned of prior appearance to the *Allgemeine Zeitung*, founded at Leipsic by the bookseller Cotta (at first under the title of *Neueste Weltkunde*) in 1798, and which is still at the head of the political press of Germany. Posselt was its first editor, but his want of nerve—and perhaps his weak health—hindered the application of his high powers to political journalism. His articles, too, gave offence to the Austrian court, and the paper had to change both its title and its place of publication. It had been commenced at Tübingen, and removed to Stuttgart; it was now transferred to Ulm, and again to Augsburg. It was Cotta's aim to make this the organ of statesmen and publicists, to reach the public through the thinkers, to hold an even balance between the rival parties of the day, and to provide a trustworthy magazine of materials for the historians to come; and, in the course of time, his plan was so worked out as to raise the *Allgemeine Zeitung* into European fame. Cotta was also the founder, at various periods, of the *Morgenblatt*, which became famous for its critical ability and tact, of *Vesperus*, of *Das Inland*, of *Nemesis*, of the *Oppositionsblatt* of Weimar (for a time edited by Bertuch), and even of the *Archives Parisiennes*. His ventures were not, of course, uniformly successful, but it is rare that men of like enterprise have made so few failures. Whilst French influence was dominant in Germany, the German papers were naturally little more than echoes of the Parisian press. But amidst the excitements of the "war of liberation" a crowd of new journals appeared. Niebuhr started a *Preussischer Correspondent*; Görres—who in 1798 had founded at Coblentz *Das rothe Blatt*, soon suppressed by the invading French—undertook the *Rheinischer Mercur* (January 1814 to January 1816), which was suppressed by the Prussian Government, under Von Hardenberg. This journal, during its initiatory year, had the honour of being termed by Napoleon—perhaps satirically—"the fifth power of Europe." Wetzel, somewhat later, founded the *Fränkischer Mercur*, published at Bamberg, and Friedrich Seybold the *Neckarzeitung*. Some of these journals lasted but two or three years. Most of the survivors fell victims to that resolution of the diet (20th September 1819) which subjected the newspaper press, even of countries where the censorship had been formally abolished, to police superintendence of a very stringent kind.

The aspirations for some measure of freedom which burst forth again under the influences of 1830 led to the establishment of such papers as Siebenpfeiffer's *Westbote*, Lohbauer's *Hochwächter*, Wirth's *Deutscher Tribune*, Eisenmann's *Baierisches Volksblatt*, *Der Freisinnige* of Rotteck and Welcker, and many more of much freer utterance than had been heard before in Germany. This led, in the ordinary course, to new declarations in the diet against the licence and revolutionary tendencies of the press, and to "regulations" of a kind which will be sufficiently indicated by the mention of one, in virtue whereof no editor of a suppressed journal could undertake another journal, during the space of five years, within any part of Germany. It need hardly be added that few of the newspapers of 1830 saw the Christmas of 1832. Very gradually some of the older journals—and amongst the number the patriarch of all, the *Frankfurter Oberpostamtszeitung*—plucked up courage enough to speak out a little; and some additional newspapers were again attempted. Amongst those which acquired deserved influence were Brockhaus's *Deutsche Allgemeine Zeitung*, the advocate of free trade and of a moderate liberalism, and possessing a large circulation in northern Germany (1837); the *Deutsche Zeitung*, edited by Gervinus, at Heidelberg (July 1847); and the *Dorfzeitung*, published at Hildburghausen. The stirring events of 1848 called forth in Germany, as in so many other countries, a plentiful crop of political instructors of the people, many of whom manifestly lacked even the capacity to learn, and vanished almost as suddenly as they had appeared. But it is undeniable that a marked improvement in the ability and energy of the German political press may be dated from this period; and of late years the press of Germany has gone far towards turning into very grave earnest the ironical words of the first Napoleon.

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[1] The history of French journals published abroad is interesting, but is necessarily passed over in these pages. The *Annales politiques* of Linguet,—for a time of Linguet and Mallet du Pan jointly,—was, from about 1770 to about 1785, almost a power in Europe, in its way. Mallet's own *Mercure Britannique*, during the eventful years 1798-1800, was brilliant, sagacious, and honest. When the pen literally fell from his dying hand,—a hand that had kept its integrity under the pains of exile and of bitter poverty,—that pen was taken up (for a short interval) by Malonet. When Napoleon forcibly suppressed, a little later, the *Courrier de l'Europe* of the count of Montlosier, he offered the deprived editor a pension, which was refused, until accompanied by the offer of a post in which the able minister of Louis XVI. could still work for his country. In our own day, another *Courrier de l'Europe* has had a long and useful existence, and still appears weekly in London.

[2] The writer desires to express here, once for all, his deep sense of obligation to the curators of the Taylor Institution at Oxford and to their learned librarian, Dr Krebs, for liberally granting facilities of access to the store of foreign newspapers with which its library is admirably supplied.

[3] Fr. Kapp, "Berliner geschriebene Zeitungen," in *Deutsche Rundschau*, xxi. 107-122, 1879, citing Droysen, *Zeitschr. f. preuss. Gesch.*, xiii. 11. The story, as told by Droysen, is an instructive commentary on Carlyle's praise of Frederick's "love of the liberty of the press."

[4] Kapp, *ut supra*.

In 1833 the number of German newspapers of all kinds, popular journals (Volksblätter) included, but without reckoning periodicals devoted to literature or science, amounted to no more than about 335; in 1849 this number had increased to 1551, their geographical distribution being as follows:—Anhalt, 10; Austria (German), 74; Baden, 55; Bavaria, 127; Bremen, 18; Brunswick, 9; Frankfort, 17; Hamburg, 24; Hanover, 82; Hesse-Cassel, 22; Hesse-Darmstadt, 34; Hesse-Homburg, 4; Hohenzollern, 4; Holstein, 17; Lippe-Detmold, 4; Lübeck, 4; Luxemburg, 4; Mecklenburg, 22; Nassau, 18; Oldenburg, 8; Prussia, 632; Reuss, 11; Saxon Duchies, 44; Saxony, 188; Schaumburg-Lippe, 2; Schleswig, 5; Schwartzburg, 12; Waldeck, 2; Würtemberg, 67. In addition to these, but included in the total of 1551, 77 German newspapers were published in the Swiss cantons, and 14 in the Baltic provinces of Russia. Many of those reckoned in this enumeration soon ceased to appear, but others took their place, and the total in 1855 was estimated at a little above 1600.

In 1879 it was estimated that the total number of newspapers and periodicals published in the German language, in all parts of the world, reached to nearly 5480:—in Germany proper, 3780; Austria-Hungary, about 700; Switzerland, about 300; Russia, about 50; Great Britain, Netherlands, Belgium, Italy, &c., 40; North America, 600; South America, 9; Africa (Cape Town) 1.[1] In Germany, in foreign languages, there appeared at the same period—in Polish, 26; French, 17; Danish, 10; Wendish, 6; Lithuanian, 2; English, 2; Hebrew, 4; total, 67.[2]

All the leading German papers have daily correspondence from Paris; in the *Cologne Gazette* sometimes five Paris letters may be seen at a time. Foreign state papers are largely collected and translated.

The *National Zeitung*, published at Berlin, holds a conspicuous place amongst existing German newspapers. Dr Bernhard Wolff, who founded it (also in 1848), continued to be chief editor until his death in 1879. He was a notable precursor (only a little in advance) in telegraphic enterprise of Julius Reuter; and, to some extent, his telegraphic bureau at Berlin may be regarded as the germ at once of the "Agence Havas" and of "Reuter's telegrams." Like Reuter, he found it expedient, as the affair grew, to turn it over to a company. He did so in 1864, but continued to work the enterprise until 1871. Of strictly political papers, the *Volkszeitung* is probably that which has the largest circulation of all Germany.

As regards the socialistic press, "German socialism," says Sorel, "has turned journalist. It has established 14 printing offices, and publishes 41 political journals, 13 of which are of daily publication. . . . The collective circulation is said to exceed 130,000. The leading paper of this party, *Vorwärts*, published at Leipsic, prints about 12,000; *Die neue Welt*, literary rather than political, is said to sell 35,000 copies."[3] . . . *Die Zukunft*, another of their organs (1848), long edited by Johann Jacoby, was suppressed in 1871, mainly on account of its vigorous protests against the annexation of Alsace-Lorraine.

The total number of political journals of all kinds throughout Germany in 1879 was 2451, of which 640 were avowedly Government or administrative organs.

Authorities (in addition to those above cited).—Articles "Bertuch," "Cotta," "Görres," "Huber," "Niebuhr," "Posselt," &c., in *Biographie Universelle*; Bluntschli and others, article "Zeitungswesen," *Deutsches Staatswörterbuch*, 1870; Vapereau, *Dictionnaire des Contemporains*, edition of 1880.

Newspapers of Austria-Hungary.

At the beginning of 1840 the whole number of Austro-German and Hungarian periodicals, of all sorts, was less than 100, only 22 being (after a fashion) political newspapers; and of these nearly all drew their materials and their inspiration from the official papers of Vienna (*Wiener Zeitung* and *Oesterreichischer Beobachter*). These two were all that appeared in the capital. Agram, Pesth, Pressburg, Lemberg, and Prague had also two each; but no other city had more than a single journal. In 1846 the aggregate number of periodicals had grown to 155, of which 46 were political, but political only in the character of mere conduit-pipes for intelligence "approved of" by the Government. In 1855 the number of political papers published throughout the entire territory under Austrian government, the Italian provinces excepted, was 60.[4] In 1873, ten years after the virtual cessation of a strict censorship,[5] the number of political journals, including all the specifically administrative organs, as well local as general, was 267, and that of mere advertising papers 42; now, in 1883, the former number is increased to about 280, the latter to about 60. The comparatively brief duration of Austrian-Hungarian newspapers and periodicals generally is a characteristic feature. Of 866 journals of all kinds existing at a recent date, 153 had their birth in 1873, 145 others in 1872, 109 in 1871; only 67 dated from the decennium 1851–60, 30 from 1841–50, and there were but 21 with any claim to a date earlier than 1840.

Vienna had in 1883 in all 18 daily newspapers (really such), ten of which range in average circulation from 14,000 to 54,000 copies, and, according to the consular returns collected by Hubbard, no less than 483 periodicals of all kinds, and of all periods of issue. Of 1016 journals, classified as to language, 600 appear in German, 170 in Hungarian, 79 in Bohemian, 58 in Polish, 56 in Italian, 22 in Slovenian, 11 in Croatian and Servian, 9 in Ruthenian, 8 in Roumenian, 3 in Hebrew. Budapest claims to have 229 journals, and Prague 99, counting those of all descriptions. The aggregate number of stamps issued to political journals in 1860 was about 42,100,000; in 1871 it reached nearly 81,000,000.

See *Die periodische Presse Oesterreichs*, 1875; Lagai, "Zeitungen und Zeitschriften," *ut sup.*; Bluntschli and others, "Zeitungswesen," *ut sup.*

Newspapers of other European States.

Denmark, Sweden, and Norway.—In Sweden the earliest regular newspaper appears to have been the *Ordinarie Post-Tidende* of Stockholm, first published in 1643, and continued until 1680, then, after long suspension, revived under the title *Post- och Inrikes-Tidning*, under which name it is still published daily. Stockholm has also its *Aftonbladet*. The *Post-Tidende* was followed by the *Svensk Mercurius* (1675–83) and the Latin *Relationes Curiosæ* (1682–1701). In 1742 a Swedish newspaper in French (*Gazette Française de Stockholm*) was commenced, and was followed in

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[1] Lagai, "Zeitungen und Zeitschriften," in Pierer's *Univ. Lexicon*, 1879. The statistics given by Hubbard (*Newspaper Directory of the World*, vol. ii. pp. 1399–1563) differ enormously from those given above. But Hubbard mingles the most heterogeneous "periodicals" in one undigested mass with the newspapers which are strictly such.

[2] "La Presse Allem. in 1873," *Rev. d. d. Mondes*, 1873, ii. 715.

[3] Valbert, "Le parti socialiste en Allemagne," *Rev. d. d. Mondes*, 1878, ii. 708.

[4] Distributed thus:—Vienna, 19; Linz, 1; Salzburg, 2; Gratz, 1; Klagenfurt, 1; Laibach, 1; Trieste, 3 (two Italian); Prague, 4 (one Czech); Brunn, 3 (one Czech); Olmütz, 1; Troppau, 1; Innsbruck, 4; Pesth, 4 (two Magyar); Pressburg, 1; Agram, 2 (one Crotian); Temesvar, 1; Neusatz, 1 (Servian); Hermannstadt, 2 (one Roumanian); Cronstadt, 2 (one Roumanian); Lemberg, 2 (one Polish); Cracow, 1 (Polish); Zara, 3 (one Slavonic and one Italian).

[5] What that censorship had been in its palmy days may be sufficiently seen from the one fact that in January 1818 the *Rheinischer Merkur*, the Nuremberg *Concordant*, the Neuwied *Zeitung*, all the papers in French printed in the Netherlands, and all Polish papers whatever were suppressed at a blow.

1772 by the *Mercure de Suède*. But the press in Sweden had small political influence until 1820, when the *Argus* was established by Johannsen. The strife between "classicists" and "romanticists" spread itself in Sweden, as in France, from the field of literature into that of politics. Crusenstolpe's *Fäderneslandbladet* and Hjerta's *Aftonbladet*, founded in 1830, were long the most conspicuous of the Swedish journals,—the former on the side of the royalists, the latter on that of the reformers. Hjerta's paper, in its best days, could boast of a circulation of 5000 copies; but on the accession of King Oscar it ceased to appear as an opposition organ. Almost every town in the provinces has its paper. The growth of the Swedish press during the present century may be thus briefly epitomized:—

	Papers.		Papers.		Papers.
1801	25	1831	80	1853	106
1821	48	1841	112	1856	101
1829	63	1850	113	1870	180

In 1882 the newspapers and "other journals," according to Hubbard, numbered 303.

While Denmark, as regards mere news-journals, followed the example of its rival by publishing an *Europäische Zeitung* as early as 1663 and the *Danske Mercurius* in 1666, the political influence of the press is a newer thing in that country than even in Sweden. Until 1830 Copenhagen had but two papers, and they filled their columns with mild extracts from foreign journals. Real activity in this direction dates but from the establishment of the provincial states in 1834. The oldest existing paper is the *Berlingske Tidende*, which dates from 1749, and was at first published in German. It is now a semi-ministerial journal. The *Fädrelandet* belongs to the opposition, and in 1848–49 was in a glow of zeal for Scandinavianism and "Young Denmark." The total number of political journals in 1849 was 36. Of political and miscellaneous journals together there were in 1879, according to Larousse, 207, of which number 97 were published in Copenhagen. Those belonging to the provinces are of small account. The American consular returns furnished to Hubbard in 1882 give to Denmark 142 (in the text 61 only, but 81 are added in a supplement apparently printed subsequently to the table) of all kinds. So great is the diversity of the most recent accounts. Iceland has in all 12 journals; 10 of these may fairly be looked upon as newspapers, while 2 are magazines. The 10 include two papers printed in Copenhagen for circulation in Iceland.

The earliest Norwegian paper was the Christiania *Intelligentssedler*, founded in 1763. Next to this came the *Adressecontors Efterretninger* (1765), published at Bergen. *Den Constitutionelle* was until recently the organ of the Government, and had absorbed an older paper, called *Norske Rigstidende*. The *Morgenblad* is now the daily journal of the popular party, and dates from 1819.

See A. Geffroy, "La presse périodique dans les États Scandinaves," in *Revue des deux Mondes*, 1861, iv. 759–765; Larousse, article "Journal," in *Grand Dictionnaire*, 1875; Hubbard, *ut sup.*, ii. 1297–1300, 1532–1551, 1921, 2560–2562.

The Netherlands and Belgium.—The *Nieuwe Tijdinghen* of Antwerp, published by Abraham Verhoeven, has been said to date virtually from 1605, in which year a "licence for the exclusive retailing of news" was accorded to him by the archdukes Albert and Isabella. But the claim is conjectural. No copy of any number of this paper anterior to 1616 is now known to exist. It seems probable that the *Gazette Extraordinaris Posttijdinghen*, published by Wilhem Verdussen between 1637 and 1644, is a continuation of Verhoeven's paper. But, be this as it may, that of Verdussen was certainly the foundation of the well-known *Gazette van Antwerpen*, which continued to appear until 1827.

Bruges had its *Nieuwe Tijdinghen uyt verscheyden Quartieren*, published (in black letter) by Nicholaes Breyghel. When this paper was commenced is uncertain, but various numbers of it exist with dates between 1637 and 1645. In one of these (26th July 1644) a *Brusselsche Gazette* of the 24th of that month is quoted, apart from which citation no Brussels paper is known of earlier date than 1649. When the first number of *Le Courrier véritable des Pays-Bas* made its appearance, the publisher (Jean Mommaert) prefaced the first number by an address to the reader, in which he says:—"I have long endeavoured to meet with somebody who would give employment to my presses in defending truth against the falsehoods which malignity and ignorance *send daily abroad*. I have at length found what I sought, and shall now be able to tell you, weekly, the most important things that are going on in the world." This paper became afterwards the *Gazette de Bruxelles*, then *Gazette des Pays-Bas*; and, under the last-named title, it continued to appear until 1791. The *Annales Politiques* of Linguet was one of the most remarkable of the political journals of Brussels in the last century. For a time the editor won the favour of the emperor Joseph II. by praising his reforms, and the Government subscribed for 1200 copies of his paper at two louis d'ors each a year; but here, as in almost every other place of residence during his chequered career, Linguet at length incurred fine and imprisonment. His journal was repeatedly suppressed, and as often resumed under many modifications of title. It was continued in France, in Switzerland (at Lausanne), and in England. At one time it was so popular that a printer in Brussels regularly and rapidly published a pirated edition of it. For a brief period the publication was resumed at Brussels. A complete set extends to eighteen volumes, and ranges in date from 1780 to 1791.[1] Mallet Du Pan was, for a time, a collaborator in the editorship. Linguet died by the guillotine in 1794. *Le National* was a famous paper for a short period prior to the revolution of 1830. Soon after its cessation—its presses were destroyed by the populace on the 26th August—the official journal, *Le Moniteur Belge*, was established,—"the ministry deeming it indispensable to the success of its great political enterprise that a journal should be created which might expound its views, and act daily upon public opinion"; and, on decree of the regency, it was published accordingly. It now claims a circulation of 30,500, and the restored *National* one of 21,100 copies. But *L'Étoile* outshines both; according to its publishers, it circulates, on the average, 40,500 copies daily. Hubbard's correspondents assign to Brussels a total of 28 daily newspapers, but this heaps together publications of the most incongruous kind.

The first newspaper published at Ghent, *Gazette van Gent*, appeared in 1667. *Den Vaderlander*, begun in October 1829, was, for a long period, one of the most widely circulated of the Flemish journals. *La Flandre libérale* is now the leading newspaper of Ghent, with a circulation of about 15,000 daily.

The kingdom of the Netherlands has always been rich in newspapers, but they have usually had more weight commercially than politically. Those in most esteem are *Het Nieuws van den Dag* (about 25,000 copies) and the *Allgemeen Handelsblad* (both daily) of Amsterdam; the *Haarlemsche Courant*;[2] and the *Nederlandsche Staats-Courant*, and *Dagblad van Zuidholland en 's Gravenhage* (originally *Journal de la Haye*), both printed at the Hague.

See Hatin, *Les Gazettes de Hollande*, Paris, 1865; Warzée, *Essai Historique et Critique sur les Journaux Belges*, Ghent, 1845; Kolb, article "Linguet," in *Biographie Universelle*; Alex. Chalmers, article "Linguet," in *Gen. Biog. Dict.*

Russia, Poland, and Finland.—The earliest gazette of Moscow (*Moskovskia Wiedomosti*) was issued by order of Peter the Great on the 16th December 1702, but no copy is known now to exist of earlier date than the 2d January following. The whole gazette of the year 1703 was reproduced in facsimile by order of the late Baron de Korff (the able imperial librarian at St Petersburg) in 1855, on occasion of the festival for the 3d century of Moscow university. The existing *Wiedomosti* dates only from 1766; its circulation in 1882 has been estimated at 50,000 copies. That of St Petersburg dates from 1718.[3] The historian Karamzin established a short-lived Moscow journal (*Moskovski Listok*), and afterwards at St Petersburg the once widely-known Russian *Courrier de la Europe* (1802). The profits of the successful *Invalide Russe*, established in 1815 by Persorovius, were devoted to the sufferers by the war with France. It continues to appear, not in its original weekly form, but daily, and is now published in Russian (*Russkii Invalid*). It is said to have an average circulation of about 7000 copies (1882). It is the organ of the "old Russia" party, and also of the ministry of war. Adding to the distinctively political journals those of miscellaneous character, the whole number of newspapers published within the Russian states—Poland and Finland excepted—in the year 1835 was 136; in 1858 that number had grown to 179, of which 32 were published in St Petersburg and 15 in Moscow; 132 were printed in Russian, 3 in Russian and in German, 1 in Russian and in Polish, 28 in German, 8 in French, 3 in English, 1 in Polish, 1 in Lithuanian, 1 in Italian. In 1879, under the more liberal rule of Alexander II., the number of political and miscellaneous journals—if we may trust the native authorities used by Lagai—had grown to 293, and of these 105 were under the direct influence of the Government. But, in truth, the period of relaxation of censorship, if strictly examined, will be found to have lasted only from 1855 to 1864, when repressive measures were again and frequently resorted to. Only 107 foreign political journals are now authorized to circulate. The total number of licensed foreign periodicals amounts to about 300, and of that number no less than 154 are in German.

Poland in 1830 had 49 newspapers. Fifty years later the number was still less than 70, of which 54 are in Polish, these numbers including journals of all kinds.

Finland in 1860 had 24 newspapers, half in Swedish, half in Finnish. In 1863 the number had increased to 32, in spite of the zealous opposition of Count de Berg, the governor-general, to all discussion of political events and "subjects which do not concern the people." He was very friendly to journals of gardening and cottage economy, and to magazines of light literature, and did not regard comic papers with anger provided they kept quite clear of politics. The paper which was long the chief Finnish organ, *Suometar* (founded at Helsingfors in 1847, and circulating to more than 4000 copies), owed much of its popularity to the pains its editors took with their correspondence. The *Oulun Wukko-Sanomat* ("Uleaborg Daily News") was for a considerable period the most northerly newspaper of the world, with the one exception of the little journal published at Tromsö, in Norway. Uleaborg, with a population of less than 9000, supports 6 periodicals, 4 of which are strictly newspapers.

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[1] *Collection de Matériaux*, &c. [*Bibliog. des Journaux*], par M. D[eschiens], p. 97.

[2] The late M. Xavier Marmier says in his *Lettres sur la Hollande*, "the *Haarlemsche Courant* is the senior of all the gazettes of Europe," but in truth it dates only from 1656, seventeen years later than the *Tijdinghen uyt verscheyden Quartieren*, and twenty-five years later than his own familiar *Gazette de France*.

[3] There are now (1883) no less than four St Petersburg gazettes, all dailies, the three which are in Russian having an aggregate circulation of about 16,700, while the one in German (1827) circulated nearly 15,000 copies in 1882. Lagai says of the latter:—"Its aim is to restore the state of affairs which existed under Peter the Great."

In 1880 the whole number of newspapers printed within the government of Finland was 46, while the total number of newspapers and journals of all kinds published within the whole Russian empire during the same year was 608. Of these, 417 were printed in the Russian language, 155 of them being official or administrative organs; 54 were printed in Polish, 40 in German, 11 in Lettish, 10 in French, 7 in Esthonian, 3 in Lithuanian.

See Hatin, *Bibliographie de la Presse périodique*, Introduction, pp. xxix. et; *Bibliographie de la France*, January 30, 1875, "Chronique"; *Annuaire de la Presse Russe* (for 1880), as quoted in *Bibliographie de la France*, 1880, "Chronique," p. 19; Lagai, article "Zeitungen," *ubi sup.*, 745 *sq.*; A. Geffroy, "De la Presse périodique en Finlande," in *Revue des deux Mondes*, 1860, vi. 771–777; Sampson Low, in *Publishers' Circular*, 1879, p. 410.

Italy.—The *Diario di Roma*, although dating only from 1716, may claim to have been the patriarch of the Italian press. It lasted for nearly a century and a half. During its later years it was a daily paper, with a weekly supplement having the somewhat whimsical title *Notizie del Giorno*. Next to this, we believe, came the *Gazzetta Uffiziale di Napoli*, which continues to exist. These and their congeners were published under a rigid censorship until far into the present century, and exercised little influence of any kind. The first tentative movement towards a free press may, perhaps, be dated from the effort to establish at Milan, in 1818, under the editorship of Silvio Pellico, the *Conciliatore*, in which Simonde de Sismondi, Gonfalonieri, and Romagnosi were fellow-writers. But the new journal was suppressed in 1820. The first really effectual effort had to wait for the lapse of nearly thirty years. *L'Opinione*, which in many respects is the leading journal of Italy, although its circulation is far inferior to that of many of its rivals, was first published in Turin (26th December 1847). It is now published in Rome. It has had, amongst its many editors, Giacomo Durando (a soldier of mark, and twice minister of foreign affairs), Montezenolo, Ciovini Bianchi, and Giacomo Dina. At one period it attained, according to credible report, a circulation of 15,000 copies. Its present circulation averages less than the half of that, but few Italian papers are so often met with in other countries. Fewer still are edited with equal ability.

The *Gazzetta del Popolo* of Turin had in 1855 about 7000 subscribers. In later days its sale has occasionally reached almost 20,000 copies. Hubbard's agents, in 1882, reported its circulation as 8000. The Florence *Diritto*, originally founded at Turin, in 1851, by Lorenzo Valerio, was edited successively by Macchi, Bargini, and Civinini, and as a radical organ attained great influence. When (under the last-named editor) it displayed a wise moderation in its politics, popularity rapidly declined; and it has long ceased to appear.

Counting journals of all kinds, there were published in Italy in 1836 185 newspapers; in 1845, 220; in 1856, 311; in 1864, 450;[1] in 1875, 479. In 1882 the "periodicals" of all kinds[2] numbered 1454, distributed as follows:—Piedmont, 155; Liguria, 63; Lombardy, 291; Venice, 83; the Emilia, &c., 301; Tuscany, 178; Naples, 243; Sicily, 132; Sardinia, 8. The total number of political dailies is 149, of which the Roman district claims 35,[3] Naples and Sicily 36, Lombardy 22. Amidst all the vicissitudes of things political in Italy, the press-law of March 1848 remains substantially and in the main the law of to-day. There is neither stamp, caution-money, nor obligatory signature; but there are provisions—used with great moderation—for a wise and firm repression of libel. It was in Piedmont that the best portion of the press learned the lesson that its duty is rather to fructify and to expand established institutions than to attack them by sap and mine. By the Police Act of November 1859 the vending of newspapers is made subject to due regulation. And by the constitutional law of Italy (June 1874) it is made illegal for newspapers to publish reports of criminal procedure until after the delivery of the verdict or definitive judgment in each case.

See *Statistica Amministrativa del regno d'Italia*, Rome, 1882; *Calendario generale*, 1876, appendix; *Bibliografia Italiana*, 1876–77, section "Cronaca"; Hatin, *Bibliographie de la Presse périodique*, supplement; *Annuario statistico Italiano*, 1881, Introduction, pp. 149 and 150, 328, 329; Charles de Mazade, "Les précurseurs Italiens," in *Revue des deux Mondes*, 1867, i. 906; André Folliet, "La presse Italienne et sa législation," in *Revue Moderne*, vol. ii. pp. 659–698, and vol. iii. pp. 87–113, 1869; Cesare Cantù, in *Bibliografia Italiana*, xiv. 909 *sq.*, 1880.

Spain and Portugal.—In Spain no newspaper of any kind existed earlier than the last century.[4] Even during the early years of the present its capital contented itself with a single journal, the *Diario de Madrid*. The Peninsular War and the establishment of the Cortes gave the first impulse towards something which might be called political journalism, but the change from total repression to absolute freedom was too sudden not to be grossly abused. The *Diario de las Cortes*, the *Semanario Patriotico* (published at Cadiz from 1808 to 1811), and the *Aurora Mallorquina* (published at Palma in 1812–13) are the first of the new papers that attained importance. In 1814 the circulation or receipt in Spain of English newspapers was prohibited under penalty of ten years' imprisonment.[5] Most of the native journals fell with the Cortes in 1823. In the following year Ferdinand decreed the suppression of all the journals except the *Diario* and the *Gaçeta* of Madrid,[6] the *Gaçeta de Bayona*, and certain provincial papers which dealt exclusively with commercial or scientific subjects. At the close of his reign only three or four papers were published in Madrid. Ten years afterwards there were 40; but the number was far more noticeable than the value. Spanish newspapers have been too often the mere stepping-stones of political adventurers, and not unfrequently the worst of them appear to have served the turn more completely than the best. Gonzales Bravo attained office mainly by the help of a paper of notorious scurrility,—*El Guirigay*. His press-law of 1867 introduced a sort of indirect censorship, and a system of "warnings," rather clandestine than avowed; and his former rivals met craft with craft. The *Universal* and the *Correo* were successively the organs of José Salamanca. At the end of 1854 the political journals published in Madrid numbered about 40, the most conspicuous being the now defunct *España* and *El Clamor Publico*.

Hubbard's agents assign to Spain in 1882 220 newspapers of all sorts, of which 58 appear in Madrid. The same authorities assign to *El Correo* a circulation of about 10,000 copies, to the *Diario de Madrid* [? *Diario Español*] a circulation of 12,275 copies, and to *La Vanguardia Federal* one of 16,000 copies; all these are dailies. To the weekly paper, *Correspondencia de España*, they assign an average sale of 42,000 copies. Cadiz has 5 political newspapers, Seville 4, and Barcelona 4.

Portugal in 1882 is credited by the resident American consuls with 179 journals of all kinds and of various periodicity. Of this number 68 appeared in Lisbon. The strictly political daily papers of Lisbon are 6 in number; those of Oporto 3.

See Ford, *Handbook of Spain*; S. T. Wallis, *Spain, her Institutions and Public Men*, 1853, p. 83–95; Charles de Mazade, "La Révolution et la réaction en Espagne," in *Revue des deux Mondes*, 1867, v. 501; "The Newspaper Press of Spain," in *British Quarterly Review*, vi. 315–332; Hubbard, *Newspaper Directory*, ii. 1853–1857, 1877–1893, 2456–9, and 2587–8.

Switzerland.—In 1878 the total number of political and general newspapers in Switzerland was 230. In 1881 they numbered 342, of which 45 may be described as class journals, 297 as political, general, and advertising. Of 226 of the whole number, 53 were of daily issue, 166 appeared twice or thrice a week, and 7 only were of weekly issue. Of 225 political journals, 185 are classed as "Progressist" organs, 40 as "Conservative." Zurich claimed 44; Bern, 34; Vaud, 20 Basel, 18; and Geneva, 10. The aggregate average circulation is estimated approximately at 606,000 copies, an average circulation of about 1770 to each newspaper.

A monthly compendium of the news of the day appeared at Rorschach, in the canton of St Gall, as early as January 1597. The editor was a German, one Samuel Dilbaum, of Augsburg. He varied his titles, so that his monthly newsbooks, although really consecutive, do not wear the appearance of serial publications. Sometimes he called his issue *Historische Relatio*, sometimes *Beschreibung*, sometimes *Historische Erzählung*.

See Bleuler, "Statistique de la Presse Suisse," in *Journal des Économistes*, 1882, xviii. 134; Weller, *Die ersten deutschen Zeitungen*, Tübingen, 1872; *cf.* Lagai, in Pierer, *ubi sup.*; and Hubbard, ii. 1897–1912, 2458–9, and 2568 (supplement).

Greece.—The few newspapers that made their sudden appearance in Greece during the war of liberation departed as hastily when King Otho brought with him a press-law, one of the provisos of which demanded caution-money by actual deposit. The journal *Saviour* was established, in 1834, as a Government organ, and was soon followed by *Athena* as the journal of the opposition. Ten years later 7 distinctively political papers had been established, along with 13 journals of miscellaneous nature. In 1877 there were, of all sorts, 81 journals, of which 77 appeared in Greek, 2 in Greek and French, 2 in French only; 37 of these were printed in Athens, 17 in the Ionian Islands. Of strictly political newspapers there were 12 at Athens and 3 in the Islands. In 1882 the American consul reported 89 periodicals in all, of which 52 were published at Athens.

See Lagai, in Pierer, *ut sup.*, 745; Hubbard, *ut sup.*, ii. 1779–1781, and 2458–9.

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[1] Of these Turin published 100, Milan 80, Florence 51, Genoa 37.

[2] There are no means of separating, with assured accuracy, the newspapers strictly so called from other "periodicals" under the forms of return employed in the official publications of latest date.

[3] The city of Rome itself publishes 18; Naples, in 1881, followed closely with 16.

[4] Lagai (article "Zeitungen," in Pierer's *Universal Lexicon*, 1878) cites a *Gaceta de Madrid* of 1626, but gives no evidence whatever.

[5] A contemporary communication to *Gent. Mag.*, lxxxiv. part 2, 176.

[6] The present *El Diario Español* is a paper of more recent date.

Roumania and Servia.—Bucharest has now 4 daily newspapers (*Romanulu, Timpul, Telegraphulu, Tagblatt*), and Galatz one (*Vocea Covurluiului*). Roumania has in all 19 journals, with an estimated average aggregate circulation of 32,700 copies. Servia at the end of 1877 had 19 political journals. The Government organ (*Scrbske Novine*) dates from 1841, the independent journal (*Vidov Dan*) from 1861, the clerical organ (*Pastir*) from 1868.

See Lagai, *ut sup.*; Hubbard, *ut sup.*, ii. 2458 *sq.*

Turkey.—During the embassy (1795) of Verninac Saint-Maur, envoy of the French republic, a French journal was established at Pera. This, possibly, is the pioneer of all Turkish newspapers. Thirty years later (1825) the *Spectateur de l'Orient* was founded at Smyrna, also by a Frenchman (Alexander Blacquet ?). It was afterwards published under the titles *Courrier* and *Journal de Smyrne*, and its latest editor was a third Frenchman, Bousquet des Champs. In like manner, the *Moniteur Ottoman*, first of strictly Constantinopolitan journals, was founded by the above-named Blacquet in 1831. It soon changed its language to Turkish, and was edited by Franceschi. The second Smyrna newspaper, *Echo de l'Orient*, established in 1838, was transferred to Constantinople in 1846. But not one of these papers has survived until now. In 1876 the total number of journals of all kinds published in the capital was 72 (namely, 20 in French, 16 in Turkish, 13 in Armenian, 12 in Greek, 11 in as many other tongues); in 1877 it was 80. In 1882 the whole number published in all the Turkish dominions, Asiatic as well as European, is reported as 121 of all kinds and of all varieties of periodicity. Among the papers printed in Constantinople are four Bulgarian journals; the *Istoch no Vreme* is edited by an Englishman. Three other official newspapers for Bulgaria are published by the Turkish Government at Rustchuk, Adrianople, and Salonica. The Arabic *Jawáib* of the notorious and learned Fáris al-Shidiák has long been one of the best-known Oriental journals.

See *Bibliografia Italiana*, 1876, "Cronaca," p. 50; Lagai, *ut sup.*; Hubbard, ii. 1914–1918, 2458–9, 2588; *Zeitung für Staatswissenschaft*, 1876.

NEWSPAPERS OF INDIA AND CHINA.

India.—For a considerable period under the rule of the East India Company, the Indian press was very unimportant both in character and influence. It was permitted to shape its course and to gain a position as it could, under the potent checks of the deportation power and the libel law, without any direct censorship. Nor was it found difficult to inflict exemplary punishment on the writers of "offensive paragraphs."

Prior to Lord Wellesley's administration the most considerable newspaper published at Calcutta were *The World*, *The Bengal Journal*, *The Hurkaru*, *The Calcutta Gazette* (the organ of the Bengal Government), *The Telegraph*, *The Calcutta Courier*, *The Asiatic Mirror*, and *The Indian Gazette*. Not one of these eight journals has survived, as a substantive publication,[1] until now. Mr Duane, the editor of the first-named paper, was sent to Europe in 1794 for "an inflammatory address to the army," as was Mr Charles Maclean, four years afterwards, for animadverting in *The Telegraph* on the official conduct of a local magistrate. Lord Wellesley was the first governor-general who created a censorship (April 1799). His press-code was abolished by the marquis of Hastings in 1818. The power of transporting obnoxious editors to Europe of course remained. Perhaps the most conspicuous instance of its exercise was the removal of the editor of *The Calcutta Journal* (Silk Buckingham), which occurred immediately after Lord Hastings's departure from India, and during the government of his temporary successor, Mr John Adam. Buckingham's departure was followed closely (14th March 1823) by a new licensing Act, far exceeding in stringency that of Lord Wellesley, and (5th April 1823), by an elaborate "Regulation for preventing the Establishment of Printing-Presses without Licence, and for restraining under certain circumstances the Circulation of Printed Books and Papers." The first application of it was to suppress *The Calcutta Journal*.

In the course of the elaborate inquiry into the administration of India which occupied both Houses of Parliament in 1832, prior to the renewal of the Company's charter, it was stated that there were, besides 5 native journals, 6 European newspapers:—three daily, *The Bengal Hurkaru*, *John Bull*, and *The Indian Gazette*; one published twice a week, *The Government Gazette*; and two weekly, *The Bengal Herald* and *The Oriental Observer*. At this period every paper was published under a licence, revocable at pleasure, with or without previous inquiry or notice. At Madras, on the other hand, the press remained under rigid restriction. The Madras censorship was removed whilst the parliamentary inquiry of 1832 was still pending.

One question only, and that but for a brief interval, disturbed Lord William Bentinck's love of free discussion. The too famous "Half-Batta" measure led him to think that a resolute persistence in an unwise policy by the home Government against the known convictions of the men actually at the helm in India and an unfettered press were two things that could scarcely co-exist. It was on this occasion that Sir Charles Metcalfe recorded his minute of September 1830, the reasoning of which fully justifies the assertion—"I have, for my own part, always advocated the liberty of the press, believing its benefits to outweigh its mischiefs; and I continue of the same opinion." This opinion was amply carried out in the memorable law (drafted by Macaulay, and enacted by Metcalfe as governor-general in 1835), which totally abrogated the licensing system. It left all men at liberty to express their sentiments on public affairs, under the legal and moral responsibilities of ordinary life, and remained in force until the outbreak of the mutiny of 1857.

In 1853 Garcin de Tassy, when opening at Paris his annual course of lectures on the Hindustani language, enumerated and gave some interesting details concerning twenty-seven journals (of all sorts) in Hindustani. In 1860 he made mention of seventeen additional ones. Of course the circulation and the literary merits of all of them are relatively small. One, however, he said, had reached a sale of 4000 copies.[2]

In 1857 Lord Canning's law, like that of 1823, on which it is closely modelled, absolutely prohibited the keeping or using of printing-presses, types, or other materials for printing, in any part of the territories in the possession and under the government of the East India Company, except with the previous sanction and licence of Government, and also gave full powers for the seizure and prohibition from circulation of all books and papers, whether printed within the Indian territories or elsewhere.

The Act (March 1878) which now regulates the important part of the subject that concerns the vernacular press of India runs thus:—"Printers or publishers of journals in Oriental languages must, upon demand by the due officer, give bond not to print or publish in such newspapers anything likely to excite feelings of disaffection to the Government or antipathy between persons of different castes or religions, or for purposes of extortion. Notification of warning is to be made in the official gazette if these regulations be infringed (whether there be bond or not); on repetition, a warrant is to issue for seizure of plant, &c.; if a deposit have been made, forfeiture is to ensue. Provision is made not to exact a deposit if there be an agreement to submit to a Government officer proofs before publication."

The total number of journals of all kinds published within all the territories of British India was reported by the American consular staff in 1882 as 373, with an estimated average aggregate circulation per issue of 288,300 copies. Of these, 43, with an aggregate circulation of 56,650 copies, were published in Calcutta; 60, with an aggregate circulation of 51,776 copies, at Bombay.

See *Minutes of Evidence on the Affairs of the East India Company*, February to July 1832, i. 96–101, 166–180 (Company's edition); *Report of the Select Committee of House of Commons on the Affairs*, &c., 16th August 1832, 31, 32; *Report from Select Committee on the Suppression of the Calcutta Journal*, 4th August 1834; *Second Report from Select Committee on Indian Territories*, 12th May 1853, 64–68; *Further Papers on the Mutinies in the East Indies*, 1857, No. 5, 89–96; *Returns relating to the Restriction of the Liberty of the Press in India*, 24th August 1857; *Selections from the Papers of Lord Metcalfe*, 1855, 311 *sq.*; *The Oriental Herald*, 1824, i. 6–77, 123–142, 197–224; *Letters to the Marquis of Hastings on the Indian Press*, 1824, 61, &c.; *Memoirs and Correspondence of the Marquess Wellesley*, i. 281, ii. 128 *sq.*; Wilson, *History of British India, from 1805 to 1835*, 1848, iii. 581-585; *An Act for the Better Control of Publications in Oriental Languages*, March 1878; Hubbard, *Directory*, ii. 2458 *sq.*

China.—The *Peking Gazette* is said, traditionally, to date from the 10th century of the Christian era, but this is unsupported by evidence. The *Gazette* consists of three parts:—(1) *Kung-men-ch'ao*, "Copy of the Palace Gate," a sort of court circular; (2) *Shang-yü*, "Imperial Decrees"; (3) *Tsow-pao*, "Memorials from Officers of State." The answers to the documents printed in (3) sometimes appear subjoined as "apostils," sometimes as decrees in (2).[3] During part of the last century the *Gazette* was printed in the imperial palace from movable types of copper (probably brought into China by the Jesuits), afterwards from wax tablets, and for the last sixty years from movable types of wood.

Since 1858 several newspapers on the European model have been established in various large mercantile towns of China. The most notable is the *Seng-pao* of Shanghai, which circulates throughout many provinces. The *Daily Press* of Hong-Kong dates from 1860, the *North China Herald* from 1862. Of all sorts of journals China is credited with 22, of which 14 appear at Hong-Kong, the *Gazette* only at Peking.

See Sir Rutherford Alcock, "The Peking Gazette," in *Fraser's Magazine*, February and March 1873; W. F. Mayer, in *China Review* of 1877; *Bibliographie de la France*, 1877, pp. 103, 104; *Journal des Economistes*, xvi. 228, 1881.

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[1] *The Hurkaru* and *The Indian Gazette* were long afterwards combined under the new leading title, *Indian Daily News* (with the old name appended), and the joint publication survives, circulating, in 1882, about 1700 copies. All the Calcutta newspapers, properly so called, are comparatively of short duration, and also of narrow circulation. None at present exceeds 2000 copies, and only one—*Englishman's Overland Mail*—attains so high. The sporting journal, *Asian*, sells about 4500.

[2] Some valuable notices of vernacular journals in various tongues have been published from time to time in Trübner's *Oriental and American Record*.

[3] Of the former kind the following is a recent example. Li-Hung-Chang reports that the leader of the Nien-fei (northern rebels) "did really die by drowning," as lately announced. The emperor apostils, "I am greatly delighted to hear it."

NEWSPAPERS OF SOUTH AFRICA.

The chief papers of the Cape Colony are *The Evening Express* (6000) and *The Cape Argus* (5000). At Pretoria, the capital of the Transvaal, in 1882, four papers were published—three in Dutch, one in English.

NEWSPAPERS OF THE UNITED STATES.

Boston was the first city of America that possessed a local newspaper; but the earliest attempt in that direction, made in 1689, and a second attempt, under the title *Publick Occurrences*, which followed in September 1690, were both suppressed by the Government of Massachusetts. Only one copy of the first and two copies of the second of these two pioneers are now known to exist. One copy of the *Publick Occurrences* may be seen in the State Paper Department of the Rolls House in London. The other was recently exhibited at Philadelphia. The paper is a small quarto sheet, one of the four pages of which is blank, while the other three contain a record of passing occurrences, not unlike the contemporary news of the English press; and there is little in the paper to justify, in any sense, the governor's assertion that "it contained reflexions of a very high nature." Although it purports to be "printed by Richard Pierce for Benjamin Harris," it is probable that the latter was both printer and editor, as he had already been of a London paper (*The Post*), and was again at a subsequent period. Nearly fourteen years afterwards (April 24, 1704), the first number of *The Boston News-Letter* was "printed by B. Green, and sold by Nicholas Boone"; but its proprietor and editor—so far as it can be said to have had an editor, for extracts from the London papers were its staple contents—was John Campbell, postmaster of the town. In 1719 he enlarged his paper, in order, as he told his readers, "to make the news newer and more acceptable; . . . . whereby that which seem'd old in the former half-sheets becomes new now by the sheet. . . . . This time twelvemonth we were thirteen months behind with the foreign news beyond Great Britain [or, in other words, the attention of the Bostonian politicians was engrossed on the siege of Belgrade, when their contemporaries in the mother country were intent on the destruction of the Spanish fleet on the coast of Sicily], and now less than five months; so that . . . . we have retrieved about eight months since January last"; and he encourages his subscribers with the assurance that if they will continue steady "until January next, life permitted, they will be accommodated with all the news of Europe . . . . that are needful to be known in these parts." But Campbell's new plans were soon disturbed by the loss of his office, and the commencement of a new journal by his successor in the postmastership, William Brooker, entitled *The Boston Gazette*, "published by authority" (No. 1, 21st December 1719). The old journalist had a bitter controversy with his rival, but at the end of the year 1722 relinquished his concern in the paper to Benjamin Green, by whom it was carried on with higher aims and greater success.

Green conducted the paper until his death, at the close of 1733, and was succeeded by his son-in-law, John Draper, who published it until December 1762. By Richard Draper, who followed his father, the title was altered to *Massachusetts Gazette and Boston News-Letter*; and the maintenance of the British rule against the rising spirit of independence uniformly characterized his editorship and that of his widow (to whom, at a subsequent period, a pension was granted by the British Government). It was the only paper printed in Boston during the siege, and ceased to appear when the British troops were compelled to evacuate the city.

The Boston Gazette began, as we have seen, in 1719. James Franklin, elder brother of the celebrated Benjamin Franklin, was its first printer. It lasted until the end of 1754, its editorship usually changing with the change of the postmasters. On the 17th August 1721 James Franklin started *The New England Courant*, the publication of which ceased in 1727; and two years later Benjamin Franklin established *The Pennsylvania Gazette*, which he continued weekly until 1765.

To *The Boston Gazette* and the *Courant* succeeded *The New England Weekly Journal* (20th March 1727; incorporated with *The Boston Gazette* in 1741), and *The Weekly Rehearsal* (27th September 1731), which became *The Boston Evening Post* (August 1735), and under that title was for a time the most popular of the Boston newspapers. It aimed at neutrality in politics, and therefore did not survive the exciting events of the spring of 1775. Several minor papers followed, which may be passed over without notice. A new *Boston Gazette*, which began in April 1755, has, however, claims to be particularized. For a long time it was the main organ of the popular party, and expounded their policy with great ability, and in a dignified temper. Otis, John Adams, Samuel Adams, and Warren were amongst its writers.

The Massachusetts Spy, under the indefatigable editorship of the American historian of printing, Isaiah Thomas, did yeoman's service in this struggle, although of a different kind from that of *The Boston Gazette*. The latter spoke chiefly to the thinkers and natural leaders of the people. The *Spy* was a light and active skirmisher who engaged his antagonists wherever he met them, and frequently carried the war into the enemy's country. In July 1774, during the operation of the Boston Port Act, and soon after the landing of four British regiments, it adopted Franklin's odd device, representing Great Britain as a dragon, and the colonies as a snake divided into nine parts with the motto, "join or die." But Boston grew too hot for the patriotic printer, and he had to remove to Worcester on the day of the battle of Lexington. Here the paper continued to be published until 1786,—the lack of the stirring revolutionary matter being occasionally supplied by the republication in its columns of entire books, such as Robertson's *America* and Gordon's *History of the Revolution*. This journal, like so many more, was for a time killed by a tax. The stamp duty imposed in March 1786, though amounting to but two-thirds of a penny, and very speedily repealed, led to the suspension of the *Spy* until April 1788. At that period it was resumed; and it still continues, being the oldest newspaper in Massachusetts.

The Boston Sentinel is on many grounds a memorable newspaper. It was founded and for nearly forty years edited by Major Bursell, a man who combined ability with singular moderation of temper, and with singular modesty and disinterestedness. He printed the Acts of Congress for a very long time without charge. William Lloyd Garrison's once well-known *Boston Liberator* was founded on New Year's Day 1831. For a time its editor was also writer, compositor, and pressman. In December of that year the assembly of his State offered a reward of 5000 dollars to any one who would cause him to be apprehended and brought to trial. He continued the paper to the last day of 1861, and lived to witness the abolition of negro slavery.

At the commencement of the struggle for independence in 1775 Massachusetts possessed 7 newspapers, New Hampshire 1 (*The New Hampshire Gazette*, founded in 1756), Rhode Island 2, and Connecticut 3,—making 13 in all for the New England colonies. Pennsylvania had 8, of which the earliest in date was *The American Weekly Mercury* (No. 1, 22d December 1719); and New York but 3, the oldest of them being *The New York Gazette*, the publication of which had commenced on the 16th October 1725. Up to that period (1725) Boston and Philadelphia were the only towns possessing a newspaper throughout America. In the middle and southern colonies there were, in 1775, in the aggregate, 10 journals, of which Maryland, Virginia, and North Carolina possessed each 2, South Carolina 3, and Georgia 1. The total number of the Anglo-American papers was 34, and all of them were of weekly publication.

The New Hampshire Gazette still exists, and is the "father" of the New-England press. In 1810 this State possessed 12 papers; in 1828, 17; in 1840, 27; in 1850, 32,—viz., 22 described as "political," and 10 as "miscellaneous." The earliest paper established in Vermont was *The Green Mountain Postboy*, first published in April 1781. In 1850 the number of newspapers was 30, 27 of which are described as "political." Maine possessed in 1850 29, 4 of them of daily publication. Rhode Island had 13, of which 5 were daily; Connecticut had 28, including 7 daily papers; Massachusetts possessed in 1850 no less than 91 newspapers, about two-thirds of them published in Boston. Of the whole number, 22 were of daily and 54 of weekly publication.

Pennsylvania had in 1810 71 newspapers; in 1850, 210, with a collective circulation of 338,336 copies; in 1870, 540, with a circulation of 3,419,765 copies; and in 1880, 973, with a circulation of 5,031,061 copies.

The Aurora was the most notable of the early Philadelphia papers, next to Franklin's *Gazette*. Its hostility to Federalism, and to Washington as the main pillar of the Federalists, was violent. *The Daily National Gazette*, started in 1820, soon became prominent for its union of literature with politics.

The earliest journal of Maryland was William Parker's *Maryland Gazette*, established in 1727, when in all America it had but six existing predecessors. Discontinued in 1736, it was revived in 1745 by Jonas Green, to exist to the present day as the flourishing patriarch of American journals. In Maryland there were, at the census of 1850, 40 newspapers; at that of 1870, 88, with an aggregate circulation of 235,450 copies. In March 1880 its capital, Baltimore, had 4 daily newspapers—a number equal to that of Boston, and surpassed only by Philadelphia, New York, Cincinnati, and Chicago.

New Jersey had no really established newspaper before the Revolution, although the first number of an intended journal was published in 1765, under the title of *The Constitutional Gazette, containing matters interesting to Liberty, but no wise repugnant to Royalty*. The earliest regular paper was *The New Jersey Gazette*, which began in December 1777. New Jersey in 1850 had 45 newspapers; in 1870, 122.

Virginia, notwithstanding its illustrious precedency,—the province of Raleigh, the cradle of Washington,—possessed neither newspaper nor printing office until 1736, so that (as respects one-half at least of the wish) there was once a prospect that the devout aspiration of Sir William Berkeley might be realized. "Thank God," said this Virginian governor in 1671, "we have neither free school nor printing press, and I hope may not have for a hundred years to come." The earliest journal established in the State was *The Virginia Gazette*, commenced in 1736. *The Richmond Inquirer*, which started in 1804, early attained a leading position. In 1810 the total number of Virginian papers was 23; in 1828, 37; at the census of 1850, 67; in 1870, 173, with an average total circulation of 198,272 copies. North Carolina had, in 1850, 37 journals, with an aggregate circulation of 25,439 copies; in 1870 it had 64, with 64,820; South Carolina in 1870 had 55, with 80,900; Georgia 110, with 150,987 of circulation; Florida 23, with 10,545; Alabama 89, with a circulation of 91,165 copies.

In New York, the *Gazette* already mentioned was followed by *The Weekly Journal* (No. 1, 5th November 1733), still memorable for the prosecution for sedition which it entailed on its printer, John Peter Zenger, and for the masterly defence of the accused by Andrew Hamilton. "The trial of Zenger," said Gouverneur Morris, "was the germ of American freedom." Gaines's *New York Mercury* was published from 1752 to 1783. Rivington's *Royal Gazette* was established in 1773, and in the first year of its existence is said to have attained a circulation of 3600. After the Revolution this paper was continued under the title *New York Gazette and Universal Advertiser*. The first daily newspaper published in the city or State of New York was *The New York Journal and Register*, commenced in 1788. In 1810 the aggregate number of papers published within the State was 66, of which 14 belonged to New York city. Ten years later the city press included 8 daily journals, with an aggregate daily circulation of 10,800 copies. No one paper circulated more than 2000, and but two—*The Evening Post* and *The Commercial Advertiser*—attained that number. In 1832 there were 13 daily journals, with a collective daily circulation of 18,200. In 1850 the number of daily papers was 51, with an aggregate annual circulation of 63,928,685.

The penny press of America began in New York, and the pioneer was *The Daily Sun* (No. 1, 23d September 1833), written, edited, set up, and worked off by Benjamin Franklin Day, a journeyman printer. Its circulation at first was 600 copies; in 1854 its average issue was 36,525 copies. Its success has been described with sufficient significancy as mainly owing to "piquant police reports," at least at the outset. It was afterwards reorganized, and made to take a more vigorous political course, chiefly on the Democratic side. Without increasing its size or changing its price, it has thus become one of the most profitable journals in New York. *The New York Herald* followed in May 1835. Exceptional and eccentric forms of advertisement were persistently used to gain notoriety for the new paper, and its commercial success was great. Within twenty years it had attained a circulation of 36,158 copies,—which was at that date about five times the circulation of any London newspaper, *The Times* only excepted,—and the issue has since greatly increased. The *Herald* is said to be still "the most fickle, coarse, and blustering of American papers," but it is none the less conducted with conspicuous skill and enterprise. It often contains several columns of "exclusive" telegrams, obtained by a lavish outlay. In a single number during 1882, forty columns of original matter appeared. In another number (also of 1882) one hundred columns of advertisements appeared, containing nearly 4000 several insertions. The one fact explains the other. James Gordon Bennett, the founder, proprietor, and editor of the *Herald*, gradually yielded its management in the later years of his life to his only son, of the same name, who succeeded to the absolute control on his father's death. The elder Bennett left a large fortune; and of part of this a noble use was eventually made. Besides the expenditure on the world-famous mission in search of Livingstone, a generous but unfortunate Arctic exploration enterprise was fitted out from the same fund. A popular subscription for the relief of the suffering in Ireland was also started with a gift of a hundred thousand dollars from the *Herald*. *The New York Tribune* was established in 1841 by Horace Greeley, who remained its editor and one of its proprietors until his death, shortly after his defeat for the presidency in 1872. It was also, at the outset, a penny paper, but it differed from its cheap rivals in being a vigorous political propagandist, and in giving hospitable attention to literature and to novel ideas in social and political economy. Thus it allowed contributors to expound and defend the doctrines of Fourier; it encouraged various efforts at founding associations more or less communistic and educational; after the failure of the famous Brook Farm experiment, it took the president and three other conspicuous members of that association upon its staff; it was early in giving serious notice to the so-called manifestations of spiritualism; it advocated co-operation instead of trades unions and strikes as the best remedy for the wrongs or misfortunes of labour; and it led in the warfare upon slavery through political agencies. The *Tribune* made the first great use of the Atlantic cables for transmitting war correspondence, in its voluminous reports of the Franco-Prussian war. Another of its notable feats was the translation of the "cipher dispatches," revealing the effort by some of Mr Tilden's partisans to purchase electoral votes for him, in the disputed presidential election of 1876. Its circulation in 1851 was 19,000 copies, of which somewhat more than half was sold within the limits of the city. It had gained in 1857 a daily circulation of about 29,000 copies, and in addition issued as a weekly paper 163,000 copies, irrespectively of certain special issues for California and for Europe. The circulation in both forms is now, in 1883, greatly increased, but there are no quite trustworthy records of the present issues of the New York press. *The New York Times* was established by Henry J. Raymond in September 1851; and, though absent at times in the discharge of his duties as lieutenant-governor of New York and member of congress, he continued its editor and chief proprietor until his death in June 1869. It was intended to satisfy the wants of those who preferred a journal of the *Tribune's* general political tendencies and literary character, but with a more moderate and conservative spirit. The *Times* also began as a cheap paper; and it was successful almost from the first. Its greatest good fortune came after the death of its founder, in its discovery and vigorous exposure of the frauds and robberies committed by the "Tweed Ring," in the municipal government of New York, a work for which it received great praise and profit. These are amongst the prizes of New York journalism. How numerous the blanks are may be inferred from the statement that between the years 1820 and 1850 32 daily newspapers were founded and abandoned.

The prices of the more important New York papers were advanced to three, and finally, during the war of the Rebellion, to four cents. They all came to make regular issues on Sunday also, when the price was generally five cents. In September 1883 the *Times* suddenly reduced its price from four to two cents. The *Herald* did the same; but the *Tribune* stopped at three cents, being now the only one of the great morning journals to charge over two cents. There are also several one-cent papers, with considerable circulations. Their inroads upon the larger journals, and that from the *World*, an eight-page Democratic newspaper sold at two cents, are supposed to have forced the reductions in price above named, which are obviously to make a great change both in the character and prosperity of the press of New York.

The expenditures upon the New York newspapers have greatly increased since 1860. Forty columns of news and editorial comment are often given in a single eight-page paper; extra sheets are frequent, and are always given when advertisements require it. The *Herald* sometimes prints as many as 32 pages in one issue. Nearly all the news is now received by telegraph, and a large part of it is collected for each paper by its own staff of correspondents and reporters. Several papers lease telegraphic wires to Washington for their own use. A large staff of reporters is also maintained by each for occurrences in and about the city—twenty-five to fifty reporters not being an unusual number for any of the more important journals.

The New York Associated Press is the chief news agency of the American continent. It is a partnership between the *Herald*, *Tribune*, *Times*, *Sun*, *World*, *Journal of Commerce*, and *Mail and Express* for the collection of such news as its members may wish to use in common, and the sale of it to others. This and the Western Associated Press—an organization of a large number of the more important newspapers of Chicago, Cincinnati, St Louis, and other cities in the Mississippi valley—are now consolidated in a working arrangement, under the management of a permanent joint executive committee, who appoint agents, contract with telegraph companies, distribute the news to the members of the two associations, and sell it to a great number of individual papers and other associations. They transmit proceedings of Congress and the State legislatures, public documents, market news, the dispatches by ocean cables, and, in general, accounts of all public occurrences of interest.

Until the reductions of 1883, the prevailing price for first-class papers, of eight or more pages, was, in New York, four cents; in Chicago, Cincinnati, St Louis, and elsewhere, five cents. The past ten years, however, had been notable for the growth of another class of journals, of about half the size, generally of only four pages, which aimed at a greater condensation of routine news, and often at giving special prominence to "sensations." These were sold at two cents, and frequently attained great success. The New York *Sun*, Boston *Herald*, Philadelphia *Times*, Chicago *News*, and San Francisco *Chronicle* were good examples. Equally successful, if generally less sensational, were the Philadelphia *Ledger*, Baltimore *Sun*, Washington *Star*, and San Francisco *Call*. The wide circulation and handsome profits of this class of journals have developed a considerable reaction against large papers, extreme fulness of news detail, and long editorial comment. Most of the newspapers started or projected now are of this two-cent class.

The great distances in the United States, the excellent and cheap telegraphic service, and the facilities afforded by the Associated Press combine to promote the growth of what would be called in England "provincial journals." Cincinnati, Chicago, and St Louis being each over a day's and a night's journey from New York, Boston, or Philadelphia, are able to build up first-class papers of their own. In Chicago the *Tribune*, *Times*, and *Inter-Ocean* are all strong and enterprising eight-page journals, often sending out double or sixteen-page sheets, maintaining large corps of correspondents, and leasing private wires from New York and Washington. Substantially the same may be said of the *Commercial Gazette* and the *Enquirer* of Cincinnati, of the *Globe-Democrat* and the *Republican* of St Louis, and of the *Times-Democrat* of New Orleans. Some of these papers realize net profits of over a hundred thousand dollars in a single prosperous year.

Nearly every town of 15,000 inhabitants has its own daily paper. Scarcely a "county seat" in the settled part of the United States is without its weekly paper,—even if the population should be below 1000. In the older counties, villages of a few hundred inhabitants in the "out-townships" are also apt to have a weekly. These are often of the class known as "patent outsides," for which the first and fourth pages, composed of reprint matter and advertisements, are made up and printed in a central office, doing such work by wholesale for hundreds of papers, while the half-printed sheets are then forwarded to the local office, to be filled out with village news and advertisements.

Only one illustrated daily paper is published in America, the *Daily Graphic* of New York. It prints regularly woodcuts and other engravings on four of its eight pages. The illustrated weeklies are numerous,—the best known in New York being *Harper's Weekly*, *Harper's Bazar*, and *Frank Leslie's Illustrated Paper*.

Elaborate as are the newspaper returns given in the successive census reports of the United States, they are only to be relied upon for precise information when limited to papers of daily issue. The classification of the main returns is headed "periods of issue"; and, although there is a subsidiary classification, according to character, this fails to elicit even the simple distinction between newspapers and magazines. Of the 5871 publications shown by the census of 1870, 4333 are classed as political. The 11,314 of the 1880 census are classified thus:—devoted to news, politics, and family reading, 8863; religious, 553[1]; agricultural, horticultural, &c., 173; commerce and trade, 284; financial, 25; insurance and railroads, 54; general literature (including magazines), 189; medicine and surgery, 114; law, 45; science and mechanics, 68; freemasonry, oddfellowship, temperance, &c., 149; educational, 248; children's periodicals, 219; miscellaneous, 330. The Sunday newspapers (included in the above figures) numbered 252. The arrangement is different from that of former returns, and, in this absence of uniformity, we cannot give any precise statement, at once comparative and detailed, of the progress of American journalism.

Nor will the *Directories* of the well-known advertising houses of agency—such as those of Pettengill and of Hubbard—serve the purpose, for reasons which are thus stated by the able statistician who edited the "Population and Social Science Tables" in the census report of 1870. "There are," he writes in his prefatory remarks, "very considerable numbers of issues of . . . . sheets, intended for distribution at places of public amusement, and a dozen other forms of advertisement, 'more or less disguised under a show of presenting news or criticism' to the public. . . . To swamp statistics [of newspapers] . . . by inconsiderately admitting hundreds of . . . advertising sheets, would be undoubtedly an abuse." But shoals of such are recorded in Pettengill's *Directory* and in Hubbard's *Record*.

The following figures are from the official returns for 1850, 1870, and 1880. "Class papers" are included among the newspapers for 1850 and 1870, while the heading in the census tables of 1880 is "newspapers and periodicals." The 1880 returns do not furnish statistics of annual circulation. The aggregate circulation per issue of the 971 dailies in 1880 was 3,566,395, and that of the 10,343 other papers (8633 of which were published weekly and 1167 monthly) 28,213,291.

General Statistics of the Newspaper Press of the United States for 1850, 1870, *and* 1880 *respectively.*

States and Territories.*	1850.				1870.				1880.			
	Population.	No. of Newspapers.	Total Circulation.	Aggregate No. of Copies Printed Annually.	Population.	No. of Newspapers.	Total Circulation.	Aggregate No. of Copies Printed Annually.	Population.	No. of Daily Papers.	Total No. of Periodicals.	Total Circulation.
1. Maine	583,169	29	29,695	2,501,680	626,915	65	170,690	9,867,680	648,936	12	123	6,214,460
2. New Hampshire	317,976	22	22,186	1,673,672	318,300	51	173,919	7,237,588	346,991	10	87	185,968
3. Vermont	314,120	27	33,990	2,025,430	330,551	47	71,390	4,055,300	332,286	5	82	130,192
4. Massachusetts	994,514	91	222,067	46,587,800	1,457,351	259	1,692,124	129,691,266	1,783,085	39	427	2,012,999
5. Rhode Island	147,545	13	20,575	2,476,150	217,353	32	82,050	9,781,500	276,531	8	44	97,121
6. Connecticut	370,792	26	34,916	3,422,432	537,454	71	203,725	17,454,710	622,700	17	139	237,660
7. New York	3,097,394	278	527,125	82,780,025	4,382,759	835	7,561,497	471,741,744	5,082,871	115	1,411	9,374,134
8. New Jersey	489,555	45	40,444	3,917,047	906,096	122	205,500	18,625,740	1,131,116	27	215	249,478
9. Pennsylvania	2,311,786	210	338,336	59,717,508	3,521,951	540	3,419,765	241,170,540	4,282,891	98	973	5,031,061
10. Delaware	91,532	8	6,600	374,400	125,015	17	20,860	1,607,840	146,608	5	26	34,425
11. Maryland	583,034	40	32,337	4,205,324	780,894	88	235,450	33,497,778	934,943	15	143	414,693
12. District of Columbia	51,687	16	99,787	11,045,336	131,700	22	81,400	10,092,800	177,624	5	44	213,923
13. Virginia	1,421,661	67	56,188	7,950,076	1,225,163	173	198,272	17,331,978	2,131,022	20	194	256,471
14. North Carolina	869,039	37	25,439	1,571,414	1,071,361	64	64,820	6,684,950	1,399,750	13	142	105,501
15. South Carolina	668,507	29	36,415	6,451,330	705,606	55	80,900	8,901,400	995,577	4	81	69,902
16 Georgia	906,185	26	23,946	2,238,690	1,184,109	110	150,947	15,539,724	1,542,180	16	200	269,066
17. Florida	87,445	7	3,500	202,800	187,748	23	10,545	649,220	269,493	3	45	27,332
18. Alabama	771,623	46	25,336	2,202,169	996,992	189	91,165	9,198,080	1,262,505	6	125	93,073
19. Mississippi	606,526	40	26,380	1,519,024	827,922	111	71,868	4,703,336	1,131,597	5	123	87,904
20. Louisiana	517,762	40	57,522	11,691,324	726,915	92	84,165	13,755,690	939,946	13	112	131,630
21. Texas	212,592	15	9,750	808,800	818,579	112	55,250	4,214,900	1,591,749	30	280	263,289
22. Arkansas	209,897	6	3,950	205,400	484,471	56	29,830	1,824,360	802,525	6	117	108,501
23. Tennessee	1,002,717	38	34,757	5,642,510	1,258,520	91	225,952	18,300,344	1,542,359	12	198	293,388
24. Kentucky	982,405	44	56,736	5,496,288	1,321,011	89	197,130	18,270,160	1,648,690	11	205	397,564
25. Missouri	682,044	42	48,340	5,496,280	1,721,295	270	522,866	47,980,422	2,168,380	43	530	965,285
26. Illinois	851,470	74	52,401	3,787,932	2,539,891	505	1,722,541	113,140,492	3,077,871	74	1,017	2,421,275
27. Indiana	988,416	84	47,900	3,569,324	1,680,637	203	363,542	28,964,964	1,978,301	40	467	661,111
28. Ohio	1,980,329	196	202,785	23,086,067	2,665,260	395	1,388,367	98,548,814	3,198,062	56	774	3,093,931
29. Michigan	397,654	40	28,998	2,582,336	1,184,059	211	253,774	19,686,978	1,636,937	33	464	620,974
30. Wisconsin	305,391	42	29,236	2,517,487	1 054,670	190	343,385	28,762,920	1,315,497	21	340	436,576
31. Iowa	192,214	26	21,380	1,469,000	1,194,020	233	219,000	16,403,380	1,624,615	30	569	547,[illegible]40
32. California	92,597	4	2,000	626,000	560,247	201	491,903	47,472,756	864,694	58	361	640,026
33. Oregon	13,294	1	510	26,520	90,923	35	45,750	3,657,300	174,768	7	74	85,786
States, &c., formed between 1850 and 1870.												
34. Arizona	...	...	...		9,658	1	380	14,560	40,440	6	17	13,550
35. Colorado	...	...	...	..	39,867	14	12,750	1,190,600	194,327	19	87	95,744
36. Dakota	...	...	...	...	14,181	3	1,651	85,904	135,177	9	67	36,943
37. Idaho	...	...	...	...	14,999	6	2,750	200,200	32,610	...	10	5,650
38. Kansas	...	...	...	...	367 399	97	96,803	9,518,176	996,096	20	347	280,729
39. Minnesota	...	...	...	...	439,706	95	110,778	9,543,636	780,773	10	223	222,074
40. Montana	...	...	...	...	20,595	10	19,580	2,860,600	39,159	4	18	20,827
41. Nebraska	...	...	...	...	122,993	42	31,600	3,388,500	452,402	15	139	154,570
42. Nevada	...	...	...	...	42,491	12	11,300	2,572,000	62,266	14	37	27,745
43. New Mexico	...	...	...	...	91,874	5	1,525	137,350	119,565	3	18	6,355
44. Utah	...	...	...	...	86,786	10	14,250	1,578,400	143,963	5	22	36,175
45. Washington	...	...	...	...	23,955	14	6,785	396,500	75,116	4	29	16,751
46. Wyoming	...	...	...	...	9,118	6	1,950	243,300	20,789	3	11	5,686
Totals	23,112,872	1,713	2,211,512	309,868,095	38,558,371	5,871	20,842,475	1,508,548,250	50,155,783	971	11,314	31,779,686

* The order of the States is here given as they are enumerated in the official tables of the census of 1850. In recent censuses the States are placed alphabetically.

Of the 11,314 periodicals in 1880, 10,515 were in English, 641 in German, 49 in Danish and Scandinavian, 41 in French, and 26 in Spanish. The number of "journalists" in the United States in 1880 was returned as 12,308 (12,020 males and 288 females).

If we adopt Hubbard's newspaper statistics of 1880 for the United States collectively,—including, as they do, a considerable number of sheets which contain advertisements only, and which therefore are rejected from the official lists adopted by the statists of the census office at Washington, while, on the other hand, trade-journals and class-journals (embraced in the census returns), which contain no "news" and no politics, are excluded,—and add to them the number of newspapers published within the Dominion of Canada, we obtain a grand total for the North American continent, as a whole, of 10,131 "newspapers" of all sorts. Of these, 899 are published daily, 8428 weekly or twice or thrice a week, and 804 at longer intervals. The aggregate circulation of the whole number amounts to about 20,680,000 copies; and the aggregate annual issue of the whole somewhat exceeds 1,836,476,000 copies.

That, on the whole, industrialism has too much over-weighted literature in the development of American journalism is the statement of the most observant and thoughtful of American publicists and statesmen. It is the shady side of a theme which, in many of its aspects, has much of brightness and of mental energy. The fact was recognized by an eminent judge many years ago in the ordinary course of his official duty. "The copyright law," said Mr Justice Thompson from the bench of the State of New York, in the cause Clayton *v.* Stone, "is an Act for the encouragement of learning, not of mere industry. A newspaper . . . is not such a publication as falls under the protection of the copyright laws."

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[1] Including Methodist, 75; Roman Catholic, 70; Baptist, 63; Presbyterian, 42; Episcopal, 32; and "unsectarian," 96.

See the different Census Reports of the United States, Washington, 1853, 1872, and 1882-83; Buckingham, *Specimens of Newspaper Literature*, 2 vols., Boston, 1850; Coggeshall, *The Newspaper Record*, Philadelphia, 1856; Sparks, *Life and Works of Franklin*, i. 23, 123, &c.; *Life and Works of John Adams*, ii. 405; *Proceedings of the New York Historical Society* for 1844; *Historical Notices of Newspapers published in New Hampshire*, in Farmer and Moore's collection, iii. 174 *sq.*; Frothingham, *History of the Siege of Boston*, 31 *sq.*; *Minutes of Evidence before the Select Committee on Newspaper Stamps* (evidence of Mr H. Greeley), pp. 389-395, 438-448; Andrews, *History of British Journalism*, i. 296-305, 1859; Hubbard, *Record, &c.*, New Haven, Conn., 1880, and other publications; papers by C. de Varigny, on "American Journalism," in *Revue des Deux Mondes*, 1877, ii. 113-149; F. Hudson, *Journalism in the United States*, New York, 1873.

Newspapers of British America and Central America.

The virtual senior of the Canadian press is the *Gazette*, still published at Montreal, which may fairly be considered as the continuation (or at least the representative) of the original *Gazette*, established in that city in January 1765. It is now a daily paper —one of 10 dailies, three of which (*La Minerve*, *Le Nouvel Monde*, and *L'Évènement*) appear in French. There are also 3 weekly papers. Toronto has now 8 daily journals, and Ottawa 4. *The Halifax Gazette* (pioneer of the Nova Scotia press) was established in January 1751, but it had an existence of less than twenty years. Halifax now publishes 4 daily papers. In all parts of British America, collectively, 67 daily newspapers were published in 1882, with an aggregate circulation of each issue estimated (by the American consular agents) at 237,788. The total number of journals of all kinds published in the British-American provinces is stated at 624, with an average circulation for each issue of about 2600 copies.

The press of the West Indies begins at Barbados with Keimer's *Gazette* of 1731, followed by Grenada in 1742. In 1882 there were in the West Indies 47 daily papers with an estimated average circulation, per issue, of 1813 copies. Kingston (in Jamaica), with a population of 38,556, had five daily papers, at the head of which appears *The Gleaner* (1300 copies). Havana (in Cuba), with a population of about 300,000, has 11 daily papers, of which the four chief are thus reported:—*Diario de la Marina* (circ. 10,000), *La Voz de Cuba* (8000), *El Triunfo* (8000), *La Discusion* (6000).

The principal newspaper of San José, the capital of the republic of Costa Rica (population about 18,000), is *The Central American Reporter*, a daily journal (circ. 8000). S. Salvador, capital of the republic of that name, has a daily journal, *El Boletin Oficial*, which circulates 2000 copies.

The city of Mexico (population about 230,000) has 24 daily papers, of which *El Diario Oficial* (4000 copies) and *La Patria* (5000) are the chief.

Newspapers of South America.

(1) *Brazil.*—The chief daily newspaper of Rio de Janeiro is the *Journal de Commercio*, which dates from 1823, and has a circulation of about 16,000. The official organ, *Gazeta de Noticias*, is said to circulate 24,000. The *Cruzeiro* follows with 12,000, and *O Apostolo*, the principal organ of the Roman Catholics, with 7000. There are, in all, 8 daily papers. Among the papers of less frequent publication are one in French (established in 1863) and also one in German.

(2) *Argentine Republic.*—The chief papers of Buenos Ayres are *The Standard and River Plate News* (3500) and *La Tribuna Nacional* (3000).

(3) *Chili.*—In Santiago are published *El Ferro Carril* and *El Diario Oficial* (5000).

(4) *Peru.*—Lima, with a population exceeding 100,000, has no journal with a larger circulation than *La Patria* (2500).

(5) *Uruguay.*—Montevideo (population 110,000) has 17 daily papers, of which the principal are—*El Ferro Carril* (6000), *El Siglo* (5000), and *La Nacion* (3000).

(6) *Venezuela.*—The chief papers of Carácas are *El Monitor* (7500), *La Opinion Nacional* (5000), and *La Gaceta Oficial* (5000).

Newspapers of Australasia.

(1) *New South Wales.*—Sydney (population 134,137) has 6 daily newspapers, of which the circulation of the chief ones, as it is stated by their respective publishers, stands thus:—*Evening News*, of which three or four successive editions are regularly published, 35,000; *The Australian Town and Country Journal*, 30,000; *The Bulletin*, 20,000.

(2) *South Australia.*—Adelaide (population 32,250) has 4 daily papers.

(3) *Victoria.*—Melbourne, with a population nearly nine times as large (282,907), has the like number. The publisher of the chief one, *The Age*, reports its circulation as 44,000.

(4) *New Zealand.*—Wellington (population about 19,000) has also 4 dailies, of which *The New Zealand Times* (7000) is the chief.

(5) *Tasmania.*—Hobart Town, with a population of about 20,000, has 3 dailies. One of these, *The Evening Star*, circulates 3000 copies.

Comparative Statistics.

It is almost impossible by any statistical detail to give an idea of the recent advances made—even as regards circulation merely—by the newspaper press; but an outline of the general results reached by three statists, who published their summaries respectively in 1828, 1866, and 1882, may have its utility.

The earliest summary is that of Adrien Balbi. It was published in the *Revue Encyclopédique* for 1828 (vol. i. pp. 593–603), along with much matter of more than merely statistical interest. The numbers of newspapers published in different countries at that date are given as follows:—France, 490; United Kingdom, 483; Austria, about 80; Prussia, 288; rest of the Germanic Confederation, 305; Netherlands, 150; Spain, 16; Portugal and the Azores, 17; Denmark, Sweden, and Norway, 161; Russia and Poland, 84. The respective proportions of journals to population were—for Prussia 1 to 41,500, German states 1 to 45,300, United Kingdom 1 to 46,000, France 1 to 64,000, Switzerland 1 to 66,000, Austria 1 to 400,000, Russia 1 to 565,000. Europe had in all 2142 newspapers, America 978, Asia 27, Africa 12, and Oceania 9; total 3168. Of these, 1378 were published in English-speaking countries (800 of them in the United States), having a population of 154 millions, and 1790 in other countries, with a population of 583 millions.

The second summary is that given by Eugène Hatin in an appendix to his very able *Bibliothèque de la Presse périodique*. His enumeration of newspapers is as follows: —France, 1640; United Kingdom, 1260; Prussia, 700; Italy, 500; Austria-Hungary, 365; Switzerland, 300; Belgium, 275; Holland, 225; Russia, 200; Spain, 200; Sweden and Norway, 150; Denmark, 100; United States, 4000. Here the proportions of papers to population are —Switzerland and United States 1 to 7000, Belgium 1 to 17,000, France and the United Kingdom 1 to 20,000, Prussia 1 to 30,000, Spain 1 to 75,000, Austria 1 to 100,000, Russia 1 to 300,000. Hatin assigns to Europe a total of 7000, to America 5000, and to the rest of the world 250, making in all 12,500.

The third summary is that of Henry Hubbard, published in his *Newspaper Directory of the World* (New Haven, Connecticut, 1882), a work the value of which is marred by the exclusively commercial spirit that has moulded its compilation, and its want of literary character. Its scope embraces a very considerable number of serial publications which cannot be classed as newspapers. Still—all this being understood—Hubbard's figures, which were collected (chiefly by the American consuls and consular agents in all parts of the world) about 1880, cannot be disregarded. The following are his general results:—

	Estimated Population (1880).	Daily Newspapers.		Other Publications.	
		Number.	Circulation per Issue.	Number.	Circulation per Issue.
Europe.....	301,356,000	2,408	15,682,425	10,730	33,901,400
Asia..	1,007,128,000	154	550,786	337	257,000
Africa.. ...	205,000,000	25	55,475	125	167,220
N. America	76,033,000	1,186	4,758,223	9,656	22,078,000
S. America	29,988,000	208	347,490	427	354,860
Australasia	3,670,000	94	246,850	471	488,000
Total.......	1,623,175,000	4,020	21,641,199	21,746	57,236,480

(E. ED.—W. R.)

NEWTON, a city of the United States, in Middlesex county, Massachusetts, about 8 miles west of Boston, on the south bank of the Charles river. It is divided into seven wards, and contains the post-villages of Auburndale, Chestnut Hill, Newton, Newton Centre, Newton Highlands, Newton Lower Falls, Newton Upper Falls, Newtonville, West Newton, and Nonantum. Newton is principally inhabited by Boston merchants, and, each village being a collection of fine residences with beautiful grounds, it has been designated "the Garden City of New England." The water-power furnished by the river is turned to account by numerous manufactories producing paper, hosiery, dye stuffs, emery paper, ink, soap, shoddy, &c. The first Baptist theological seminary in America was established in Newton Centre in 1826; it is now a flourishing institution with a library of 15,000 volumes, and five resident professors. Laselle Female Seminary at Auburndale dates from 1851. First settled in 1630, Newton was incorporated as a town in 1679, as a city in 1873. Its population was 3351 in 1840, 8382 in 1860, 12,825 in 1870, and 16,995 in 1880.

NEWTON, Sir Isaac (1642–1727), the greatest of natural philosophers, was born on the 25th of December 1642 (o.s.), at Woolsthorpe, a hamlet in the parish of Colsterworth, Lincolnshire, about 6 miles from Grantham. His father (also Isaac Newton) was the farmer of a small freehold property of his own. He died before his son's birth, a few months after his marriage to Hannah Ayscough, a daughter of James Ayscough of Market-Overton. When Newton was little more than two years old his mother married Mr Barnabas Smith, rector of the neighbouring parish of North Witham. Of this marriage there was issue, Benjamin, Mary, and Hannah Smith, and to their children Sir Isaac Newton subsequently left the greater part of his property. After having acquired the rudiments of education at two small schools in hamlets in close proximity to Woolsthorpe, Newton was sent at the age of twelve to the grammar school of Grantham, the head-master of which was Mr Stokes. While attending Grantham school Newton lived in the house of Mr Clark, an apothecary of that town. According to his own confession he was far from industrious, and stood very low in his class. An unprovoked attack from the boy next above him led to a fight, in which Newton's pluck gave him the victory. This success seems to have led him to greater exertions in school, and after some time he rose to be the head boy of the school. He cared but little for the ordinary amusements of his schoolfellows, but he displayed very early a taste and an aptitude for mechanical contrivances. He made windmills, water-clocks, kites, and dials, and he is said to have invented a four-wheeled carriage which was to be moved by the rider. In 1656 Mr Smith died, and Newton's mother came back with her three children to Woolsthorpe. Newton was then in his fifteenth year, and, as his mother in all probability intended him to be a farmer, he was taken away from school. He was frequently sent on market days to Grantham with an old and trusty servant, who made all the purchases, while Newton spent his time among the books in Mr Clark's house. It soon became apparent to Newton's relatives that they were making a great mistake in attempting to turn him into a farmer, and he was therefore sent back again to school at Grantham. His mother's brother, Mr W. Ayscough, the rector of the next parish, was a graduate of Trinity College, Cambridge, and when he found that Newton's mind was wholly devoted to mechanical and mathematical problems, he urged upon Mrs Smith the desirability of sending her son to his own college, a proposal to which she was not at all unwilling to give her consent. He was accordingly admitted a member of Trinity College on June 5, 1661, as a subsizar, and was matriculated on July 8. We have scarcely any information as to his attainments when he commenced residence, and very little as to his studies at the university before he took the degree of bachelor of arts. It is known that while still at Woolsthorpe Sanderson's *Logic*, a book which his uncle had given him, had been read by him to such purpose that his tutor at Trinity College excused his attendance at a course of lectures on that subject. Newton tells us himself that, when he had purchased a book on astrology at Stourbridge fair, a fair held close to Cambridge, he was unable, on account of his ignorance of trigonometry, to understand a figure of the heavens which was drawn in this book. He therefore bought an English edition of Euclid with an index of propositions at the end of it, and, having turned to two or three which he thought likely to remove his difficulties, he found them so self-evident that he expressed his astonishment that any one should have taken the trouble to offer demonstrations of them. He therefore put aside Euclid "as a trifling book," and applied himself to the study of Descartes's *Geometry*. He had some difficulty in mastering this work, but he succeeded in doing so without any assistance. It is reported that in his examination for a scholarship at Trinity, to which he was elected on April 28, 1664, he was examined in Euclid by Dr Barrow, who formed a poor opinion of his knowledge, and that in consequence Newton was led to read the *Elements* again with care, and thereby to form a more favourable estimate of Euclid's merits.

The study of Descartes's *Geometry* seems to have inspired Newton with a love of the subject, and to have introduced him to the higher mathematics. In a small commonplace book, bearing on the seventh page the date of January 1663–4, there are several articles on angular sections, and the squaring of curves and "crooked lines that may be squared," several calculations about musical notes, geometrical propositions from Francis Vieta and Schooten, annotations out of Wallis's *Arithmetic of Infinites*, together with observations on refraction, on the grinding of "spherical optic glasses," on the errors of lenses and the method of rectifying them, and on the extraction of all kinds of roots, particularly those "in affected powers." And in this same commonplace book the following entry made by Newton himself, many years afterwards, gives a further account of the nature of his work during the period when he was an undergraduate:—

> "July 4, 1699.—By consulting an account of my expenses at Cambridge, in the years 1663 and 1664, I find that in the year 1664, a little before Christmas, I, being then Senior Sophister, bought Schooten's *Miscellanies* and Cartes' *Geometry* (having read this *Geometry* and Oughtred's *Clavis* clean over half a year before), and borrowed Wallis's works, and by consequence made these annotations out of Schooten and Wallis, in winter between the years 1664 and 1665. At such time I found the method of Infinite Series; and in summer 1665, being forced from Cambridge by the plague, I computed the area of the Hyperbola at Boothby, in Lincolnshire, to two and fifty figures by the same method."

That Newton must have begun early to make careful observations of natural phenomena is sufficiently testified by the following remarks about halos, which appear in his *Optics*, book ii. part iv. obs. 13:—

> "The like Crowns appear sometimes about the moon; for in the beginning of the Year 1664, February 19th, at night, I saw two such Crowns about her. The Diameter of the first or innermost was about three Degrees, and that of the second about five Degrees and an half. Next about the moon was a Circle of white, and next about that the inner Crown, which was of a bluish green within next the white, and of a yellow and red without, and next about these Colours were blue and green on the inside of the Outward Crown, and red on the outside of it. At the same time there appear'd a Halo about 22 Degrees 35′ distant from the center of the moon. It was elliptical, and its long Diameter was perpendicular to the Horizon, verging below farthest from the moon."

In the month of January 1665 Newton took the degree of bachelor of arts. The persons appointed (in conjunction with the proctors, John Slade of Catharine Hall, and Benjamin Pulleyn of Trinity College, Newton's tutor) to examine the questionists were John Eachard of Catharine Hall and Thomas Gipps of Trinity College. It is a curious accident that we have no information about the respective merits of the candidates for a degree in this year, as the "ordo senioritatis" of the bachelors of arts for the year is omitted in the "Grace Book."

It is supposed that it was in 1665 that the method of fluxions first occurred to Newton's mind. There are several papers still existing in Newton's handwriting bearing dates 1665 and 1666 in which the method is described, in some of which dotted or dashed letters are used to represent fluxions, and in some of which the method is explained without the use of dotted letters.

Both in 1665 and in 1666 Trinity College was dismissed on account of the plague. On each occasion it was agreed, as appears by entries in the "Conclusion Book" of the college, bearing dates August 7, 1665, and June 22, 1666, and signed by the master of the college, Dr Pearson, that all fellows and scholars who were dismissed on account of the pestilence be allowed one month's commons. Newton must have left college before August 1665, as his name does not appear in the list of those who received extra commons on that occasion, and he tells us himself in the extract from his commonplace book already quoted that he was "forced from Cambridge by the plague" in the summer of that year.

Newton was elected a fellow of his college on October 1, 1667. There were nine vacancies, one of which was caused by the death of Cowley in the previous summer, and the nine successful candidates were all of the same academical standing. A few weeks after his election to a fellowship Newton went to Lincolnshire, and did not return to Cambridge till the February following. On the 16th of March 1668 he took his degree of M.A.

During the years 1666 to 1669 Newton's studies were of a very varied kind. It is known that he purchased prisms and lenses on two or three several occasions, and also chemicals and a furnace, apparently for chemical experiments; but he also employed part of his time on the theory of fluxions and other branches of pure mathematics. He wrote a paper *Analysis per Equationes Numero. Terminorum Infinitas*, which he put, probably in June 1669, into the hands of Isaac Barrow (then a fellow of Trinity College, and the first occupant of the Lucasian chair of mathematics), at the same time giving him permission to communicate the contents to their common friend Mr John Collins, a mathematician of no mean order, and a correspondent of many of the eminent men of his time. Barrow did this on the 31st of July 1669, but kept the name of the author a secret, and merely told Collins that he was a friend staying at Cambridge, who had a powerful genius for such matters, and expressed a hope that the paper would not a little delight him. In a subsequent letter on the 20th of August, Barrow expressed his pleasure at hearing the favourable opinion which Collins had formed of the paper, and added, "the name of the author is Newton, a fellow of our college, and a young man, who is only in his second year since he took the degree of master of arts, and who, with an unparalleled genius (*eximio quo est acumine*), has made very great progress in this branch of mathematics." Shortly afterwards Barrow, who had resolved to devote his attention to theological in preference to mathematical studies, resigned the Lucasian chair, and was instrumental in securing Newton's election as his successor. Newton was elected Lucasian professor on the 29th of October 1669. It was his duty as professor to lecture at least once a week in term time on some portion of geometry, arithmetic, astronomy, geography, optics, statics, or some other mathematical subject, and also for two hours in the week to allow an audience to any student who might come to consult with the professor on any difficulties he had met with. The subject which Newton chose for his lectures was optics. He gave courses of lectures on this subject, and the success which attended his researches in optics must have been great. The results of his investigations, however, were known only through his own oral lectures, and were not published until he presented an account of them to the Royal Society in the spring of 1672. On December 21, 1671, he was proposed as a candidate for admission into the Royal Society by Dr Seth Ward, bishop of Salisbury, and on January 11, 1672, he was elected a fellow of the Society. At the meeting at which Newton was elected a description of a reflecting telescope which he had invented was read, and "it was ordered that a letter should be written by the secretary to Mr Newton to acquaint him of his election into the Society, and to thank him for the communication of his telescope, and to assure him that the Society would take care that all right should be done him with respect to this invention."

In his reply to the secretary on January 18, 1672. Newton writes:—

> "I desire that in your next letter you would inform me for what time the society continue their weekly meetings; because, if they continue them for any time, I am purposing them to be considered of and examined an account of a philosophical discovery, which induced me to the making of the said telescope, and which I doubt not but will prove much more grateful than the communication of that instrument, being in my judgment the oddest if not the most considerable detection which hath hitherto been made into the operations of nature."

The promise here made was fulfilled in a communication which Newton addressed to Oldenburg, the secretary of the Royal Society, on February 6, 1672, and which was read before the Society two days afterwards. The whole is printed in No. 80 of the *Philosophical Transactions*, and the first part of it has been already printed in the article LIGHT, vol. xiv. p. 590. After explaining his discovery of the composition of white light, he proceeds:—

> "When I understood this, I left off my aforesaid Glass works; for I saw, that the perfection of Telescopes was hitherto limited, not so much for want of glasses truly figured according to the prescriptions of Optick Authors (which all men have hitherto imagined), as because that Light it self is a *Heterogeneous mixture of differently refrangible Rays*. So that, were a glass so exactly figured as to collect any one sort of rays into one point, it could not collect those also into the same point, which having the same Incidence upon the same Medium are apt to suffer a different refraction. Nay, I wondered, that seeing the difference of refrangibility was so great, as I found it, Telescopes should arrive to that perfection they are now at."

He then points out why

> "The object-glass of any Telescope cannot collect all the rays which come from one point of an object, so as to make them convene at its *focus* in less room than in a circular space, whose diameter is the 50th part of the Diameter of its Aperture: which is an irregularity some hundreds of times greater, than a circularly figured *Lens*, of so small a section as the Object-glasses of long Telescopes are, would cause by the unfitness of its figure, were Light *uniform*";

and he adds—

> "This made me take reflections into consideration, and finding them regular, so that the Angle of *Reflection* of all sorts of Rays was equal to their Angle of Incidence; I understood, that by their mediation Optick instruments might be brought to any degree of perfection imaginable, provided a Reflecting substance could be found, which would polish as finely as Glass, and *reflect* as much light, as glass *transmits*, and the art of communicating to it a *Parabolick* figure be also attained. But these seemed very great difficulties, and I have almost thought them insuperable, when I further considered, that every irregularity in a reflecting superficies makes the rays stray 5 or 6 times more out of their due course, than the like irregularities in a refracting one; so that a much greater curiosity would be here requisite, than in figuring glasses for Refraction.

"Amidst those thoughts I was forced from *Cambridge* by the Intervening Plague, and it was more than two years before I proceeded further. But then having thought on a tender way of polishing, proper for metall, whereby, as I imagined, the figure also would be corrected to the last; I began to try, what might be effected in this kind, and by degrees so far perfected an Instrument (in the essential parts of it like that I sent to *London*), by which I could discern Jupiters 4 Concomitants, and shewed them divers times to two others of my acquaintance. I could also discern the Moon-like phase of *Venus*, but not very distinctly, nor without some niceness in disposing the Instrument.

"From that time I was interrupted till this last Autumn, when I made the other. And as that was sensibly better than the first (especially for Day-Objects), so I doubt not, but they will be still brought to a much greater perfection by their endeavours, who, as you inform me, are taking care about it at *London*."

Then, after a remark that microscopes seem as capable of improvement as telescopes, he adds—

"I shall now proceed to acquaint you with another more notable difformity in its Rays, wherein the *Origin of Colour* is unfolded: Concerning which I shall lay down the *Doctrine* first, and then, for its examination, give you an instance or two of the *Experiments*, as a specimen of the rest.

"The Doctrine you will find comprehended and illustrated in the following propositions:—

"1. As the Rays of light differ in degrees of Refrangibility, so they also differ in their disposition to exhibit this or that particular colour. Colours are not *Qualifications of Light*, derived from Refractions, or Reflections of natural Bodies (as 'tis generally believed), but *original and connate properties*, which in divers Rays are divers. Some Rays are disposed to exhibit a red colour and no other; some a yellow and no other, some a green and no other, and so of the rest. Nor are there only Rays proper and particular to the more eminent colours, but even to all their intermediate gradations.

"2. To the same degree of Refrangibility ever belongs the same colour, and to the same colour ever belongs the same degree of Refrangibility. The *least Refrangible* Rays are all disposed to exhibit a *Red* colour, and contrarily those Rays, which are disposed to exhibit a *Red* colour, are all the least Refrangible: So the *most refrangible* Rays are all disposed to exhibit a deep *Violet Colour*, and contrarily those which are apt to exhibit such a violet colour are all the most Refrangible.

"And so to all the intermediate colours in a continued series belong intermediate degrees of refrangibility. And this Analogy 'twixt colours, and refrangibility is very precise and strict; the Rays always either exactly agreeing in both, or proportionally disagreeing in both.

"3. The species of colour, and degree of Refrangibility proper to any particular sort of Rays, is not mutable by Refraction, nor by Reflection from natural bodies, nor by any other cause, that I could yet observe. When any one sort of Rays hath been well parted from those of other kinds, it hath afterwards obstinately retained its colour, notwithstanding my utmost endeavours to change it. I have refracted it with Prismes, and reflected it with Bodies, which in Day-light were of other colours; I have intercepted it with the coloured film of Air interceding two compressed plates of glass, transmitted it through coloured Mediums, and through Mediums irradiated with other sorts of Rays, and diversly terminated it; and yet could never produce any new colour out of it. It would by contracting or dilating become more brisk, or faint, and by the loss of many Rays, in some cases very obscure and dark; but I could never see it changed *in specie*.

"Yet seeming transmutations of Colours may be made, where there is any mixture of divers sorts of Rays. For in such mixtures, the component colours appear not, but, by their mutual allaying each other constitute a mingling colour."

Further on, after some remarks on the subject of compound colours, he says—

"I might add more instances of this nature, but I shall conclude with this general one, that the Colours of all natural Bodies have no other origin than this, that they are variously qualified to reflect one sort of light in greater plenty then another. And this I have experimented in a dark Room by illuminating those bodies with uncompounded light of divers colours. For by that means any body may be made to appear of any colour. They have there no appropriate colour, but ever appear of the colour of the light cast upon them, but yet with this difference, that they are most brisk and vivid in the light of their own day-light colour. *Minium* appeareth there of any colour indifferently, with which 'tis illustrated, but yet most luminous in red, and so *Bise* appeareth indifferently of any colour with which 'tis illustrated, but yet most luminous in blew. And therefore *minium* reflecteth Rays of any colour, but most copiously those indued with red; and consequently when illustrated with day-light, that is with all sorts of Rays promiscuously blended, those qualified with red shall abound most in the reflected light, and by their prevalence cause it to appear of that colour. And for the same reason *Bise*, reflecting blew most copiously, shall appear blew by the excess of those Rays in its reflected light; and the like of other bodies. And that this is the intire and adequate cause of their colours, is manifest, because they have no power to change or alter the colours of any sort of Rays incident apart, but put on all colours indifferently, with which they are inlightened.

. . .

"Reviewing what I have written, I see the discourse it self will lead to divers Experiments sufficient for its examination: And therefore I shall not trouble you further, than to describe one of those, which I have already insinuated.

"In a darkened Room make a hole in the shut of a window, whose diameter may conveniently be about a third part of an inch, to admit a convenient quantity of the Suns light: And there place a clear and colourless Prisme, to refract the entring light towards the further part of the Room, which, as I said, will thereby be diffused into an oblong coloured Image. Then place a Lens of about three foot radius (suppose a broad Object-glass of a three foot Telescope), at the distance of about four or five foot from thence, through which all those colours may at once be transmitted, and made by its Refraction to convene at a further distance of about ten or twelve feet. If at that distance you intercept this light with a sheet of white paper, you will see the colours converted into whiteness again by being mingled.

"But it is requisite, that the *Prisme* and *Lens* be placed steddy, and that the paper, on which the colours are cast be moved to and fro; for, by such motion, you will not only find, at what distance the whiteness is most perfect but also see, how the colours gradually convene, and vanish into whiteness, and afterwards having crossed one another in that place where they compound Whiteness, are again dissipated and severed, and in an inverted order retain the same colours, which they had before they entered the composition. You may also see, that, if any of the Colours at the *Lens* be intercepted, the Whiteness will be changed into the other colours. And therefore, that the composition of whiteness be perfect, care must be taken, that none of the colours fall besides the *Lens*."

And he concludes his communication with the words—

"This, I conceive, is enough for an Introduction to Experiments of this kind: which if any of the *R. Society* shall be so curious as to prosecute, I should be very glad to be informed with what success: That, if any thing seem to be defective, or to thwart this relation, I may have an opportunity of giving further direction about it, or of acknowledging my errors, if I have committed any."

The publication of these discoveries led to a series of controversies which lasted for several years, in which Newton had to contend with the eminent English natural philosopher Hooke, Lucas, mathematical professor at Liége, Linus, a physician in Liége, and many others. Some of his opponents denied the truth of his experiments, refusing to believe in the existence of the spectrum. Others criticized the experiments, saying that the length of the spectrum was never more than three and a half times the breadth, whereas Newton found it to be five times the breadth. It appears that Newton made the mistake of supposing that all prisms would give a spectrum of exactly the same length; the objections of his opponents led him to measure carefully the lengths of spectra formed by prisms of different angles and of different refractive indices; and it seems strange that he was not led thereby to the discovery of the different dispersive powers of different refractive substances.

Newton carried on the discussion with the objectors with great courtesy and patience, but the amount of pain which these perpetual discussions gave to his sensitive mind may be estimated from the fact of his writing on November 18, 1676, to Oldenburg:—

"I promised to send you an answer to Mr Lucas this next Tuesday, but I find I shall scarce finish what I have designed, so as to get a copy taken of it by that time, and therefore I beg your patience a week longer. I see I have made myself a slave to philosophy, but if I get free of Mr Lucas's business, I will resolutely bid adieu to it eternally, excepting what I do for my private satisfaction, or leave to come out after me; for I see a man must either resolve to put out nothing new, or to become a slave to defend it."

It was a fortunate circumstance that these disputes did not so thoroughly damp Newton's ardour as he at the time felt they would. He subsequently published many papers in the *Philosophical Transactions* on various parts of the science of optics, and, although some of his views have been found to be erroneous, and are now almost universally rejected, his investigations led to discoveries which are of permanent value. He succeeded in explaining the colour of thin and of thick plates, and the inflexion of light, and he wrote on double refraction, polarization, and binocular vision. He also invented a reflecting sextant for observing the distance between the moon and the fixed stars,—the same in every essential as the instrument which is still in everyday use at sea under the name of Hadley's quadrant. This discovery was communicated by him to Dr Halley in 1700, but was not published, or communicated to the Royal Society, till after Newton's death, when a description of it was found among his papers.

In March 1673 we find Newton taking a somewhat prominent part in a dispute in the university. The public oratorship fell vacant, and a contest arose between the heads of the colleges and the members of the senate of the university as to the mode of electing to the office. The heads claimed the right of nominating two persons, one of whom was to be elected by the senate. The senate on the other hand insisted that the proper mode was by an open election. The duke of Buckingham, who was the chancellor of the university, endeavoured to effect a compromise between the contending parties. He suggested an expedient which, he says, "I hope may for the present satisfy both sides. I propose that the heads may for this time nominate and the body comply, yet interposing (if they think fit) a protestation concerning their plea that this election may not hereafter pass for a decisive precedent in prejudice of their claim," and, "whereas I understand that the whole university has chiefly consideration for Dr Paman of St John's and Mr Craven of Trinity College, I do recommend them both to be nominated. For it is very reasonable that in this nomination, before the difference be determined between you, the heads should have regard to the inclination of the body, especially seeing you all agree in two men that are very worthy, and very fit for the place." The heads, notwithstanding this reasonable and conciliatory suggestion of the chancellor, nominated Dr Paman and Mr Ralph Sanderson of St John's, and the next day one hundred and twenty-one members of the senate recorded their votes for Craven and ninety-eight for Paman. On the morning of the election a protest in which Newton's name appeared was read, and entered in the Regent House. But the vice-chancellor admitted Paman the same morning, and so ended the first contest of a non-scientific character in which we find Newton taking part.

On March 8, 1673, Newton wrote to Oldenburg, the secretary of the Royal Society:—

> "Sir, I desire that you will procure that I may be put out from being any longer Fellow of the Royal Society: for though I honour that body, yet since I see I shall neither profit them, nor (by reason of this distance) can partake of the advantage of their assemblies, I desire to withdraw."

Oldenburg must have replied to this by an offer to apply to the Society to excuse Newton the weekly payments, as in a letter of Newton's to Oldenburg, dated June 23, 1673, he says, "For your proffer about my quarterly payments, I thank you, but I would not have you trouble yourself to get them excused, if you have not done it already." Nothing further seems to have been done in the matter until January 28, 1675, when Oldenburg informed "the Society that Mr Newton is now in such circumstances that he desires to be excused from the weekly payments." Upon this "it was agreed to by the council that he be dispensed with, as several others are." Very soon after this—that is, on February 18, 1675—Newton was formally admitted into the Society. The most probable explanation of the cause why Newton wished to be excused from these payments is to be found in the fact that, as he was not in holy orders, his fellowship at Trinity College would lapse in the autumn of 1675. It is true that the loss to his income which this would have caused was obviated by a patent from the crown in April 1675, allowing him as Lucasian professor to retain his fellowship without the obligation of taking holy orders. This must have relieved Newton's mind from a great deal of anxiety about pecuniary matters, as we find him so soon after this event as November 1676 subscribing £40 towards the building of the new library of Trinity College.

It is supposed that it was at Woolsthorpe in the summer of 1666 that Newton's thoughts were directed to the subject of gravity. Voltaire is the authority for the well-known anecdote about the apple. He had his information from Newton's favourite niece Catharine Barton, who married Conduitt, a fellow of the Royal Society, and one of Newton's intimate friends. How much truth there is in what is a plausible and a favourite story can never be known, but it is certain that tradition marked a tree as that from which the apple fell, till 1820, when, owing to decay, the tree was cut down and its wood carefully preserved.

Kepler had proved by an elaborate series of measurements that each planet revolves in an elliptical orbit round the sun, whose centre occupies one of the foci of the orbit, that the radius vector of each planet drawn from the sun describes equal areas in equal times, and that the squares of the periodic times of the planets are in the same proportion as the cubes of their mean distances from the sun. The fact that heavy bodies have always a tendency to fall to the earth, no matter at what height they are placed above the earth's surface, seems to have led Newton to conjecture that it was possible that the same tendency to fall to the earth was the cause by which the moon was retained in its orbit round the earth. Newton, by calculating from Kepler's laws, and supposing the orbits of the planets to be circles round the sun in the centre, had already proved that the force of the sun acting upon the different planets must vary as the inverse square of the distances of the planets from the sun. He therefore was led to inquire whether, if the earth's attraction extended to the moon, the force at that distance would be of the exact magnitude necessary to retain the moon in its orbit. He found that the moon by her motion in her orbit was deflected from the tangent in every minute of time through a space of thirteen feet. But by observing the distance through which a body would fall in one second of time at the earth's surface, and by calculating from that on the supposition of the force diminishing in the ratio of the inverse square of the distance, he found that the earth's attraction at the distance of the moon would draw a body through 15 feet in one minute. A less careful calculator might have been satisfied with the close approximation of these two results; but Newton, on the contrary, regarded the discrepancy between the results as a proof of the inaccuracy of his conjecture, and "laid aside at that time any further thoughts of this matter." The idea thus laid aside was not finally condemned. In 1679 a controversy between Hooke and Newton, about the form of the path of a body falling from a height, taking the motion of the earth round its axis into consideration, led Newton again to revert to his former conjectures on the moon. The measure of the earth, which had hitherto been accepted by geographers and navigators, was based on the very rough estimate that the length of a degree of latitude of the earth's surface measured along a meridian was 60 miles. More accurate estimates had been made by Norwood and Snell, and more recently by Picard. At a meeting of the Royal Society on January 11, 1672, Oldenburg the secretary read a letter from Paris describing the method followed by Picard in measuring a degree, and specifically stating the precise length that he calculated it to be. It is probable that Newton had become acquainted with this measurement of Picard's, and that he was therefore led to make use of it when his thoughts were redirected to the subject. This estimate of the earth's magnitude, giving 69·1 miles to one degree, made the two results, the discrepancy between which Newton had regarded as a disproof of his conjecture, to agree so exactly that he now regarded his conjecture as fully established.

In January 1684 Sir Christopher Wren, Halley, and Hooke were led to discuss the law of gravity, and, although probably they all agreed in the truth of the law of the inverse square, yet this truth was not looked upon as established. It appears that Hooke professed to have a solution of the problem of the path of a body moving round a centre of force attracting as the inverse square of the distance; but Halley, finding, after a delay of some months, that Hooke "had not been so good as his word" in showing his solution to Wren, started in the month of August 1684 for Cambridge to consult Newton on the subject. Without mentioning the speculations which had been made, he went straight to the point and asked Newton what would be the curve described by a planet round the sun on the assumption that the sun's force diminished as the square of the distance. Newton replied promptly, "an ellipse," and on being questioned by Halley as to the reason for his answer he replied, "Why, I have calculated it." He could not, however, put his hand upon his calculation, but he promised to send it to Halley. After the latter had left Cambridge, Newton set to work to reproduce the calculation. After making a mistake and producing a different result he corrected his work and obtained his former result.

In the following November Newton redeemed his promise to Halley by sending him, by the hand of Mr Paget, one of the fellows of his own college, and at that time mathematical master of Christ's Hospital, a copy of his demonstration; and very soon afterwards Halley paid another visit to Cambridge to confer with Newton about the problem; and on his return to London on December 10, 1684, he informed the Royal Society "that he had lately seen Mr Newton at Cambridge, who had showed him a curious treatise *De Motu*," which at Halley's desire he promised to send to the Society to be entered upon their register. "Mr Halley was desired to put Mr Newton in mind of his promise for the securing this invention to himself, till such time as he could be at leisure to publish it," and Paget was desired to join with Halley in urging Newton to do so. Newton was not slow in responding to the wish of the Society. By the middle of February he had sent his paper to Aston, one of the secretaries of the Society, and in a letter to Aston dated February 23, 1685, we find Newton thanking him for "having entered on the register his notions about motion." Newton adds, "I designed them for you before now, but the examining several things has taken a greater part of my time than I expected, and a great deal of it to no purpose. And now I am to go to Lincolnshire for a month or six weeks. Afterwards I intend to finish it as soon as I can conveniently." This treatise *De Motu* was the germ of the *Principia*, and was obviously meant to be a short account of what that work was intended to embrace. It occupies twenty-four octavo pages, and consists of four theorems and seven problems, some of which are identical with some of the most important propositions of the second and third sections of the first book of the *Principia*

The years 1685 and 1686 will ever be memorable in the history of science. It was in them that Newton composed almost the whole of his great work. During this period Newton had a very extensive correspondence with Flamsteed, who was then the astronomer-royal. Many of the letters are lost, but it is clear from one of Newton's, dated September 19, 1685, that he had received many useful communications from Flamsteed, and especially regarding Saturn, "whose orbit, as defined by Kepler," Newton "found too little for the sesquialterate proportions." In the other letters written in 1685 and 1686 he applies to Flamsteed for information respecting the orbits of the satellites of Jupiter and Saturn, respecting the rise and fall of the spring and neap tides at the solstices and the equinoxes, respecting the flattening of Jupiter at the poles (which, if certain, he says, would conduce much to the stating the reasons of the precession of the equinoxes), and respecting the difference between the observed places of Saturn and those computed from Kepler's tables about the time of his conjunction with Jupiter. On this last point the information supplied by Flamsteed was peculiarly gratifying to Newton; and it is obvious from the language of this part of his letter that he had still doubts of the universal application of the sesquialteral proportion. "Your information," he says, "about the errors of Kepler's tables for Jupiter and Saturn has eased me of several scruples. I was apt to suspect there might be some cause or other unknown to me which might disturb the sesquialteral proportions, for the influences of the planets one upon another seemed not great enough, though I imagined Jupiter's influence greater than your numbers determine it. It would add to my satisfaction if you would be pleased to let me know the long diameters of the orbits of Jupiter and Saturn, assigned by yourself and Mr Halley in your new tables, that I may see how the sesquialteral proportion fills the heavens, together with another small proportion which must be allowed for."

Upon Newton's return from Lincolnshire in the beginning of April 1685, he seems to have devoted himself to the preparation of his work. In the spring he had determined the attractions of masses, and thus completed the law of universal gravitation. In the summer he had finished the second book of the *Principia*, the first book being the treatise *De Motu*, which he had enlarged and completed. Excepting in the correspondence with Flamsteed, to which we have already referred, we hear nothing more of the preparation of the *Principia* until April 21, 1686, when Halley read to the Royal Society his *Discourse concerning Gravity and its Properties*, in which he states "that his worthy countryman Mr Isaac Newton has an incomparable treatise of motion almost ready for the press," and that the law of the inverse square "is the principle on which Mr Newton has made out all the phenomena of the celestial motions so easily and naturally, that its truth is past dispute." The intelligence thus given by Halley was speedily confirmed. At the very next meeting of the Society, on April 28, "Dr Vincent presented to the Society a manuscript treatise entitled *Philosophiæ Naturalis Principia Mathematica*, and dedicated to the Society by Mr Isaac Newton." Although this manuscript contained only the first book, yet such was the confidence the Society placed in the author that an order was given "that a letter of thanks be written to Mr Newton; and that the printing of his book be referred to the consideration of the council; and that in the meantime the book be put into the hands of Mr Halley, to make a report thereof to the council." Although there could be no doubt as to the intention of this report, yet no step was taken towards the publication of the work. At the next meeting of the Society, on May 19, some dissatisfaction seems to have been expressed at the delay, as it was ordered "that Mr Newton's work should be printed forthwith in quarto, and that a letter should be written to him to signify the Society's resolutions, and to desire his opinion as to the print, volume, cuts, and so forth." Three days afterwards, namely, on May 22, Halley communicated the resolution to Newton, and stated to him that the printing was to be at the charge of the Society. At the next meeting of the council, on June 2, it was again ordered "that Mr Newton's book be printed," but, instead of sanctioning the resolution of the general meeting to print it at their charge, they added "that Mr Halley undertake the business of looking after it, and printing it at his own charge, which he engaged to do."

In order to explain to Newton the cause of the delay, Halley in his letter of May 22 alleges that it arose from "the president's attendance on the king, and the absence of the vice-presidents, whom the good weather had drawn out of town"; but there is reason to believe that this was not the true cause, and that the unwillingness of the council to undertake the publication arose from the state of the finances of the Society. Halley certainly deserves the gratitude of posterity for undertaking the publication of the work at a very considerable pecuniary risk to himself. Halley in his letter to Newton of May 22, found it necessary to inform him of Hooke's conduct when the manuscript of the *Principia* was presented to the Society. Sir John Hoskyns was in the chair when Dr Vincent presented the manuscript, and passed a high encomium on the novelty and dignity of the subject. Hooke was offended because Sir John did not mention what he had told him of his own discovery. Halley only communicated to Newton the fact "that Hooke had some pretensions to the invention of the rule for the decrease of gravity being reciprocally as the squares of the distances from the centre," acknowledging at the same time that, though Newton had the notion from him, "yet the demonstration of the curves generated thereby belonged wholly to Newton." "How much of this," Halley adds, "is so, you know best, so likewise what you have to do in this matter; only Mr Hooke seems to expect you should make some mention of him in the preface, which 'tis possible you may see reason to prefix. I must beg your pardon that 'tis I that send you this ungrateful account; but I thought it my duty to let you know it, so that you might act accordingly, being in myself fully satisfied that nothing but the greatest candour imaginable is to be expected from a person who has of all men the least need to borrow reputation."

In thus appealing to Newton's candour, Halley obviously wished that some acknowledgment of Hooke should be made. He knew indeed, that before Newton had announced the inverse law Hooke and Wren and himself had spoken of it and discussed it, and therefore justice demanded that, though none of them had given a demonstration of the law, Hooke especially should receive credit for having maintained it as a truth of which he was seeking the demonstration. On June 20, 1686, Newton wrote to Halley the following letter:—

"Sir,—In order to let you know the case between Mr Hooke and me, I give you an account of what passed between us in our letters, so far as I could remember; for 'tis long since they were writ, and I do not know that I have seen them since. I am almost confident by circumstances, that Sir Chr. Wren knew the duplicate proportion when I gave him a visit; and then Mr Hooke (by his book *Cometa* written afterwards) will prove the last of us three that knew it. I intended in this letter to let you understand the case fully; but it being a frivolous business, I shall content myself to give you the heads of it in short, viz., that I never extended the duplicate proportion lower than to the superficies of the earth, and before a certain demonstration I found the last year, have suspected it did not reach accurately enough down so low; and therefore in the doctrine of projectiles never used it nor considered the motions of the heavens; and consequently Mr Hooke could not from my letters, which were about projectiles and the regions descending hence to the centre, conclude me ignorant of the theory of the heavens. That what he told me of the duplicate proportion was erroneous, namely, that it reached down from hence to the centre of the earth.

"That it is not candid to require me now to confess myself, in print, then ignorant of the duplicate proportion in the heavens; for no other reason, but because he had told it me in the case of projectiles, and so upon mistaken grounds accused me of that ignorance. That in my answer to his first letter I refused his correspondence, told him I had laid philosophy aside, sent him only the experiment of projectiles (rather shortly hinted than carefully described), in compliment to sweeten my answer, expected to hear no further from him; could scarce persuade myself to answer his second letter; did not answer his third, was upon other things; thought no further of philosophical matters than his letters put me upon it, and therefore may be allowed not to have had my thoughts of that kind about me so well at that time. That by the same reason he concludes me then ignorant of the rest of the duplicate proportion, he may as well conclude me ignorant of the rest of that theory I had read before in his books. That in one of my papers writ (I cannot say in what year, but I am sure some time before I had any correspondence with Mr Oldenburg, and that 's) above fifteen years ago, the proportion of the forces of the planets from the sun, reciprocally duplicate of their distances from him, is expressed, and the proportion of our gravity to the moon's *conatus recedendi a centro terræ* is calculated, though not accurately enough. That when Hugenius put out his *Horol. Oscil.*, a copy being presented to me, in my letter of thanks to him I gave those rules in the end thereof a particular commendation for their usefulness in Philosophy, and added out of my aforesaid paper an instance of their usefulness, in comparing the forces of the moon from the earth, and earth from the sun; in determining a problem about the moon's phase, and putting a limit to the sun's parallax, which shews that I had then my eye upon comparing the forces of the planets arising from their circular motion, and understood it; so that a while after, when Mr Hooke propounded the problem solemnly, in the end of his attempt to prove the motion of the earth, if I had not known the duplicate proportion before, I could not but have found it now. Between ten and eleven years ago there was an hypothesis of mine registered in your books, wherein I hinted a cause of gravity towards the earth, sun, and planets, with the dependence of the celestial motions thereon; in which the proportion of the decrease of gravity from the superficies of the planet (though for brevity's sake not there expressed) can be no other than reciprocally duplicate of the distance from the centre. And I hope I shall not be urged to declare, in print, that I understood not the obvious mathematical condition of my own hypothesis. But grant I received it afterwards from Mr Hooke, yet have I as great a right to it as to the ellipsis. For as Kepler knew the orb to be not circular but oval, and guessed it to be elliptical, so Mr Hooke, without knowing what I have found out since his letters to me, can know no more, but that the proportion was duplicate *quam proximè* at great distances from the centre, and only guessed it to be so accurately, and guessed amiss in extending that proportion down to the very centre, whereas Kepler guessed right at the ellipsis. And so Mr Hooke found less of the proportion than Kepler of the ellipsis.

"There is so strong an objection against the accurateness of this proportion, that without my demonstrations, to which Mr Hooke is yet a stranger, it cannot be believed by a judicious philosopher to be any where accurate. And so, in stating this business, I do pretend to have done as much for the proportion as for the ellipsis, and to have as much right to the one from Mr Hooke and all men, as to the other from Kepler; and therefore on this account also he must at least moderate his pretences.

"The proof you sent me I like very well. I designed the whole to consist of three books; the second was finished last summer being short, and only wants transcribing, and drawing the cuts fairly. Some new propositions I have since thought on, which I can as well let alone. The third wants the theory of comets. In autumn last I spent two months in calculations to no purpose for want of a good method, which made me afterwards return to the first book, and enlarge it with divers propositions, some relating to comets, others to other things, found out last winter. The third I now design to suppress. Philosophy is such an impertinently litigious lady, that a man has as good be engaged in lawsuits, as have to do with her. I found it so formerly, and now I am no sooner come near her again, but she gives me warning. The two first books, without the third, will not so well bear the title of *Philosophiæ Naturalis Principia Mathematica*; and therefore I had altered it to this, *De Motu Corporum libri duo*.

"But, upon second thoughts, I retain the former title. 'Twill help the sale of the book, which I ought not to diminish now 'tis yours. The articles are, with the largest, to be called by that name; if you please you may change the word to sections, though it be not material. In the first page, I have struck out the words '*uti posthac docebitur*,' as referring to the third book; which is all at present, from your affectionate friend and humble servant,

"IS. NEWTON."

On June 29, 1686, Halley wrote to Newton:—"I am heartily sorry that in this matter, wherein all mankind ought to acknowledge their obligations to you, you should meet with anything that should give you unquiet"; and then, after an account of Hooke's claim to the discovery as made at a meeting of the Royal Society, in which he says, "As to the manner of Mr Hooke's claiming the discovery, I fear it has been represented in worse colours than it ought; for he neither made public application to the Society for justice, nor pretended you had all from him," he concludes

> "But I found that they were all of opinion that nothing thereof appearing in print, nor on the books of the Society, you ought to be considered as the inventor. And if in truth he knew it before you, he ought not to blame any but himself for having taken no more care to secure a discovery, which he puts so much value on. What application he has made in private, I know not; but I am sure that the Society have a very great satisfaction, in the honour you do them, by the dedication of so worthy a treatise. Sir, I must now again beg you, not to let your resentments run so high, as to deprive us of your third book, wherein the application of your mathematical doctrine to the theory of comets and several curious experiments, which, as I guess by what you write, ought to compose it, will undoubtedly render it acceptable to those, who will call themselves Philosophers without Mathematics, which are much the greater number. Now you approve of the character and paper, I will push on the edition vigorously. I have sometimes had thoughts of having the cuts neatly done in wood, so as to stand in the page with the demonstrations. It will be more convenient, and not much more charge. If it please you to have it so, I will try how well it can be done; otherwise I will have them in somewhat a larger size than those you have sent up.—I am, Sir, your most affectionate humble servant, E. HALLEY."

On June 30, 1686, the president was desired by the council to license Mr Newton's book, entitled *Philosophiæ Naturalis Principia Mathematica.*

On July 14, 1686, Newton wrote to Halley approving of his proposal to introduce woodcuts among the letterpress, stating clearly the different things which he had from Hooke, and adding, "And now having sincerely told you the case between Mr Hooke and me, I hope I shall be free for the future from the prejudice of his letters. I have considered how best to compose the present dispute, and I think it may be done by the inclosed scholium to the fourth proposition." This scholium was—"The inverse law of gravity holds in all the celestial motions, as was discovered also independently by my countrymen Wren, Hooke, and Halley." After this letter of Newton's the printing of the *Principia* was commenced, and went on with considerable regularity. The second book, though ready for the press in the autumn of 1686, was not sent to the printers until March 1687. The third book was presented to the Society on April 6, 1687, and the whole work published about midsummer in that year. It was dedicated to the Royal Society, and to it was prefixed a set of Latin hexameters addressed by Halley to the author. The work, as might have been expected, caused a great deal of excitement throughout Europe, and the whole of the impression was very soon sold. In 1691 a copy of the *Principia* was hardly to be procured.

While Newton was writing the second and third books of the *Principia*, a very important event occurred at Cambridge which had the effect of bringing him before the public in a new light. James II. had already, in 1686, in open violation of the law, conferred the deanery of Christ Church at Oxford on John Massey, a person whose sole qualification was that he was a member of the Church of Rome; and the king had boasted to the pope's legate that "what he had done at Oxford would very soon be done at Cambridge." In accordance with this boast, in February 1687, he issued a mandate directing that Father Alban Francis, a Benedictine monk, should be admitted a master of arts of the university of Cambridge, without taking the oaths of allegiance and supremacy. Upon receiving the mandamus Dr Pechell, the master of Magdalene College, who was vice-chancellor, sent a messenger to the duke of Albemarle, the chancellor, to request him to get the mandamus recalled; and the registrary and the bedells waited upon Francis to offer him instant admission to the degree if only he would take the necessary oaths. Both the king and the monk were inexorable. The court and the university were thus placed in open collision. A menacing letter was despatched by Sunderland to shake the firmness of the university; but, though humble and respectful explanations were returned, the university showed no sign of compliance, nor even of a desire to suggest a compromise. In consequence the vice-chancellor and deputies from the senate were summoned to appear before the High Commission Court at Westminister. Newton was one of the eight deputies appointed by the senate for this purpose. The deputies, before starting for London, held a meeting to prepare their case for the court. A compromise which was put forward by one of them was stoutly and successfully resisted by Newton, and on April 21 the deputation, with their case carefully prepared, appeared before the court. Jeffreys presided at the board. The deputation appeared as a matter of course before the commissioners, and were dismissed. On April 27 they gave in their plea. On May 7 it was discussed, and feebly defended by the vice-chancellor. The deputies maintained that in the late reign several royal mandates had been withdrawn, and that no degree had ever been conferred without the oaths having been previously taken. Jeffreys spoke with his accustomed insolence to the vice-chancellor, silenced the other deputies when they offered to speak, and ordered them out of court. When recalled the deputies were reprimanded, and Pechell was deprived of his office as vice-chancellor, and of his emoluments as master of Magdalene. From the precincts of the High Commission Court Newton returned to Trinity College to complete the *Principia.*

At the time when Newton was writing the latter part of this great work, he had an extensive correspondence with Halley, a very great part of which is extant. The following letter from Halley, dated London, July 5, 1687, announcing the completion of the *Principia*, is of peculiar interest:—

> "I have at length brought your book to an end, and hope it will please you. The last errata came just in time to be inserted. I will present from you the book you desire to the Royal Society, Mr Boyle, Mr Paget, Mr Flamsteed, and if there be any else in town that you design to gratify that way; and I have sent you to bestow on your friends in the University 20 copies, which I entreat you to accept. In the same parcel you will receive 40 more, which having no acquaintance in Cambridge, I must entreat you to put into the hands of one or more of your ablest booksellers to dispose of them. I intend the price of them, bound in calves' leather, and lettered, to be 9 shillings here. Those I send you I value in quires at 6 shillings, to take my money as they are sold, or at $5^{\text{sh.}}$ for ready, or else at some short time; for I am satisfied there is no dealing in books without interesting the booksellers; and I am contented to let them go halves with me, rather than have your excellent work smothered by their combinations. I hope you will not repent you of the pains you have taken in so laudable a piece, so much to your own and the nation's credit, but rather, after you shall have a little diverted yourself with other studies, that you will resume those contemplations wherein you had so great success, and attempt the perfection of the lunar theory, which will be of prodigious use in navigation, as well as of profound and public speculation. Sir, I shall be glad to hear that you have received the books, and to know what farther presents you wish in town, which shall be accordingly done. You will receive a box from me on Thursday next by the waggon, that starts from town to-morrow."

In 1692 and 1693 Newton seems to have had a serious illness, the nature of which has in late years given rise to very considerable dispute. In a letter dated September 13, 1693, addressed to Mr Pepys, he writes:—

> "Some time after Mr Millington had delivered your message, he pressed me to see you the next time I went to London. I was

averse, but upon his pressing consented, before I considered what I did, for I am extremely troubled at the embroilment I am in, and have neither ate nor slept well this twelvemonth, nor have my former consistency of mind. I never designed to get any thing by your interest, nor by King James's favour, but am now sensible that I must withdraw from your acquaintance, and see neither you nor the rest of my friends any more, if I may but have them quietly. I beg your pardon for saying I would see you again, and rest your most humble and obedient servant."

And in a letter written to Locke in reply to one of his about the second edition of his book, and dated October 15, 1693, Newton wrote:—

"The last winter, by sleeping too often by my fire, I got an ill habit of sleeping; and a distemper, which this summer has been epidemical, put me farther out of order, so that when I wrote to you, I had not slept an hour a night for a fortnight together, and for five days together not a wink. I remember I wrote to you, but what I said of your book I remember not. If you please to send me a transcript of that passage, I will give you an account of it if I can."

These letters of Newton are sufficient evidence that he must have been for a very considerable time seriously unwell. The loss of sleep to a person of Newton's temperament, whose mind was never at rest, and at times so wholly engrossed in his scientific pursuits that he even neglected to take food, must necessarily have led to a very great deal of nervous excitability. It is not astonishing that rumours got abroad that there was a danger of his mind giving way, or, according to a report which was believed at the time, that it had actually done so. Mr Pepys must have heard such rumours, as in a letter to his friend Mr Millington, the tutor of Magdalene College at Cambridge, dated September 26, 1693, he wrote:—

"I must acknowledge myself not at the ease I would be glad to be at in reference to excellent Mr Newton; concerning whom (methinks) your answer labours under the same kind of restraint which (to tell you the truth) my asking did. For I was loth at first dash to tell you that I had lately received a letter from him so surprising to me for the inconsistency of every part of it, as to be put into great disorder by it, from the concernment I have for him, lest it should arise from that which of all mankind I should least dread from him and most lament for,—I mean a discomposure in head, or mind, or both. Let me, therefore, beg you, Sir, having now told you the true ground of the trouble I lately gave you, to let me know the very truth of the matter, as far at least as comes within your knowledge. For I own too great an esteem for Mr Newton, as for a public good, to be able to let any doubt in me of this kind concerning him lie a moment uncleared, where I can have any hopes of helping it."

On September 30, 1693, Mr Millington wrote to Mr Pepys that he had been to look for Newton some time before, but that "he was out of town, and since," he says,

"I have not seen him, till upon the 28th I met him at Huntingdon, where, upon his own accord, and before I had time to ask him any question, he told me that he had writt to you a very odd letter, at which he was much concerned: added, that it was in a distemper that much seized his head, and that kept him awake for above five nights together, which upon occasion he desired I would represent to you, and beg your pardon, he being very much ashamed he should be so rude to a person for whom he hath so great an honour. He is now very well, and though I fear he is under some small degree of melancholy, yet I think there is no reason to suspect it hath at all touched his understanding, and I hope never will; and so I am sure all ought to wish that love learning or the honour of our nation, which it is a sign how much it is looked after, when such a person as Mr Newton lyes so neglected by those in power. And thus, honoured Sir, I have made you acquainted with all I know of the cause of such inconsistencys in the letter of so excellent a person; and I hope it will remove the doubts and fears you are, with so much compassion and publickness of spirit, pleased to entertain about Mr Newton, but if I should have been wanting in any thing tending to the more full satisfaction, I shall, upon the least notice, endeavour to amend it with all gratitude and truth."

The illness of Newton was very much exaggerated by foreign contemporary writers. In a manuscript journal of Huygens is to be found an entry:—

"29 Maj. 1694.—Narravit mihi D. Colm Scotus virum celeberrimum ac summum geometram Is. Neutonum in phrenesin incidisse abhinc anno et sex mensibus. An ex nimia studii assiduitate, an dolore infortunii, quod incendio laboratorium chymicum et scripta quædam amiserat? Cum ad Archiepiscopum Cantabrigiensem venisset, ea locutum, quæ alienationem mentis indicarent. Deinde ab amicis curam ejus susceptam, domoque clauso remedia volenti nolenti adhibita, quibus jam sanitatem recuperavit ut jam rursus librum suum Principiorum Philosophiæ Mathematicorum intelligere incipiat."

Huygens, in a letter dated June 8, 1694, wrote to Leibnitz, "I do not know if you are acquainted with the accident which has happened to the good Mr Newton, namely, that he has had an attack of phrenitis, which lasted eighteen months, and of which they say his friends have cured him by means of remedies, and keeping him shut up." To which Leibnitz, in a letter dated June 22, replied, "I am very glad that I received information of the cure of Mr Newton at the same time that I first heard of his illness, which doubtless must have been very alarming."

The active part which Newton had taken in defending the legal privileges of the university against the encroachments of the crown had probably at least equal weight with his scientific reputation when his friends chose him as a candidate for a seat in parliament as one of the representatives of the university. The other candidates were Sir Robert Sawyer and Mr Finch. Sir Robert stood at the head of the poll with 125 votes, Newton next with 122, and Mr Finch was last with 117 votes. Newton retained his seat only about a year, from January 1689 till the dissolution of the Convention Parliament in February 1690. During this time Newton does not appear to have taken part in any of the debates in the House; but he was not neglectful of his duties as a member. On April 30, 1689, he moved for leave to bring in a Bill to settle the charters and privileges of the university of Cambridge, just as Sir Thomas Clarges did for Oxford at the same time, and he wrote a series of letters to Dr Lovel, the vice-chancellor of the university, on points which affected the interests of the university and its members.

Some of the members of the university who had lately sworn allegiance to James had some difficulty in swearing allegiance to his successor. On February 12, 1689, the day of the coronation of William and Mary, Newton intimated to the vice-chancellor that he would soon receive an order to proclaim them at Cambridge. He enclosed a form of the proclamation, and expressed a hearty "wish that the university would so compose themselves as to perform the solemnity with a reasonable decorum."

During his residence in London Newton had made the acquaintance of John Locke. Locke had taken a very great interest in the new theories of the *Principia*. He was one of a number of Newton's friends who began to be uneasy and dissatisfied at seeing the most eminent scientific man of his age left to depend upon the meagre emoluments of a college fellowship and a professorship.

At one time Newton's friends had nearly succeeded in getting him appointed provost of King's College, Cambridge, but the college offered a successful resistance on the ground that the appointment would be illegal, as the statutes required that the provost should be in priest's orders. Charles Montague, who was afterwards earl of Halifax, was a fellow of Trinity College, and was a very intimate friend of Newton's; and it was on his influence that Newton relied in the main for promotion to some post of honour and emolument. His hopes, however, were blighted by long delay. In one of his letters to Locke at the beginning of the year 1692, when Montague, Lord Monmouth, and Locke were exerting themselves to obtain some appointment for him, Newton wrote that he was "fully convinced that Mr Montague, upon an old grudge which he thought had been worn out, was false to him." Newton was now in his fifty-fifth year, and whilst those of his own standing at the university had been appointed to high posts in church or state, he still remained without any mark of national gratitude. But this blot upon the English name was at last removed by Montague in 1694, when he was appointed chancellor of the exchequer. He had previously consulted Newton upon the subject of the recoinage, and on the opportunity occurring he appointed Newton to the post of warden of the mint. In a letter to Newton announcing the news, Montague writes:—

> "I am very glad that at last I can give you a good proof of my friendship, and the esteem the king has of your merits. Mr Overton, the warden of the mint, is made one of the Commissioners of Customs, and the king has promised me to make Mr Newton warden of the mint. The office is the most proper for you. 'Tis the chief office in the mint: 'tis worth five or six hundred pounds per annum, and has not too much business to require more attendance than you can spare."

This letter must have convinced Newton of the sincerity of Montague's good intentions towards him; we find them living as friends on the most intimate terms until Halifax's death in 1715.

The chemical and mathematical knowledge of Newton proved of great use in carrying out the recoinage. This was completed in about two years, and such was the zeal and devotion with which Newton discharged the laborious duties of his office that he was in 1697 appointed to the mastership of the mint, a post worth between £1200 and £1500 per annum. While he held the latter office, Newton drew up a very extensive table of assays of foreign coins, and composed an official report on the coinage.

Up to the time of the publication of the *Principia* in 1687 the method of fluxions which had been invented by Newton, and had been of great assistance to him in his mathematical investigations was still, except to Newton and his friends, a secret. One of the most important rules of the method forms the second lemma of the second book of the *Principia*. Though this new and powerful method was of great help to Newton in his work, he did not exhibit it in the results. He was aware that the well-known geometrical methods of the ancients would clothe his new creations in a garb which would appear less strange and uncouth to those not familiar with the new method. The *Principia* gives no information on the subject of the notation adopted in the new calculus, and it was not until 1693 that it was communicated to the scientific world in the second volume of Dr Wallis's works.

Newton's admirers in Holland had informed Dr Wallis that Newton's method of fluxions passed there under the name of Leibnitz's *Calculus Differentialis*. It was therefore thought necessary that an early opportunity should be taken of asserting Newton's claim to be the inventor of the method of fluxions, and this was the reason for this method first appearing in Wallis's works. A further account of the method was given in the first edition of Newton's *Optics*, which appeared in 1704. To this work were added two treatises, entitled *Tractatus duo de speciebus et magnitudine figurarum curvilinearum*, the one bearing the title *Tractatus de Quadratura Curvarum*, and the other *Enumeratio linearum tertii ordinis*. The first contains an explanation of the doctrine of fluxions, and of its application to the quadrature of curves; the second, a classification of seventy-two curves of the third order, with an account of their properties. The reason for publishing these two tracts in his *Optics*, from the subsequent editions of which they were omitted, is thus stated in the advertisement:—

> "In a letter written to M. Leibnitz in the year 1679, and published by Dr Wallis, I mentioned a method by which I had found some general theorems about squaring curvilinear figures on comparing them with the conic sections, or other the simplest figures with which they might be compared. And some years ago I lent out a manuscript containing such theorems; and having since met with some things copied out of it, I have on this occasion made it public, prefixing to it an introduction, and joining a Scholium concerning that method. And I have joined with it another small tract concerning the curvilineal figures of the second kind, which was also written many years ago, and made known to some friends, who have solicited the making it public."

In the year 1707 Whiston published the algebraical lectures which Newton had delivered at Cambridge, under the title of *Arithmetica Universalis, sive de Compositione et Resolutione Arithmetica Liber*. We are not accurately informed how Whiston obtained possession of this work; but it is stated by one of the editors of the English edition "that Mr Whiston, thinking it a pity that so noble and useful a work should be doomed to a college confinement, obtained leave to make it public." It was soon afterwards translated into English by Mr Raphson; and a second edition of it, with improvements by the author, was published at London in 1712, by Dr Machin, secretary to the Royal Society. With the view of stimulating mathematicians to write annotations on this admirable work, the celebrated 'S Gravesande published a tract, entitled *Specimen Commentarii in Arithmeticam Universalem*; and Maclaurin's *Algebra* seems to have been drawn up in consequence of this appeal.

In mentioning the mathematical works of our author, we must not omit his solution of the celebrated problems proposed by John Bernoulli and Leibnitz. In June 1696 Bernoulli addressed a letter to the mathematicians of Europe challenging them to solve two problems—(1) to determine the brachistochrone between two given points not in the same vertical line, (2) to determine a curve such that, if a straight line drawn through a fixed point A meet it in two points P_1, P_2, then $AP_1^m + AP_2^m$ will be constant. This challenge was first made in the *Acta Lipsiensia* for June 1696. Six months were allowed by Bernoulli for the solution of the problem, and in the event of none being sent to him he promised to publish his own. The six months elapsed without any solution being produced; but he received a letter from Leibnitz, stating that he had "cut the knot of the most beautiful of these problems," and requesting that the period for their solution should be extended to Christmas next, that the French and Italian mathematicians might have no reason to complain of the shortness of the period. Bernoulli adopted the suggestion, and publicly announced the prorogation for the information of those who might not see the *Acta Lipsiensia*.

On the 29th January 1696–97 Newton received from France two copies of the printed paper containing the problems, and on the following day he transmitted a solution of them to Montague, then president of the Royal Society. He announced that the curve required in the first problem must be a cycloid, and he gave a method of determining it. He solved also the second problem, and he showed that by the same method other curves might be found which shall cut off three or more segments having the like properties. Solutions were also obtained from Leibnitz and the Marquis de L'Hôpital; and, although that of Newton was anonymous, yet Bernoulli recognized the author in his disguise: "tanquam," says he, "ex ungue leonem."

In the year 1699 Newton's position as a mathematician and natural philosopher of the first order were recognized in a very honourable manner by the French Academy of Sciences. In that year the Academy was remodelled, and eight foreign associates were created. Leibnitz, Guglielmini, Hartsoeker, and Tschirnhausen were appointed on February 4, James Bernoulli and John Bernoulli on February 14, and Newton and Roemer on February 21.

While Newton held the office of warden of the mint, he retained his chair of mathematics at Cambridge, and discharged the duties of the post but shortly after he was promoted to the more lucrative office of master of the mint he appointed Whiston his deputy with "the full profits of the place." Whiston began his astronomical lectures as Newton's deputy in January 1701. On December 10, 1701, Newton resigned his professorship, thereby at the same time resigning his fellowship at Trinity, which he had held with the Lucasian professorship since 1675 by virtue of the royal mandate. Whiston's claims to succeed Newton in the Lucasian chair were successfully supported by Newton himself.

On November 26, 1701, Newton was again elected one of the representatives of the university in parliament, but he retained his seat only until the dissolution in the following July. Newton does not seem to have been a candidate at this election, but at the next dissolution in 1705 he was again a candidate for the representation of the university. He was warmly supported by the residents, but being a Whig in politics he was opposed by the non-residents, and beaten by a large majority.

In the autumn of 1703 Lord Somers retired from the post of president of the Royal Society, and Newton on November 30, 1703, was elected to succeed him. Newton was annually re-elected to this honourable post during the remainder of his life. He held the office in all twenty-five years, a period in which he has been exceeded by but one other president of the Royal Society, Sir Joseph Banks. As president Newton was brought into close connexion with Prince George of Denmark, the queen's husband, who had been elected a fellow of the Royal Society. The prince had offered, on Newton's recommendation, to be at the expense of printing Flamsteed's observations, and especially his catalogue of the stars. It was natural that the queen should form a high opinion of one whose merits had made such a deep impression on her husband, and she took an early opportunity of publicly showing the respect she had for his genius and character. In April 1705, when the queen, the prince, and the court were staying at the royal residence at Newmarket, they paid a visit to Cambridge, where they were the guests of Dr Bentley, the master of Trinity. Her Majesty went in state to the Regent House, where a congregation of the senate was held, and a number of honorary degrees conferred. Afterwards the queen held a court at Trinity Lodge, where (April 16, 1705) she conferred the order of knighthood upon the most distinguished of her subjects, the noblest knight who ever won his spurs in science, Sir Isaac Newton.

As soon as the first edition of the *Principia* was published Newton began to prepare for a second edition. He was anxious to improve the work by additions to the theory of the motion of the moon and the planets. Dr Edleston, in his preface to Newton's correspondence with Cotes, justly remarks :—

> "If Flamsteed the Astronomer-Royal had cordially cooperated with him in the humble capacity of an observer in the way that Newton pointed out and requested of him (and for his almost unpardonable omission to do so I know of no better apology that can be offered than that he did not understand the real nature and, consequently, the importance of the researches in which Newton was engaged, his purely empirical and tabular views never having been replaced in his mind by a clear conception of the Principle of Universal Gravitation), the lunar theory would, if its creator did not overrate his own powers, have been completely investigated, so far as he could do it, in the first few months of 1695, and a second edition of the *Principia* would probably have followed the execution of the task at no long interval."

Newton, however, could not get the information he wanted from Flamsteed, and after the spring of 1696 his time was much occupied by his duties at the mint. Rumours, however, of his work, and of a new edition, were heard from time to time. In February 1700 Leibnitz writes of Newton, "J'ai appris aussi (je ne sçai où) qu'il donnera encore quelque chose sur le mouvement de la lune : et on m'a dit aussi qu'il y aura une nouvelle édition de ses principes de la natur

Dr Bentley, the master of Trinity College, had for a long time urged Newton to give his consent to the republication of the *Principia*. In the middle of 1708 Newton's consent was obtained, but it was not till the spring of 1709 that he was prevailed upon to entrust the superintendence of it to a young mathematician of great promise, Roger Cotes, fellow of Trinity College, who had been recently appointed the first Plumian professor of astronomy and experimental philosophy. On May 21, 1709, after having been that day with Newton, Bentley announced this arrangement to Cotes :—"Sir Isaac Newton," he said, "will be glad to see you in June, and then put into your hands one part of his book corrected for the press." About the middle of July Cotes went to London, in the expectation doubtless to bring down with him to Cambridge the corrected portion of the *Principia*. Although Cotes was impatient to begin his work, it was nearly the end of September before the corrected copy was put into his hands.

During the printing of this edition a correspondence went on continuously between Newton and Cotes. On March 31, 1713, when the edition was nearly ready for publication, Newton wrote to Cotes :—

> "I heare that Mr Bernoulli has sent a Paper of 40 pages to be published in the *Acta Leipsica* relating to what I have written upon the curve Lines described by Projectiles in resisting Mediums. And therein he partly makes Observations upon what I have written & partly improves it. To prevent being blamed by him or others for any disingenuity in not acknowledging my oversights or slips in the first edition, I believe it will not be amiss to print next after the old *Præfatio ad Lectorem*, the following account of this new Edition.
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> "'In hac secunda Principiorum Editione, multa sparsim emendantur & nonnulla adjiciuntur. In Libri primi Sect. ii. Inventio virium quibus corpora in Orbibus datis revolvi possint, facilior redditur et amplior. In Libri secundi Sect. vii. Theoria resistentiæ fluidorum accuratius investigatur & novis experimentis confirmatur. In Libro tertio Theoria Lunæ & Præcessio Æquinoctiorum ex Principiis suis plenius deducuntur, et Theoria Cometarum pluribus et accuratius computatis Orbium exemplis confirmatur.
>
> "'28 Mar. 1713. I. N.'
>
> "If you write any further Preface, I must not see it, for I find that I shall be examined about it. The cuts for y^{e} Comet of 1680 & 1681 are printed off and will be sent to Dr Bently this week by the Carrier."

Newton's desire to have no hand in writing the preface seems to have proceeded from a knowledge that Cotes was proposing to allude to the dispute about the invention of fluxions.[1] At last, about midsummer 1713, was published the long and impatiently expected second edition of the *Principia*, and on July 27 Newton waited on the queen to present her with a copy of the new edition.

In 1714 the question of finding the longitude at sea, which had been looked upon as an important one for several years, was brought into prominence by a petition presented to the House of Commons by a number of captains of Her Majesty's ships and merchant ships and of London merchants. This petition set forth "that the discovery of longitude is of such consequence to Great Britain, for safety of the navy, for merchant ships, as well as of improvement of trade, that for want thereof many ships had been retarded in their voyages, and many lost; but if due encouragement were proposed by the public for such as shall discover the same, some persons would offer themselves to prove the same before the most proper judges." The petition was referred to a committee of the House, who called witnesses. Newton appeared before them and gave evidence. He stated that for determining the longitude at sea there had been several projects, true in theory but difficult to execute. He mentioned four:—(1) by a watch to keep time exactly, (2) by the eclipses of Jupiter's satellites, (3) by the place of the moon, (4) by a new method proposed by Mr Ditton. Newton criticized all the methods, pointing out their weak points, and it is due mainly to his evidence that the committee brought in the report which was accepted by the House, and shortly afterwards was converted into a Bill, passed both Houses, and received the royal assent. The report ran "that it is the opinion of this committee that a reward be settled by parliament upon such person or persons as shall discover a more certain and practicable method of ascertaining the longitude than any yet in practice; and the said reward be proportioned to the degree of exactness to which the said method shall reach." For the history of the consequences of this report we must refer to the article NAVIGATION, p. 258 *sq.* of the present volume.

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[1] For an account of the dispute concerning the rival claims of Newton and Leibnitz to be considered the inventor of the method of fluxions or the differential calculus, and an account of the case as drawn up by a committee of the Royal Society in the *Commercium Epistolicum*, see INFINITESIMAL CALCULUS, vol. xiii. pp. 8-10.

Sir Isaac Newton was a very popular visitor at the court of George I. The princess of Wales, afterwards Queen Caroline, wife of George II., took every opportunity of conversing with him. Having one day been told by Sir Isaac that he had composed a new system of chronology while he was still resident at Cambridge, she requested him to give her a copy. He accordingly drew up an abstract of the system from his papers, and sent it to the princess for her own private use; but he afterwards allowed a copy to be made for the Abbé Conti on the express understanding that it should not be communicated to any other person. The abbé, however, unmindful of his promise not to divulge the system, lent his copy to M. Fréret, an antiquary at Paris, who translated it, and endeavoured to refute it. The translation was printed under the title *Abrégé de Chronologie de M. le Chevallier Newton, fait par lui-même et traduit sur le Manuscrit Anglais.* Upon receiving a copy of this work, Sir Isaac Newton printed, in the *Philosophical Transactions* for 1725, a paper entitled *Remarks on the observations made on a Chronological Index of Sir Isaac Newton, translated into French by the observator, and published at Paris.* In these remarks Sir Isaac charged the abbé with a breach of promise, and gave a triumphant answer to the objections which Fréret had urged against his system. Father Souciet entered the field in defence of Fréret; and in consequence of this controversy Sir Isaac was induced to prepare his larger work, which was published in 1728, after his death, and entitled *The Chronology of Ancient Kingdoms amended, to which is prefixed a short Chronicle from the First Memory of Kings in Europe to the Conquest of Persia by Alexander the Great.*

From an early period of his life Newton had paid great attention to theological studies, and it is well known that he had begun to study the subject of the prophecies before the year 1690. M. Biot, with a view of showing that his theological writings were the productions of his dotage, has fixed their date between 1712 and 1719. That Newton's mind was even then quite clear and powerful is sufficiently proved by his ability to attack the most difficult mathematical problems with success. For it was in 1716 that Leibnitz, in a letter to the Abbé Conti, proposed a problem for solution "for the purpose of feeling the pulse of the English analysts." The problem was to find the orthogonal trajectories of a series of curves represented by a single equation. Newton received this problem about 5 o'clock in the afternoon as he was returning from the mint, but, though he was fatigued with business, he solved the problem the same evening.

One of the most remarkable of Sir Isaac's theological productions is his *Historical Account of Two Notable Corruptions of the Scripture*, in a letter to a friend. This friend was Mr Locke, who received the letter in November 1690. Sir Isaac seems to have been then anxious for its publication; but, as the effect of his argument was to deprive the Trinitarians of two passages in favour of the Trinity, he became alarmed at the probable consequences of such a step. He therefore requested Locke, who was then going to Holland, to get it translated into French, and published on the Continent. Being prevented from going to Holland, Locke copied the manuscript, and sent it, without Newton's name, to Le Clerc, who received it before the 11th of April 1691. On the 20th of January 1692 Le Clerc announced to Locke his intention to publish the pamphlet in Latin; and, upon the intimation of this to Sir Isaac, he entreated him "to stop the translation and impression as soon as he could, for he designed to suppress them." This was accordingly done; but Le Clerc sent the manuscript to the library of the Remonstrants, and it was afterwards published at London in 1754, under the title of *Two Letters from Sir Isaac Newton to M. le Clerc.* This edition is imperfect, and in many places erroneous. Dr Horsley therefore published a genuine one, which is in the form of a single letter to a friend, and was taken from a manuscript in Sir Isaac's own hand.

Sir Isaac Newton left behind him in manuscript a work entitled *Observations on the Prophecies of Daniel and the Apocalypse of St John*, which was published in London in 1733, in one volume 4to; another work, entitled *Lexicon Propheticum*, with a dissertation on the sacred cubit of the Jews, which was printed in 1737; and four letters addressed to Bentley, containing some arguments in proof of a Deity, which were published by Cumberland, a nephew of Bentley, in 1756. Sir Isaac also left a *Church History* complete, a *History of the Creation*, *Paradoxical Questions regarding Athanasius*, and many divinity tracts.

Newton devoted much of his time to the study of chemistry; but the greater number of his experiments still remain in manuscript. His *Tabula Quantitatum et Graduum Caloris* contains a comparative scale of temperature from that of melting ice to that of a small kitchen fire. He wrote also another chemical paper *De Natura Acidorum*, which has been published by Dr Horsley. Sir Isaac spent much time in the study of the works of the alchemists. He had diligently studied the works of Jacob Boehme, and there were found amongst his manuscripts copious abstracts from them in his own handwriting. In the earlier part of his life he and his relation Dr Newton of Grantham had put up furnaces, and had wrought for several months in quest of the philosopher's tincture. Among the manuscripts in the possession of the earl of Portsmouth there are many sheets in Sir Isaac's hand of Flamsteed's *Explication of Hieroglyphic Figures*, and in another hand many sheets of William Yworth's *Processus Mysterii Magni Philosophicus*.

In the last few years of his life Newton was troubled with incontinence of urine, which was supposed to be due to stone; but with care he kept the disease under control. In January 1725 he was seized with a violent cough and inflammation of the lungs, which induced him to reside at Kensington; and in the following month he had a severe attack of gout, which produced a decided improvement in his general health. His duties at the mint were discharged by Mr Conduitt, and he therefore seldom went from home. On the 28th of February 1727, feeling well, he went to London to preside at a meeting of the Royal Society; but the fatigue which attended this duty brought on a violent return of his former complaint, and he returned to Kensington on the 4th of March, when Dr Mead and Dr Chesselden pronounced his disease to be stone. He endured the sufferings of this complaint with wonderful patience and meekness. He seemed a little better on the 15th of March, and on the 18th he read the newspapers, and conversed with Dr Mead; but at 6 o'clock in the evening he became insensible, and continued in that state till Monday the 20th of March 1726-7, when he expired without pain between one and two o'clock in the morning, in the eighty-fifth year of his age. His body was removed to London, and on Tuesday the 28th of March it lay in state in the Jerusalem Chamber, and was thence conveyed to Westminster Abbey, where it was buried.

Authorities.—Commercium Epistolicum D. Johannis Collins et aliorum de analysi promota: jussu Societatis Regiæ in lucem editum, &c., 1712 (2d edition, 1722); H. Pemberton, *A View of Sir Isaac Newton's Philosophy*, 1728; F. Baily, *An Account of the Rev. John Flamsteed, the First Astronomer-Royal*, &c., 1835; Whewell's *History of the Inductive Sciences*, 1837; S. P. Rigaud, *Historical Essay on the First Publication of Sir Isaac Newton's Principia*, 1838; Edleston, *Correspondence of Sir Isaac Newton and Professor Cotes*, &c., 1850; Sir D. Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton*, 1855; Lord Brougham and Mr Routh's *Analytical View of Sir Isaac Newton's Principia*, 1855; *Correspondence of Scientific Men of the 17th Century, &c., from the Originals in the Collection of the Earl of Macclesfield*, 1841; J. Raphson, *History of Fluxions, showing in a compendious manner the First Rise of and Various Improvements made in that Incomparable Method*, 1715. The collected works of Newton were published in 1779 by Dr Samuel Horsley, F.R.S., under the title *Isaaci Newtoni Opera quæ exstant Omnia*. (H. M. T.)

NEWTON, JOHN (1725–1807), a prominent Evangelical clergyman of the Church of England, and an intimate friend of the poet Cowper, was born in London 24th July 1725. His father, who for a long time was master of a ship in the Mediterranean trade, became in 1748 governor of York Fort, Hudson's Bay, where he died in 1750; his mother, a pious Dissenter, died when he was hardly seven years old. The only time spent by him at school was from his eighth to his tenth year, at Stratford, Essex. When only eleven years of age he joined his father's ship, where he continued to serve under him till 1742; shortly afterwards he was impressed on board a man-of-war, the "Harwich," where he was made a midshipman. For an attempt to escape while his ship lay off Plymouth he was degraded, and treated with so much severity that when two men from a Guinea ship came aboard the man-of-war off Madeira he was glad to take advantage of the opportunity to exchange into an African trader. At Sierra Leone he left this ship and entered into the service of a slave trader, with whom he remained two years. The hardships he suffered were, however, so severe that he brought them under the notice of his father, by whose directions an English ship called for him in 1747 and brought him to England. Shortly afterwards he became mate on board a Liverpool slave ship, with which he made another voyage to Guinea, returning by the West Indies and Charleston. After his marriage in 1750 he made several similar voyages as master, devoting his leisure time to the improvement of his education, especially in mathematics, French, and Latin. The state of his health and a growing aversion to the slave trade led him to quit the sea in 1755, when he was appointed tide-surveyor at Liverpool. He now directed his attention to the study of Greek and Hebrew, and in 1758, in consequence of a gradual deepening of his religious convictions which had been going on for years, applied to the archbishop of York for holy orders. This was refused him, but, having had the curacy of Olney offered to him in April 1764, he was ordained deacon by the bishop of Lincoln, and in June of the following year was ordained priest. About three and a half years afterwards Cowper the poet settled in the parish. An intimate friendship sprung up between them, and they published together the *Olney Hymns* (1779). They made it a rule to spend four days of the week in one another's company, and were rarely "seven successive working hours apart." In 1779 Newton left Olney to become rector of St Mary Woolnoth, London, where he laboured with unremitting diligence in visiting and preaching till his death, December 31, 1807.

Like Cowper, Newton held strongly Calvinistic views, although his evangelical fervour allied him closely with the sentiments of Wesley and the Methodists. His enduring fame rests on certain of the *Olney Hymns*, remarkable for vigour, simplicity, and directness of devotional utterance, which have passed into almost universal currency throughout the Reformed churches of English speech. His prose works include an *Authentic Narrative of some Interesting and Remarkable Particulars in his own Life*, a volume of *Sermons* (1760), *Omicron* (a series of letters on religion, 1762), *Review of Ecclesiastical History* (1769), and *Cardiphonia* (1781); but, though once extensively read, they now, with perhaps the exception of the first-named (a well-told narrative of moral and religious conversion), receive but little attention, and indeed have but little title to a permanent place in religious literature. A *Life* of Newton by Richard Cecil, first published in 1808, was prefixed to a collected edition of his works which appeared in 6 vols., 1816. Many subsequent editions of his works have been published.

NEWTON ABBOT AND NEWTON BUSHEL, situated respectively in the parishes of Wolborough and Highweek, and separated by the small river Lemon, are generally included under the one name Newton Abbot, a market-town of Devonshire, England, on the Teign, 5 miles south by west of Teignmouth, and 6 north of Torquay. The beauty of the neighbouring scenery and the salubrity of the climate have tended of late years to increase the demand for residences, while the situation of the town at the head of the Teign navigation enables it to carry on a considerable shipping trade. St Mary's, the parish church of Wolborough, about half a mile south of the town, is in the Perpendicular style, as is also the parish church of Highweek, about a mile to the north-west. A very extensive nunnery, called St Augustine's Priory, was erected near the town in 1861. To the east of the town is Forde House, an Elizabethan structure belonging to the earl of Devon, visited by Charles I. and William of Orange. The other principal buildings are the union workhouse, the town-hall, and the markets. There are two fine public parks, Courtenay Park and Forde Park. The town possesses iron foundries, malt-houses, flour-mills, a tannery, and a brewery. The engine-works of the Great Western Railway have lately been established in the town. Fine potters' clay and pipeclay are obtained in the neighbourhood, about 6000 tons being exported annually to the potteries. There is a considerable trade in cattle, corn, and agricultural produce. The population of Wolborough with Newton Abbot in 1881 was 7662, and of Highweek 2164.

Probably both Newton Abbot and Newton Bushel were originally included under *Nuistone*. Newton Abbot was given to the abbot of Tor by William Lord Brewer, founder of the monastery. Newton Bushel was so called from Robert Bussell or Bushell, foster-child and kinsman of Theobald de Englishville, who was made lord of the manor by Henry III. in 1246.

NEWTON-LE-WILLOWS, or **NEWTON-IN-MAKERFIELD**, a township and urban sanitary district of Lancashire, is situated on a branch of the London and North-Western Railway between Liverpool and Manchester, about 15¾ miles from each. The original town of Newton consists principally of one broad street, but many new buildings have sprung up in the immediate neighbourhood, especially at Earlestown junction, about half a mile distant. There is a town-hall, a mechanics' institute, and a grammar school. At a short distance from the town is a moated timber-house, and also an ancient barrow of great extent. The Liverpool farm reformatory school is in the neighbourhood. The industrial establishments include the waggon factory of the London and North-Western Railway Company (employing about 1000 hands), a large foundry, printing and stationery works, paper-mills, and sugar refineries. Coal abounds in the neighbourhood. The barony is mentioned as being possessed by Edward the Confessor, but after the Conquest it was given to the Langtons. Near the town a party of Highlanders were in 1648 taken prisoners by Cromwell's troops, and hanged in an adjoining wood, still called Gallow's Cross. The town possessed the privilege of returning two members to parliament from the 5th of Elizabeth, but was disfranchised in 1832. The population of the urban sanitary district in 1871 was 8244, and in 1881 it was 10,580.

NEWTOWN (Welsh, *Drefnewydd*; ancient name, *Llanfair Cedewain*), a market-town and parliamentary borough of Montgomeryshire, is situated on both sides of the Severn, 11 miles east-north-east of Llanidloes, and 13 south-south-west of Welshpool. It is a well-built town with wide and regular streets, although some of the houses are of timber. The principal buildings are the public rooms (1835), the infirmary (1867), and the market-hall (1870). Newtown is the principal seat of the Welsh flannel manufacture, to which now has been added that of tweeds and shawls. It joins with Welshpool, Llanfyllin, Montgomery, Llanidloes, and Machynlleth in returning a member to parliament. The population of the urban sanitary district of Newtown and Llanllwchaiarn in 1871 was 5886, and in 1881 it was 7170.

NEWTOWN, a suburban municipal district of Sydney, New South Wales. It consists chiefly of the residences of the better classes, whose business premises are in the city. It possesses a town-hall, a good free library, and a new court-house. There is a public school with an average attendance of about 800. The municipal government was proclaimed 12th December 1862. Newtown is connected with Sydney by railway, tramway, and omnibus. The population in 1881 was 15,828.

NEWTOWNARDS, or NEWTOWNARDES, a market-town, formerly a parliamentary borough, of the county Down, Ireland, is beautifully situated near the northern extremity of Lough Strangford, on the Belfast and County Down Railway, 9½ miles east of Belfast and 4½ south by west of Bangor. The town, which is sheltered by hills on the west and north, is well built, and possesses a fine square, from which the principal streets diverge. There is a court-house and a town-hall. In the market square the pedestal of an ancient cross was erected in 1636. Muslin embroidery is the principal industry, a hem-stitching factory affording employment to 500 females. There is also a mill for flax and hemp yarns. In the neighbourhood there are freestone quarries. The population in 1871 was 9562, and in 1881 it was 8676.

From an early period there were a large number of religious foundations in the district, and the town owes its origin to a Dominican monastery founded in 1244 by Walter de Burgh. The town was forfeited by the O'Neills, and given to the Hamiltons and Montgomeries, from whom it passed to the marquis of Londonderry. It received a charter from James I., and until the Union returned two members to parliament.

NEW YEAR'S DAY. The first day (*calends*) of January, as marking the beginning of the year, was observed as a public holiday in Rome from at least the time of the Julian reformation of the calendar. Ovid (*Fas.*, i. 63 *sq.*) alludes to the abstinence from litigation and strife, the smoking altars, the white-robed processions to the Capitol; and later writers describe the exchanges of visits, the giving and receiving of presents (*strenæ*), the masquerading, and the feasting with which the day was in their time celebrated throughout the empire. Libanius (*c.* 346 A.D.) speaks of it as being in his day the one great holiday common to all under the Roman rule. Participation by Christians in the ordinary New Year's Day observances, as well as in the Saturnalia of the preceding month of December, which was from the first discouraged by the church, called forth repeated protests, not only from eminent individuals such as Tertullian (*De Idol.*, 14), Augustine (*Serm. de Kal. Jan.*), and Chrysostom (*Hom. in Kal.*), but also from various provincial synods; and the sixty-second canon of the Quinisext general council (692) was expressly directed against "the so-called Calends, and Vota, and Brumalia." Christians were expected to spend the day in quiet meditation, reading of scripture, and acts of charity and beneficence. When about the 5th century the 25th of December had gradually become a fixed festival commemorative of the Nativity, the 1st January ultimately also assumed a specially sacred character as the octave of Christmas Day and as the anniversary of the circumcision of our Lord, and as such it still figures in the calendars of the various branches of the Eastern and of the Western Church, though only as a feast of subordinate importance. The practice of giving and receiving "strenæ" for luck about the beginning of the year survives in such institutions as the French "jour d'étrennes" and the Scottish "Handsel Monday." The Persians also, it may be mentioned, celebrated the beginning of the year (*nev-rúz*) by exchanging presents of eggs. For particulars as to the date of commencement, and also as to the duration, of the year, whether civil or sacred, in various nations and religions, reference may be made to the article CALENDAR.

NEW YORK

I. NEW YORK STATE.

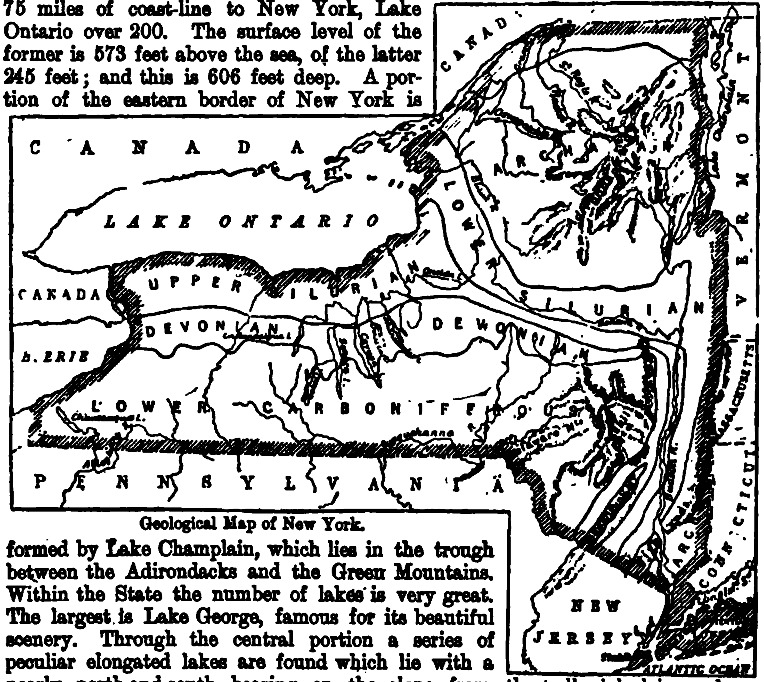
NEW YORK, one of the original thirteen United States of America, is situated between 40° 29′ 40″ and 45° 0′ 2″ N. lat. and between 71° 51′ and 79° 45′ 54″·4 W. long. It is bounded N. by Lake Ontario and the St Lawrence river, which separate it from the province of Ontario; E. by Vermont, Massachusetts, and Connecticut; S. by the Atlantic Ocean, New Jersey, and Pennsylvania; and W. by Pennsylvania, Lake Erie, and the Niagara river.

Topography.—The State of New York has a triangular outline, with a breadth from east to west of 326·46 miles, and from north to south, on the line of the Hudson, of 300 miles. In addition it includes Long Island and Staten Island on the Atlantic coast. Its area is 49,170 square miles,—47,620 square miles, or 30,476,800 acres, being land, and the remainder portions of the great lakes that border it. The surface is more diversified than that of any other State in the Union. The eastern and southern portions are high, and from these the land slopes gently north and west to Lake Ontario. The mountainous belt of the eastern part is cut through by the great water-gap of the Mohawk valley, which once connected the Ontario basin with the trough of the Hudson below the present ocean-level, and is the most interesting and important feature in the topography of the State.

Mountains.—The mountains of New York form three distinct groups. (1) The Adirondacks, a series of short ranges having a north-north-east and south-south-west direction, form the centre of the elevated region of the north-east section of the State. The highest of these is Mount Marcy, 5344 feet, with several associated summits which reach the altitude of 5000 feet. (2) The Catskill Mountains, with their foothills, occupy about 500 square miles south of the Mohawk valley and west of the Hudson; the highest peaks reach an altitude of 4000 feet. The Helderberg and Shawangunk Mountains are topographically a portion of the Catskills, the first on the north, the second on the south. These all belong to the

Alleghany system, and are connected with the mountains of Pennsylvania by the Delaware Mountains, which have an altitude of from 1600 to 2800 feet. (3) The Highlands of the Hudson, through which the river passes at West Point, are the northern continuation of the Blue Ridge of Pennsylvania, having an altitude of from 1200 to 1800 feet. The so-called mountains of the central and southern counties are portions of a high plateau which connects with the Helderberg and Catskill Mountains on the east. This is cut by eroded valleys in such a way as to leave many elevated points, of which the highest is East Hill in Otsego county, 2300 feet above the sea.

One of the most peculiar and impressive topographical features is formed by the cliffs of the Palisades, which border the Hudson in Rockland county. and are continuous with those of New Jersey.



Geological Map of New York.

Lakes and Rivers.—Two of the chain of great lakes border the State, Lake Erie and Lake Ontario, connected by the Niagara river, on which is the most celebrated cataract in the world. Lake Erie gives about 75 miles of coast-line to New York, Lake Ontario over 200. The surface level of the former is 573 feet above the sea, of the latter 245 feet; and this is 606 feet deep. A portion of the eastern border of New York is formed by Lake Champlain, which lies in the trough between the Adirondacks and the Green Mountains. Within the State the number of lakes is very great. The largest is Lake George, famous for its beautiful scenery. Through the central portion a series of peculiar elongated lakes are found which lie with a nearly north-and-south bearing on the slope from the southern highlands to the Ontario basin, or the Mohawk valley. The largest of these are Cayuga, Seneca, Oneida, Crooked, Canandaigua, Owasco, and Otsego. These are river valleys once occupied and modified by glaciers and dammed up by moraines. The Adirondack region is famous for its system of lakes, which are favourite places of resort for tourists. Among the rivers of New York the Hudson is the largest and most beautiful. Formerly it ran several hundred feet below its present level, and was the great channel of drainage which led through the Mohawk valley from the interior. Now, by a subsidence of the continent, it is an arm of the sea, and navigable to Troy, 151 miles from its mouth. The Black River, the Mohawk, and the Genesee are all large streams which lie entirely within the State, while the Alleghany, the Susquehanna, and the Delaware rise there, but soon leave it to become the great rivers of Pennsylvania. From the varied topography and the abundant rainfall the number of streams is large, and many of them are marked by picturesque falls. Besides the great cataract of Niagara, a mile wide and 164 feet high, which New York shares with Canada, there are many other falls worthy of mention, as those of the Genesee at Rochester and Portage, Trenton Falls, the Falls of Ticonderoga, &c. Among the natural features which distinguish the State its mineral springs deserve special mention. Those of Saratoga, Balston, Sharon, Avon, and Richfield are famous throughout the Union. They differ much in chemical composition and medicinal virtues, but all are popular places of resort, and some have gathered round them towns of considerable size.

Climate.—In a general way it may be said that the climate of New York is typical of that of the northern United States, a climate of extremes, hot in summer and cold in winter, and yet healthful, stimulating, and on the whole not disagreeable. The average annual temperature is about 47° Fahr., the average maximum of summer heat 93°, the temperature of 100° being rarely reached, and 102° the highest maximum record. The minimum temperature is about − 20° Fahr., never attained in the southern portion, seldom in the central, but often passed by four or five degrees in the most northern counties. The average rainfall is about 40 inches. Frosts begin from September 1st to October 1st, and end from April 1st to May 1st, according to the locality and year. In the Adirondack region the snowfall is heavy, the winter long and severe. In central New York it is not uncommon for snow to accumulate to the depth of 3 or 4 feet, and yet this is not persistent. About New York city and on Long Island the snow rarely exceeds a foot in depth, sleighing is always uncertain, and sometimes the ground will be bare for weeks together. Thus it will be seen that the climate of New York is intermediate in character between that of New England and the Mississippi valley States,—a little milder than the first, severer than the last. The great lakes which border it are never frozen to their centres, and exert an equalizing influence upon the climate of their shores.

In the absence of extensive alluvial plains and marshes, there is little malaria, and the climate is salubrious. About New York city and on Long Island the ocean softens the rigours of winter, and through the influence of the Arctic current, which bathes the coast as far south as Cape Hatteras, renders the summer perceptibly cooler.

The local variation of climate within the limits of the State will be best seen by the following table :—

	Lat.	Long	Elevation.	Mean Annual Temp.	Mean Annual Rainfall.
	° ′	°	Feet.	°	Inches.
Moriches, Long Island	40 49	72 36	Sea-level.	54·2	54·67
New York City	40 42	74	100	51·2	44·59
Albany	42 40	74 45	150	46·9	40·67
Rochester	43 8	77 51	525	46·9	32·56
Buffalo	42 53	78 55	660	46·6	33·84
Gouverneur	44 25	75 25	400	44·1	30·15
Plattsburg	44 41	73 25	186	44	33·4

Fauna.—At the advent of the whites the fauna of New York included all the wild animals which were found in the north-eastern States of the Union or the adjacent portions of Canada, but by the cutting off of forests, and the occupation of the surface by farms, the range of the native animals has been greatly reduced, and they have been unceasingly destroyed by man. Formerly the elk, the moose, and the caribou were abundant in the northern part of the State, but are now all exterminated, while the Virginia deer in many localities is still quite plentiful. Of the carnivorous animals, the cougar, the black bear, two species of lynx, the red and grey foxes, the wolf, otter, fisher, pine marten, mink, and skunk still remain, but the wolf is on the eve of extermination, and the wolverine, never abundant, has perhaps migrated northward. Among the rodents the beaver and variable hare are found, but in small numbers, while rabbits, squirrels, rats, mice, field-mice, &c., are still unpleasantly numerous.

Civilization has made but little difference with the reptiles, birds, and fishes. All the birds indigenous to the eastern portion of the continent may probably at times be found within the State, though their relative numbers are affected by the removal of the forests. Among the reptiles are seventeen species of snakes, three of which, two rattlesnakes and the copperhead, are venomous. The fishes include all the species found in the lower lakes, in the rivers of the temperate portions of the continent, and on the Atlantic coast; and the fisheries constitute an important element in the revenues and subsistence of the people. The streams and lakes of the more elevated portions contain brook trout in abundance; those of the lower levels are well stocked with bass, pickerel, perch, and other game fish. The salmon, which formerly inhabited the Hudson and its tributaries, was long since exterminated; but an effort has been made to restock some of the streams, and, like the German carp recently introduced, it may now be reckoned as an inhabitant of the waters of New York. Some of the interior lakes are stocked with a land-locked salmon, or lake trout, a valuable and interesting fish. The oyster industry of the coast has its chief commercial centre in New York city, and an important fraction of the supply of clams, oysters, lobsters, and sea fish is obtained from the New York coast.

Flora.—Originally the surface of New York was occupied by an almost unbroken forest, and, as a consequence of the general fertility of the soil, its topographical diversity, and the range of latitude and longitude, the flora is rich and varied. About seventy species of trees are known to inhabit the State, and these include all found in the adjacent portions of the Union and Canada. The most abundant are oaks, of which there are fifteen species, but with these mingle five species each of maple, pine, and poplar, four species of hickory, three each of elm, spruce, and ash, two of willow, cherry, magnolia, and pepperidge, and one each of larch, liriodendron, dogwood, arbor vitæ, balsam, yew, sycamore, honey locust, sweet gum, locust, butternut, black walnut, chestnut, beech, hornbeam, basswood, sassafras, and mulberry. On the summits of the Adirondacks a true alpine vegetation is found, though consisting of but a small number of plants; several of these exist in no other locality in the United States except the mountain summits of Vermont and New Hampshire. The flowering plants and ferns of New York were studied with much care by the late Dr Torrey, and his report upon them forms two of the series of twenty-three quarto volumes which compose the *Report on the Natural History of New York*. The flowering plants enumerated by Dr Torrey amount to 1540 species, to which a few additions have since been made. The ferns number fifty-four species—more than are found in any other State; the lower forms of plant life, seaweeds, fungi, lichens, &c., are constantly supplying new material, and many years will yet be required for their complete elaboration.

Geology.—The geological structure of New York is more varied and comprehensive than that of any other State, since it includes, with perhaps the exception of the Jurassic, the entire geological column from the Archæan to the Tertiary. A tabular view of the relations of the rocks of New York may be given as follows:—

Quaternary...	Alluvium, peat, shell-marl, diatomaceous earth. Champlain clays. Glacial deposits. Till, kames, moraines, erratics.	
Tertiary......	Miocene (?). Eocene.	Gay Head group.
Cretaceous.....	Greensands (?). Raritan group. Long and Staten Island clays, with lignite.	
Jurassic.	Wanting (?).	
Triassic........	Palisade group. Sandstones, shale, and trap of Rockland county.	
Carboniferous	Coal-measures, wanting. Mountain limestone, wanting. Waverly group, "White Catskill." Catskill group, "Red Catskill." Chemung group.	
Devonian.....	Hamilton group.	Gardeau shale. Cashaqua shale Genesee shale. Tully limestone. Hamilton shale. Moscow shale. Encrinal limestone. Marcellus shale.
	Corniferous group.	Corniferous limestone. Onondaga limestone. Schoharie grit—passage bed.
	Oriskany group.	Caudagalli grit. Oriskany sandstone.
Upper Silurian.	Helderberg group.	Upper Pentamerus limestone. Scutella limestone. Delthyris limestone. Lower Pentamerus limestone. Water lime.
	Salina group. (Local.)	"Onondaga salt group."
	Niagara group.	Niagara limestone. Niagara shale. Clinton limestone. Clinton shale.
	Medina group.	Medina sandstone. Oneida conglomerate.
Lower Silurian.	Hudson group.	Hudson River shales. Utica shale.
	Trenton group.	Trenton limestone. Black River limestone. Birdseye limestone. Chazy limestone.
	Potsdam group.	Calciferous sand rock—passage bed. Potsdam sandstone.
Cambrian.....	Taconic group.	Rossie slate ore and marble. Troy slates and limestones. "Georgia slates."
Huronian.....	Wanting (?).	
Laurentian ..	Adirondack group.	St Lawrence marble. Moriah ophiolite. Mount Marcy norite. Gneiss with magnetite. Highlands gneiss with magnetite, &c.

The surface exposures of these rocks can be seen at a glance by reference to the accompanying outline map.

The boundaries of the State enclose an area which once formed a part of the eastern declivity of the Archæan continent, of which the Canadian and Adirondack highlands are the most important representatives. These are composed of Laurentian rocks, and are perhaps the oldest portion of the earth's surface. Upon the slope of this old continent the ocean rose and fell in the different geological ages, cutting away the shore by its waves in its advance, and spreading the debris in sheets of sand and gravel—old sea beaches. During long-continued periods of submergence organic sediments, composed of the hard parts of marine animals, accumulated over the sea bottom. In the process of emergence the shallowing and retreating sea spread over its deep water deposits mixed sediments, the finer wash of the land and organic material, carbonaceous or calcareous. When indurated, these three kinds of deposits became (1) sandstones or conglomerates, (2) limestones, (3) shales or earthy limestones. During the intervals of emergence the surface was more or less eroded, and the elevations gave obliquity to the planes of deposition, so that in each invasion of the sea it deposited its round of sediments unconformably upon the older ones. The repeated submergences which have here left their record did not cover the same area, but overlapped in such a way that the succession of deposits is easily made out,—the different groups which we call geological systems being separable by unconformability along the planes of contact, by lithological characters which are faithful records of conditions of deposition, and by differences exhibited in their fossils, for in the long intervals which separated these inundations the life of sea and land was completely and repeatedly revolutionized.

The processes described above went on through the Cambrian, Silurian, Devonian, and Carboniferous ages, forming on the south shore of the Laurentian continent the most complete and consecutive record of Palæozoic time of which we have any knowledge. Then the strata along a line passing south-westerly through eastern New York were raised in a series of folds which we call the Alleghany Mountains, and at this time all the interval between the Atlantic and the Mississippi was elevated above the ocean. There it has since remained, the sea rising and falling upon its margin, and leaving its marks, but never submerging the interior. The geological record was continued by minor contributions to the land along the Atlantic coast during the Triassic, Cretaceous, Tertiary, and Quaternary ages, and by the grinding and transporting action of glaciers which once covered the entire surface of the State.

Previous to the elevation of the Alleghanies the sheets of Palæozoic rocks formed a littoral plain sloping gently southward from the Archæan continent. But in the formation of this mountain belt the country traversed by the southern line of the State was left with a surface inclination northward, and between the Alleghanies and the Canadian and Adirondack highlands a broad valley was formed which became the channel of drainage for a great interior area. Through this valley flowed a large river which reached the sea at or near New York island. From the Carboniferous age to the Ice period this was the course of the drainage of the interior, and thus was formed the great water-gap between the Helderberg and Adirondack Mountains, the gate of the continent, through which the tide of migration has flowed from the seaboard into the Mississippi valley, and where the canal and railroad lines have been constructed which are the great arteries of commerce.

During portions of the Tertiary age perhaps the whole, but certainly the eastern margin, of the continent stood many hundred feet above its present level. The drainage of the interior flowed freely and rapidly through the channel which has been described, until that part of it which lies within the State was cut below the present sea-level, and the great river, which as a whole has never been named, but of which the Hudson, the Niagara, the Detroit, and the St Mary's are representatives, reached the ocean 80 miles south and east of New York harbour, for its channel may be traced to that point on the sea bottom, and its mouth was 600 feet below its present one. By a subsequent depression of the land or rise in the ocean-level the sea covered much of its old shore, and filled the channels cut by subaerial erosion; the Hudson became an arm of the sea, and the labyrinth of tideways was formed which are such a marked feature of the coast, and such important auxiliaries to New York harbour. During the Ice period important changes were made in the topography of the State,—by local glaciers in its advent and decline, by the great ice sheet at its climax,—the first perhaps increasing topographical variety, the second producing monotony by grinding down and rounding over asperities, and filling depressions with the debris.

The basins of the great lakes which border New York,—Ontario, Erie, and Champlain,—and of the peculiar elongated lakes of the interior, are largely the work of glaciers, which broadened and perhaps deepened river channels, and dammed them up with moraines. When the glaciers retreated from the area of New York many of the old channels of drainage were left partially or completely filled, and the flow of surface water took in some cases new directions. Among the obstructed channels was that of the Hudson west of Albany, filled by the Ontario glacier. By this cause the great river flowing from the interior was deflected from its ancient course and found a line of lowest levels leading from the north-east instead of that from the south-east corner of the Ontario valley. In this way the St Lawrence was made the outlet of the interior basin, and the Mohawk dwindled to a local draining stream. Long Island Sound and part of Long Island itself should also be classed among the products of glacial action, the Sound having been scooped out by the great glacier when it left the more resistant ledges of crystalline rocks which occupy south-eastern New York and Connecticut, and plunged into the softer Cretaceous and Tertiary beds which formed the littoral plain that bordered the continent,—the hills of the island being covered, and in part composed of loose material transported by the glacier and deposited along its edge.

Minerals.—The mineral resources of New York, though less varied than those of some other States, are still of great importance. The most valuable of these are extensive deposits of iron ore, viz.:—(1) magnetite, found in great abundance in the Adirondack region, and in Putnam, Orange, and Rockland counties; (2) hæmatite, mined in the vicinity of Rossie (St Lawrence county), Clinton (Oneida county), and elsewhere; (3) limonite, largely worked on Staten Island, and at Amenia, Sharon, &c., on the line of the New York and Harlem Railroad; (4) siderite, mined at Hyde Park on the Hudson. The production of ore from these mines in 1879 was 1,239,759 tons, valued at $3,499,132; and New York is surpassed in the quantity of iron produced by Michigan and Pennsylvania only.

The quarries of New York are numerous, and they furnish a great variety of products:—granite in the Adirondacks and along the Hudson; roofing slate in Washington county; white marble in Westchester and St Lawrence counties; red marble at Warwick, Orange county; black marble at Glenn's Falls; verde antique at Moriah and Thurman. Sandstone comes from Potsdam, Medina, and various other localities; shell-limestone from Lockport and Hudson; excellent flagging from Kingston on the Hudson; and paving stone from the trap of the Palisades. In 1880 the quarries of New York numbered two hundred and fifty-one, and the value of their product was $1,261,495. A large amount of hydraulic cement is supplied from the quarries at Rondout (Ulster county), Manlius (Onondaga county), and Akron near Buffalo; also gypsum from the vicinity of Syracuse. The deposits of these substances are very extensive, and their production could be increased indefinitely. Another item of importance among the mineral resources of the State is the salt produced from the salt-wells at Syracuse; these have been worked for many years, and the present annual product is 10,997,408 bushels, having a value of $1,374,666. In south-western New York gas and oil springs are numerous, and at Fredonia the gas has been used in lighting houses for half a century. Recent discoveries show that the petroleum fields of Pennsylvania extend into New York, and it is probable that petroleum will soon claim a place among the mineral products of the State.

The Amboy clays of New Jersey extend across Staten and Long Islands. With further investigation they may prove as valuable in the one State as in the other. (J. S. N.*)

History.—Recent investigations have added little to the knowledge of the prehistoric period of the territory known as the Middle States. The bias of scientific opinion seems to be that the earthworks, palisades, and piles of stone found in the region bounded by the St Lawrence on the north and watered by the Delaware, the Susquehanna, the Alleghany, and their tributaries are of an origin much more recent than the mound system of the Mississippi and the Ohio, and are the remains of a people intermediate between the aboriginal race and the Indians found on the soil by the first European discoverers and explorers. The latter found the eastern slope of the continent under the domination of the Iroquois tribes. John Smith met with them on the north waters of Chesapeake Bay in 1607, and Hudson found them in 1609 on the banks of the river to which he gave his name. The chief seat of this powerful nation, whose sway was recognized from the St Lawrence to the Tennessee and from the Atlantic to the Mississippi, was in the wide and fertile region of western and northern New York. Forming permanent settlements about the headwaters of the streams which gave them passage to the heart of the country, they organized the political league or confederacy known as the Five Nations. These were the tribes of Mohawks, Onondagas, Cayugas, Senecas, and Oneidas. They took the name of "Konoshioni," or People of the Long House, by which they designated the territory occupied by them, extending west from the Hudson at Albany to the foot of the great lakes, a distance of about 325 miles. There is a tradition in one of the tribes that the confederation was formed four years before Hudson's arrival, which would fix the date at 1605. On the other hand, a missionary resident among them as early as 1742 was informed by a principal chief that the confederacy was established one age (lifetime) before the white people came into the country, which, in view of the thoroughness of their organizations at the time the whites first came into immediate contact with them, seems not improbable. In 1609 Champlain, while accompanying a war party of Hurons and Algonquins on an expedition against the Iroquois, fell in with the enemy on the lake to which he gave his name. European firearms, with which the Iroquois then made first acquaintance, turned the scale of victory against them. The interference of the French aroused in the formidable confederacy a spirit of enmity which, relentlessly nourished, finally arrested the progress of French colonization and French power in Canada, and later secured the triumph of the English arms. Pursuing his explorations, Champlain in 1615 again accompanied a hostile expedition of his allies, penetrated to the very seat of the Iroquois power, and besieged their fortified village or castle, but was compelled to retreat after an ineffectual attempt to storm or fire the stockade. Thus within a few years after Hudson's voyage the French had discovered the great lakes and explored the river which separate the territories of New York from Canada. The Iroquois sought an alliance with the Dutch as a counterpoise to that of their Algonquin enemies with the French. A formal treaty (the covenant of Corlear) made in 1617 with the Amsterdam Company was faithfully observed on both sides. By the name of Corlear (a Dutchman in high honour with them) the Iroquois always addressed the governors of New York in their treaties. Tradition alleges that this first treaty was made at the mouth of the Tawasentha, the present site of the city of Albany. In 1664 a treaty made by Cartwright at Fort Orange with the Iroquois sachems secured similar advantages to the English. In 1688 this friendship was confirmed at a conference held at Albany between the chiefs of the Five Nations and Governor Andros, and again confirmed in 1689 after the accession of King William; it continued unbroken until 1775. Compelled to choose between the revolted colonists and their ancient ally, the Iroquois held fast to the "covenant chain" with the English crown. The confederacy was at the height of its power about the year 1700. In 1715 they were joined by the Tuscaroras, driven out from North Carolina, and were afterwards known as the Six Nations. Until the conquest of Canada by the English in 1763 they were in constant struggle with their French neighbours. The American revolution proved fatal to them. In 1779 their towns were burned, their orchards and stores of grain destroyed. At this time their civilization was at its height, their houses were of frame, some of elegant construction, their gardens, orchards, and farm lands extensive and abundantly supplied with fruit. From this terrible calamity they never recovered. Their numbers have been estimated as 25,000 in 1650, and in 1750 about half that number, of whom about 2500 were fighting men. Disregarded in the treaty of 1783, their political existence terminated, and their lands were ceded to the State with some small reservations. The last official State census (1875) reports the total number of Indians in the State at 5117, chiefly the remains of the Iroquois tribes. Of these 4707 were living on reservations.

At what time, and by whom, the Bay of New York was first visited by European voyagers is still in doubt. Verrazano is claimed to have entered it with the "Dauphine" in 1524, and Gomez to have sailed along the coast to the latitude of New York in 1525. Of the voyage of Henry Hudson (see HUDSON) there is no doubt. Hudson's report of the picturesque grandeur of the fine harbour and river, of the fertile country on its shores, of the kindly disposition of the Indians, and of the abundance of fur-bearing animals in the interior caused great excitement in Holland; and the United Netherlands, whose independence had been acknowledged in the spring, asserted their claim to the newly discovered country. In 1610 a vessel was despatched with merchandise suitable for traffic with the savages. The Europeans were well received, and the voyage resulted in profit. Other private ventures followed, and a lucrative trade in peltry sprung up. In 1613 a few huts were built at the southern point of Manhattan Island, and in 1615 a fortified trading house, to which the name of Fort Nassau was given, was constructed on Castle Island near the present site of Albany, and a factor permanently established there. No effort at colonization was as yet made. Encouraged by the reports of their explorers, the merchants of North Holland formed themselves into a company, which on the 11th day of October 1614 received from the states-general a special trading licence in which the name of New Netherland first appears, the association styling itself the United New Netherland Company. In 1618 the fort on Castle Island was abandoned, and in 1622 a new post, Fort Orange (now Albany), was established on the west bank of the river, at the place where, according to tradition, the first formal treaty between the Dutch and the Five Nations was made. On the expiration of the charter of the United Netherland Company (October 1618) a renewal was refused by the states-general, but private ventures were authorized. The exploration of the coast and rivers was actively continued, but special charters to the discoverers were persistently refused. On the 3d June 1621 the states-general granted to the West India Company a charter with full powers over New Netherland for a period of twenty-four years. The territory was formally erected into a province, and the management of its affairs assigned to the chamber of Amsterdam. In the year 1622 they sent out trading vessels and took formal possession of the country. It was not, however, until the 21st June 1623 that the company, its rules and regulations being formally approved by the states-general, closed their subscription books. Agricultural colonization had been already begun in the spring of the same year. The ship "New Netherland," equipped by the company with thirty families, reached Manhattan early in May; with them went Cornelis Jacobsen May, the first director of New Netherland. May was succeeded in 1624 by William Verhulst. In 1626 the plans for the government of the province by a director and council being perfected by the Amsterdam chamber, Peter Minuit was sent out as director-general. His administration was vigorous and successful. Manhattan Island was purchased of the Indians for the West India Company, and a fort built which was named Fort Amsterdam. The charter of the company provided for a form of feudal colonization under patroons, such colonies to consist of fifty adults, and the lands occupied to run 16 miles in length on the one side of a navigable river or 8 miles if on both banks, but only so far into the country as the occupiers should push their settlement. The limits of the colonies might be increased in proportion to the number of immigrants. The patroons had special privileges of trade, and magisterial powers; leet courts were held upon their manors, and later their representatives sat for them in the colonial assembly. Under these favourable conditions the example of Minuit was eagerly followed; large tracts of land were acquired from the Indians, and settlement made by the new proprietors. The jealousy caused by these purchases and privileges brought about the recall of Minuit. The little colony was annoyed by the encroachments of the English of the New Plymouth colony, and disturbed by the hostilities between the Indian tribes in their immediate neighbourhood. In 1633 Wouter van Twiller succeeded Minuit as director-general, and carried out the policy of commercial monopoly of his principals. The Swedes now began aggressions on the southern border of the Dutch province. Irregularities in administration caused the recall of Van Twiller in 1637, and in 1638 he was succeeded by William Kieft. During Kieft's administration, which was arbitrary and ill-advised, the colony was still further molested by its English and Swedish neighbours, while its prosperity was arrested by dissensions between the company and the patroons. The fatal mistake was also made of supplying the Iroquois with firearms, which completed the estrangement of all the other tribes. A collision occurred, and was the beginning of a bloody war which desolated New Netherland for five years. At its close scarcely one hundred men besides traders could be found in Manhattan, and the river settlements were nearly destroyed. This disastrous administration was closed in the summer of 1646 by the appointment of Peter Stuyvesant, who landed at Manhattan in May of the succeeding year. Though of a proud and overbearing temper, and by nature disposed to arbitrary rule, he proved the most satisfactory of the company's administrators. He closed the Indian difficulties, conciliating the friendly and utterly destroying the hostile tribes. He negotiated a settlement of the boundary disputes with the New England colonies (treaty of Hartford, 1650). In his relations with his own people he was less fortunate, and by his opposition to their demands for a larger freedom he alienated their affections and prepared them for ready submission to a more generous rule. The province was already shorn of its original limits, by English aggression and Dutch submission, before the consent of the director and council to a general assembly could be had. This, the first popular representative body of the province, met in April 1664. Before the year closed the colony fell an easy conquest to the English. The population of the province was now fully 10,000, that of New Amsterdam 1500 persons.

The English Government was hostile to any other occupation of the New World than its own. In 1621 James I. claimed sovereignty over New Netherland by right of "occupancy." In 1632 Charles I. reasserted the English title of "first discovery, occupation, and possession." In 1654 Cromwell ordered an expedition for its conquest, and the New England colonies had engaged their support. The treaty with Holland arrested these operations, and recognized the title of the Dutch. In 1664 Charles II. resolved upon a conquest of New Netherland. The immediate excuse was the loss to the revenue of the English colonies by the smuggling practices of their Dutch neighbours. A patent was issued to the duke of York granting to him all the lands and rivers from the west side of the Connecticut river to the east side of Delaware Bay. On the 29th August an English squadron under the direction of Colonel Richard Nicolls, the duke's deputy-governor, appeared off the Narrows, and on September 8 New Amsterdam, defenceless against the force, was formally surrendered by Stuyvesant. The duke's authority was proclaimed, and New Netherland became New York. The name of Fort Orange was changed to Fort Albany, after the second title of the duke. Nicolls proved an admirable ruler, and his successor Francis Lovelace continued his policy,—autocratic government, arbitrary in form but mild in practice. Religious liberty was as large as in England. In 1673 (August 7), war being declared between England and Holland, a Dutch squadron surprised New York, captured the city, and restored the Dutch authority and the names of New Netherland and New Amsterdam. But in July 1674 a treaty of peace restored New York to English rule. A new patent was issued to the duke of York, and Major Edmund Andros was appointed governor. He proved a firm but moderate ruler; the unsustained charge of maladministration made against him had its source in religious prejudice. In 1683 Thomas Dongan succeeded Andros. The province flourished under his excellent administration. A general assembly, the first under the English rule, met on October 1683, and adopted a charter of liberties which was confirmed by the duke. In August 1684 a new covenant was made with the Iroquois, who formally acknowledged the jurisdiction of Great Britain, but not subjection. By the accession of the duke of York to the English throne in 1685 the duchy of New York became a royal province. The charters of the New England colonies were revoked, and together with New York and New Jersey they were consolidated into the dominion of New England. Dongan was recalled, and Sir Edmund Andros, who suggested the policy, was commissioned governor-general. He assumed his viceregal authority at New York, August 11, 1688. The English Revolution of 1688 had its faint counterpart in the colonies in an insurrection of the militia, headed by one Jacob Leisler, which was not terminated till the arrival from England in 1691 of a new governor, Sloughter, with whose administration what may be called the second period of English rule begins.

The assembly which James had abolished in 1686 was reestablished, and in May declared the rights and privileges of the people, reaffirming the principles of the repealed charter of liberties of October 30, 1683; but religious liberty was curtailed and the Test Act put in force as to Roman Catholics. In 1697 the lords of trade, in a formal report, protested against the Act declaratory of the rights and privileges of the people of the province of New York; and the instructions of the king to Lord Bellomont, the newly appointed governor, were sharply restrictive of the rights claimed as to courts and assemblies. The government was to be ruled as a province by a governor and council,—the governor having power to institute courts, appoint judges, disburse the revenues, veto all laws, and prorogue or dissolve the assembly at pleasure. The provincial legal authorities protested at once against this excess of prerogative. Thenceforth the political history of the province records one continued struggle between the royal governors and the general assembly,—the assembly withholding money grants, and the governors exercising the power to dissolve it at will. The chief concern of the province was the defence of the northern frontier. The quartering of British troops became a source of constant irritation between the people and the officers, and the need of money by the authorities caused as severe a struggle between the governors and the assembly. The conquest of Canada in 1763 closed the long contest in which New York troops were constantly engaged. The war left a heavy burden upon Great Britain, a part of which parliament attempted to shift to the shoulders of the colonies. A general congress of the colonies held in New York in 1765 protested against the Stamp Act and other oppressive ordinances, and they were in part repealed. But parliament maintained the principle upon which the legislation was based, the supremacy of parliament and its right to tax the colonies without their representation or consent. In 1769 the total exports of the province amounted to £246,522. During this long political agitation New York, the most English of the colonies in her manners and feeling, was in close harmony with the Whig leaders of England. She firmly adhered to that principle of the sovereignty of the people which she had inscribed on her ancient charter of liberties. Largely dependent upon commerce, she was the first to recommend a non-importation of English merchandise as a measure of retaliation against Great Britain, and she was first also to invite a general congress of all the colonies. On the breaking out of hostilities, New York immediately joined the patriot cause; the English authority was overthrown, and the government passed to a provincial congress. In May 1775, Forts Ticonderoga and Crown Point, which commanded Lakes Champlain and George, and secured the northern frontier, were captured by the Americans. New York city became the headquarters of the continental army under command of General Washington. On July 9, 1776, the provincial congress reassembled at White Plains, and formally took the name of the representatives of the State of New York. The same day they proclaimed their adhesion to the Declaration of Independence. The defeat of the Americans on Long Island, 27th August 1776, was followed by the abandonment of the city, September 15, the army of Washington retiring to the high ground at the northern end of the island. Next day a conflict took place between the advanced troops where Manhattanville now stands. The movement of Howe to White Plains, and his subsequent successful operations, compelled the withdrawal of the Americans to New Jersey. In 1777 the advance of Burgoyne from Canada was checked at Saratoga and his entire army captured; a diversion attempted by St Leger by way of the Mohawk was likewise unsuccessful. An attempt of Clinton to aid Burgoyne, in which he captured the forts at the entrance to the Hudson Highlands, failed; West Point continued to command the passage of this important line of communication. On April 20, 1777, the State assembly adopted the first constitution. General George Clinton was elected governor, and held the office till the close of the war. In 1779 (July 16) Stony Point was captured by the Americans. In 1780 the failure of Arnold's treason put an end to the schemes of the British to command the river. The only other action of importance on the soil of the State was the punishment of the Indians who had aided Sir John Johnson in his incursions. Sullivan with 3000 men penetrated to the heart of the Seneca country and destroyed the towns. In the summer of 1781 Rochambeau with French troops made a junction with Washington in Westchester county, and New York city was threatened by the allied forces. News of the approach of the fleet of De Grasse to Chesapeake Bay caused a transfer to Virginia of the military operations. On the conclusion of the war New York was evacuated, November 25, 1783. Freed from armed occupation, and its seaport regained, the State made rapid progress. Its natural advantages, which the war disclosed, attracted settlers from other States, and the western lands were quickly taken up. In 1788 (July 26) New York adopted the Federal constitution, became the most important member of the national union, and received popularly the name of the Empire State. The seat of government was transferred from New York city to Albany in 1797. The progress of the State met with no interruption until the war with Great Britain in 1812, when its northern frontier became the seat of operations by land and water. The treaty of Ghent put an end to the war, and important schemes for the development of the internal navigation to bring the products of the State to tidal water were rapidly consummated. Steamboat navigation began on the Hudson in 1807, and the canal system was perfected in 1825 in the completion of the Erie Canal, which opened the country from the lakes to the sea. This important artery of commerce has been recently freed from toll by popular vote. The railroad system is still more perfect: great lines traverse the State from its eastern to its western extremity, and a network of minor lines connects every town and village of any importance in the State with the central arteries.

Progress of Settlement.—At the close of the Dutch period the settlement of that part of New Netherland which afterwards became New York was confined to Manhattan, Long, and Staten Islands, and the banks of the Hudson. Westward of these there were small trading stations on the line of the Mohawk and other water carriages. Early in the last century the admirable natural channel of communication which by the Mohawk river and Wood Creek connects the Hudson with the great lakes attracted immigration. The fertile valley of the Mohawk was the first occupied. A settlement was made there about 1722 by a colony from the Palatinate, who constituted almost the entire population until the close of the Revolution. In 1756 there were only ten county divisions in the province, of which but two were west of the Hudson. At the time of the Revolution there were fourteen counties, the most westerly of which lay on the sides of the Mohawk, about 40 miles from Albany. The inhabitants were at this time Dutch, French, English, Scotch, and Irish. The war brought the extreme richness of the western lands to the notice of the troops, and they in turn informed the people. After the war settlements spread with rapidity. The State of New York ceding to Massachusetts about 10,000 square miles of territory, there was before 1800 a large immigration from New England, which extended itself over the interior of the State to its western boundary. This was essentially an agricultural population. The military lands set apart as bounties during the war, to the amount of 180,000 acres, were rapidly taken up by the immigrants who flowed into the western country like a torrent, opening roads and founding villages and towns. Between 1784 and 1800 two cities, three large villages, and numerous smaller settlements were founded, and the population of the State doubled in numbers. The foreign immigration of the last forty years has chiefly settled on the lines of the great railroads, which present an almost unbroken chain of industrial cities.

Constitution.—The fundamental constitution of the State adopted in 1777 was in its main features after the English model:—a chief executive and two separate legislative chambers; justice administered through local county courts, a probate judiciary, a high common law tribunal called the supreme court, side by side with a court of chancery; final appellate jurisdiction in law and equity vested in the State senate. This first constitution of the State declared the people to be the only source of political power. The secret ballot insured the independence of the vote. Religious liberty to all was absolutely secured. In 1821 a new convention greatly simplified the machinery of administration. Under this new constitution the people took to themselves a large part of the powers before delegated to the assembly. The elective franchise was extended by a removal of freehold qualification. In 1846 a new constitution made radical changes in the framework of government. The elective franchise was further extended by diminution of residence qualification; elective districts were established on the basis of population, and shifted with the varying censuses. The elective principle, before confined to part of the executive and legislative officers, was applied also to the judiciary. A court of appeals of last resort was instituted. Local tribunals were invested with the powers and jurisdictions of the supreme court of common law and of the court of chancery. The separation of the legal and political departments of government was complete. The question was again submitted to the people in 1873, and the election of the judiciary maintained by a large majority. Some slight amendments have been since made. The constitution, as finally matured, completely carries out the principle of a government of the people by its own directly chosen agencies. Elective restrictions upon negroes and mulattoes were removed by degrees. Slavery was gradually abolished under an Act passed in 1799. In 1811 the only discrimination was the requirement of a certificate of freedom. The constitution of 1821 imposed both a residence and a freehold qualification, restrictions which remained until removed in 1870 by the fifteenth amendment to the Federal constitution, when suffrage to males became absolutely free in the State. The constitution of 1777 forbade Acts of Attainder after the close of the war, and provided that no Act should work corruption of blood. Primogeniture and entail were for ever abolished. That of 1846 did away with all feudal tenures of every description. Imprisonment for debt, before limited by statute so far as females were concerned to sums over $50, was entirely abolished in 1831. Married women were secured in their separate rights to real and personal property by statute in 1848. Imprisonment of witnesses was put an end to by Act of 1882.

Education.—The grant of the West India Company (1629) to the planters of New Netherland required the establishment of a school, and in 1644 the burgomasters of New Amsterdam made a municipal provision for school purposes in the colony; but this proved nominal, and instruction received little attention until after the arrival of Stuyvesant, when an academy and classical school was established (1659). At the conquest in 1664 the English found this institution in high repute, and in addition three public schools and a number of private Dutch schools in the city alone. The academy or Latin school was continued by the English authorities for a few years, but the Dutch schools received no Government contribution. In 1702 a free grammar school was established by Act of Assembly. In 1710 a school was founded by Trinity church, and similar provisions by other religious denominations followed. In 1754 King's College (reorganized in 1784 as Columbia) was established by charter. Here many of the men who became distinguished in the annals of the State received their education. Its departments were fully organized when the Revolution put an end to all instruction, and the building became a military hospital. The legislature of the State in 1795 granted an appropriation of $50,000 for five years for common school purposes. A general school system was organized by commissioners in 1812. District libraries were instituted in 1838, and a State normal school established in 1844. In 1849 a free school law was enacted, but its unequal operation caused its repeal. In 1867 a free school law was again enacted. The schools of the State are noted for their efficiency. All the common schools are free, and are supported by the income of a school fund and by a State, city, and district tax. A superintendent of public instruction has general supervision. School commissioners elected by the people have charge in each district, and there are boards of education in all the cities. The expenses for the fiscal year ending September 30, 1880, were $11,181,986·55. The attendance for the same year in public schools was 1,041,089 scholars; in normal schools 6156, and in private schools 115,646.[1] The number of volumes in school district libraries was 705,812. The result of this admirable system appears in the census of the United States for 1880. The number of the inhabitants of the State who were unable to read was reported at 166,625, or 4·2 per cent., of those unable to write at 219,600, a percentage of 5·5.

Charities.—The public charities were by Act of 1867 placed under the charge of a board of State commissioners of public charities, who are paid expenses but receive no salary. The institutions wholly or chiefly maintained by the State are—asylums for the insane, inebriate, deaf and dumb, blind, and idiots, and establishments for reform of juvenile delinquents. In the counties, cities, and towns there are public poorhouses and asylums, besides hospitals, dispensaries, and homes in great variety. The official report of January 1883 states the expenditures for the fiscal year ending September 30, 1882, for orphan asylums and homes for the friendless, at $4,486,204·21, the total number of persons supported being 46,985,—of these 24,868 remained at the close of the year. The expenditure for hospitals the same year was $1,503,283·68, the number of patients treated 27,850. During the same period the dispensaries treated 276,323 persons, at an expenditure of $102,834·20. There were in the several asylums and almshouses, October 1, 1882, 10,443 insane persons. The number of persons supported and temporarily relieved in the county poorhouses and almshouses during the year ending November 30, 1882, was 57,895; in the city almshouses 69,875; total 127,770, of whom there remained at that date 16,507. The amount expended for support and relief of the poor and other charities was $4,715,065·62. Comparison with previous statements shows that there had been no actual increase in pauperism in the State in twelve years, and a decrease in proportion to the population. A State board of commissioners of emigration has until recently had charge of the immigrants landed at the port of New York. The arrivals in 1882 were 476,086. The expenses of this board were met by a head-money tax, but, the Act under which it was levied having been declared unconstitutional, its functions have virtually ceased. A resort to the old system by which shipowners were compelled to give bonds to relieve the city from the care of pauper immigrants is the only alternative for State appropriation.

Correction.—The superintendent of prisons reported the number of convicts confined 30th September 1882 at 2937, the total expenses at $415,662·10, and the earnings at $421,916·95, showing a surplus of $6254·85. The strong and increasing jealousy of artisans has led to an abandonment of some of the most profitable kinds of convict labour.

Wealth and Taxation.—The aggregate assessed valuation of the wealth of the State was in 1882 $2,821,549,963, of which amount $2,482,012,682 was real and $339,537,281 personal. The amount of taxation was $47,573,820·07, of which $3,757,971·47 was State, $30,429,458·62 county, $10,324,339·16 city, town, and village, equal to 1·709 cents on one dollar ($1) valuation.

Finances.—The fiscal affairs of the State have been managed on correct principles, and its credit has been maintained unimpaired. To this its payment of the interest and principal of its bonds in coin during the temporary suspensions of specie payment which preceded the civil war and the long national suspension which followed its outbreak greatly contributed. The total funded debt of the State, 30th September 1882, was $6,885,556·30, over 6 millions of which represents the canal debt. The receipts of the State treasury during the fiscal year ending at same period were $17,785,761, and the payments $18,898,198·21, leaving a balance of $6,837,563·38. The rate of taxation for the year 1882 was fixed at 2·45 mills on the dollar, which is estimated to yield a revenue of $6,820,022·29. The revenues of the canals for the year ending September 30, 1882, were $659,970·35, and the expenditure $658,510·01. The canal system is for the future to be maintained by direct taxation.

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[1] In 1881–82, of 1728 Indian children of school age reported, 1169 attended school. The State pays $2500 for their education.

Banking.—The bank of New York, chartered in 1791, was the first financial institution incorporated in the State. Banks continued to be incorporated by special Acts of the legislature until 1838, when a general banking law made the business free to all under certain restrictions. In 1829 a safety fund system was established to secure the circulation of the banks contributing to it, and commissioners were created to apply its provisions, but the unequal operation and insufficiency of the system brought about its abolition in 1843, and supervision was entrusted to the comptroller of the State. In 1851 a banking department was created. The Act of the United States of 1865, to provide a national currency, in its requirement of a deposit of United States bonds to secure the circulation issued to the banks by the Government made a radical change in the entire banking system. If the policy of reduction of the debt of the United States be continued, some other form of security must be devised to take the place of the bonds of the United States. In 1867 the State passed an Act enabling national banking associations to become State banking associations. The national tax of 10 per cent. being in effect prohibitory on other than national bank circulation, the State banks are banks of discount and deposit only. On the 16th December 1882 there were seventy-seven banks in operation under this Act. Their capital was $19,455,700. The mass of the banking business of the State is done by the national banks, of which there were on December 30, 1882, 307, with a capital of $86,813,692. Their deposits at same date were $355,673,215·80, their loans and discounts $336,269,003·87, and their issues of national bank circulation amounted to $45,979,914, secured by United States bonds, deposited with the comptroller of the currency at Washington, to the amount of $52,217,050. They held in specie $54,186,128·94, and in legal tender notes of the United States $18,192,201. The first bank for savings in the State was incorporated in 1819, since which time these beneficent institutions have vastly increased. On the 1st January 1883 they numbered 127, holding for 1,095,971 depositors the sum of $412,147,218. They are incorporated by special Acts of the legislature, and the provisions for the security of their investment are very stringent. Trust companies, of which there are several, are also incorporated by special Act, and the security of their depositors is guaranteed by deposits of public stocks or cash with the banking department of the State. On the 1st October 1882 there were fourteen corporations for the safe keeping and guardianship of personal property, with a capital of $2,676,900.

Agriculture.—New York is the third State of the Union in the number of farms, and second in their value. The total number of acres in farms in 1880 was 23,780,754, of which 17,717,862 acres were improved lands. The number of farms was 241,058, value $1,056,176,741. The live stock included 610,358 horses, 5072 mules and asses, 39,633 working oxen, 1,437,855 milch cows, 862,233 other cattle, 1,715,180 sheep, 751,907 swine. The farm products were—oats, 37,575,506 bushels; Indian corn, 25,690,156; wheat, 11,587,766; barley, 7,792,062; rye, 2,634,690; buckwheat, 4,461,200; potatoes, 33,644,807; hay, 5,240,563 tons; hops, 21,628,931 ℔; tobacco, 6,481,431 ℔; milk (sold or sent to butter and cheese factories), 231,965,533 gallons; butter (made on farms), 111,922,428 ℔; cheese (made on farms), 8,362,590 ℔; wool, 8,827,195 ℔. The estimated value of all farm productions by the census of 1880 was $178,025,695.

Manufactures.—New York is the first manufacturing State in the Union, and in the last decade the value produced has increased nearly 35 per cent. In 1880 there were in the State 42,739 establishments, employing a capital of $514,246,575 and 531,533 hands. The amount paid in wages was $198,634,029; for materials, $679,612,545. The products were valued at $1,080,696,596.

Shipbuilding.—The vessels of all classes built in the State during the fiscal year ending 30th June 1882 numbered 1371, aggregating 282,269 tons. Of these there were 668 sailing vessels of 118,798 tons, 502 steamers of 121,942 tons, 68 canal boats, and 135 barges.

Fisheries.—The chief fishing industry is the taking of menhaden, in value (1880) $1,114,158, and the raising of oysters, value in 1880 $1,577,050, other fisheries $1,689,357. The total number of hands employed in all branches in 1880 was 7266, the amount of capital $2,629,585, and of product $4,380,565; the number of vessels employed was 541, measuring 11,588 tons, valued at $777,600.

Commerce.—New York, owing to its magnificent seaport and its admirable land and water communication, enjoys a large proportion of the national trade. In 1882 the State had in exports and imports of merchandize, including specie and bullion, the sum of $894,430,636, or 56¼ per cent. of the trade of the United States. Of the imports it received and distributed $499,928,774, and it exported $394,501,862. The amount of internal trade can only be estimated by the value of the tonnage moved. In the year ending 30th September 1882 the arrivals at tide water were 3,068,152 tons, and the internal movement reached 1,361,268, the total value of the property transported being $147,918,907. The freight carried on railroads amounted to 47,350,174 tons, which at the same rate of valuation as that given for canal traffic, $35 per ton, may be set down at $1,657,256,090, a total value transported of $1,805,174,997. The value of the freight carried through the Sound, the Hudson river, and the lakes may be estimated at $250,000,000, which would give an aggregate of over $2,000,000,000. Deducting from this gross amount 900 millions, the value of its foreign commerce (imports and exports), the sum of 1000 millions is arrived at as an approximate valuation of the internal trade of the State.

Conveyance.—On the 30th September 1882 there were 326 steam and 81 horse railroads incorporated under the laws of the State. The paid up capital stock of the steam roads amounted to $623,772,211·67 (of which for this State $397,386,453·21), and of the horse roads to $24,068,248·35. The steam roads carried 66,691,562 passengers; two elevated roads in New York city carried 86,361,029, and the horse roads 277,171,345 passengers. The total of miles of steam roads built and owned by New York companies was 10,058, of which 6641 were in New York State. There are twelve canals, of which the Erie is the principal. The total movement on all reached 5,467,423 tons in 1882.

Population.—New York has the largest population of any of the States. From official sources the population of the province was given in 1698 at 18,067; in 1703 at 20,665; in 1723, 40,564; in 1731, 50,824; in 1737, 60,437; in 1749, 73,448; in 1756, 96,790; in 1771, 163,337. By the first United States census of 1790 at 340,120; in 1800, 589,051; in 1810, 959,049; in 1820, 1,372,111; in 1830, 1,918,608; in 1840, 2,428,921; in 1850, 3,097,394; in 1860, 3,880,735; in 1870, 4,382,759.

The total population by the census of 1880 was 5,082,871 (2,505,322 males, 2,577,549 females); of these 3,871,492 were native born. The race division was—whites, 5,016,022; coloured, 65,104; Chinese and Japanese, 926; Indians, 819.[1] There are 59 cities having each a population of over 4000, the principal being New York, 1,206,299; Brooklyn, 566,663; Buffalo, 155,134; Albany, the State capital, 90,758; Rochester, 89,366; Troy, 56,747; Syracuse, 51,792; Utica, 33,914; Auburn, 21,924; Oswego, 21,116; Elmira, 20,541; Poughkeepsie, 20,207. There were engaged in agriculture 377,460 persons; in professional and personal service, 537,897; in trade and transportation, 339,419; and in manufactures and mechanical and mining industries, 629,869. The population averaged 106·74 persons to the square mile, and occupied 772,512 dwellings. (J. A. S.*)

II. NEW YORK CITY.

NEW YORK, the principal city of the United States in point of wealth and population, and, next to London, the most important commercial and financial centre in the world, lies mainly on Manhattan Island, which is situated at the upper end of New York Bay, between the Hudson River and East River, on the west and east respectively, and the Harlem River and Spuyten Duyvil Creek, small connecting tide-ways which separate it from the mainland on the north-east and north. The legal limits of the municipality also include on the northern side a portion of the mainland which formerly constituted the towns of Morrisania, West Farms, and Kingsbridge, the boundary on the N. being the city of Yonkers and on the E. the Bronx and East Rivers, containing in all 41½ square miles, or 26,500 acres, of which Manhattan Island makes 22 square miles, or 14,000 acres. They also contain the small islands in the East River and New York Bay known as North Brother's, Ward's, Randall's, Blackwell's, Governor's, Bedloe's, Ellis, and the Oyster Islands. The city-hall stands in 40° 42′ 43″ N. lat. and 74° 0′ 3″ W.[2] long., and is about 18 miles distant from the ocean, which is reached through the upper and lower bay, together constituting a harbour of the first order. The upper bay has an area of 14 square miles and the lower bay of 88 square miles of safe anchorage. The ship channels have from 21 to 32 feet and from 27 to 39 feet of water according to the state of the tide. The Hudson and East Rivers also afford the city 13¼ square miles of good anchorage. The tide rises and falls on the average 43 inches. Manhattan Island, as well as the adjacent country to the north and east, is composed mainly of rocks, chiefly gneiss and mica schist, with heavy intercalated beds of coarse-grained dolomitic marble and thinner layers of serpentine. These rocks have been usually supposed to be Lower Silurian, but Professor Newberry holds that they have so great a similarity to some portions of the Laurentian range in Canada that it is difficult to resist the conviction that they are of the same period. The deep troughs through which the Hudson and East Rivers now find their way through New York harbour to the ocean are supposed by the same geologist to have been excavated in the late Tertiary period, in which Manhattan Island and the other islands in New York Bay stood much higher than they do now, when Long Island did not exist, and a great sandy plain extended beyond the Jersey coast some 80 miles seaward. Manhattan Island, for half its length from the southern point, slopes on each side from a central ridge. On the upper half of the island the ground rises precipitously from the Hudson River in a narrow line of hill, which again, on the eastern side, sinks rapidly into a plain bordering on the Harlem and East Rivers, and known as Harlem Flats. The surface is throughout rocky, with the exception of this plain, and levelling on a great scale has been necessary in laying out streets. The district beyond the Harlem river, which extends as far north as the city of Yonkers, is traversed by lines of rocky hill running north and south, and still thickly wooded. The original settlement out of which New York has grown was made on the southernmost point of the island, and it has, since the beginning of the 18th century, spread due north and from river to river.

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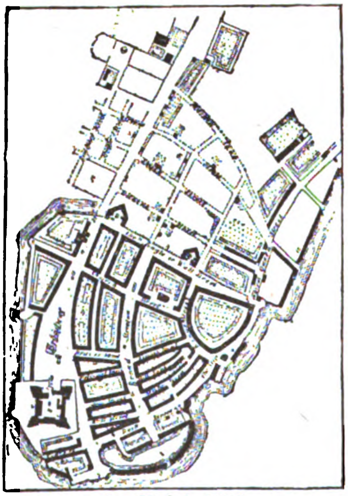
[1] This includes only Indians subject to taxation.

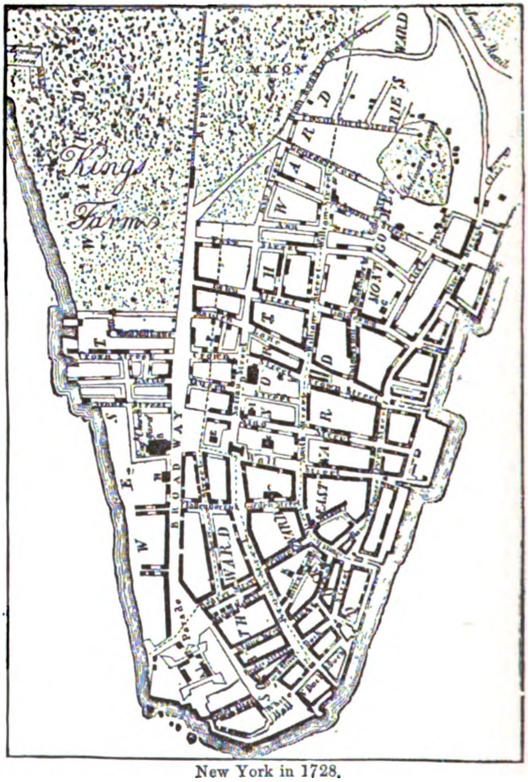
[2] New York is 3° E. of Washington. In time it is 12^{m} before Washington, 55^{m} before Chicago, $3^{h}\,14^{m}$ before San Francisco, and $4^{h}\,56^{m}$ after Greenwich.

The street called Broadway runs for nearly 3 miles along the crest of the island, forming for that distance the central thoroughfare from which streets spread with some regularity to the water on each side. The leading thoroughfares originally followed the line of the shore, along which the earliest buildings were chiefly erected, the central ridge being the last to be occupied, until the city reached what is now known as Wall Street, the site of which was marked by a rampart and stockade extending from river to river across the island. Within this space the streets were laid out either as convenience dictated or as old pathways suggested, without any general design or any attention to symmetry, and were named, for the most part, after prominent settlers. The first regular official survey of the city, tracing the line of the streets, was made in 1656, when Wall Street was its northern limit. In 1807 the present plan of the city was adopted, with its broad longitudinal avenues crossed by side streets at right angles, beginning at a point about two miles from the Battery and running the whole length of the island. The erection of buildings along these streets has led to the levelling of the region below the Central Park, but in the park the varied outline which once characterized the whole island is still retained. The precipitous banks of the Hudson river at the upper end have also compelled a treatment in which the original configuration of the ground is preserved, and the streets and roadways are adapted to it. The city in its growth northward absorbed several suburban villages known as Greenwich, Harlem, Manhattanville, Fort Washington, Morrisania, and Kingsbridge.



New York in 1695.

General Aspect.—The appearance of New York everywhere but in the leading thoroughfares is usually disappointing to strangers. The pavement of all the streets, except Broadway and Fifth Avenue, is bad, and the street cleaning in all but the principal streets is very defective. The lower part of the city, which is the centre of trade, is generally well kept, and contains a large number of imposing buildings. Wall Street in particular, which is now, after Lombard Street, the most important haunt of moneyed men in the world, has several banks of effective architecture, together with the United States custom-house; while Broad Street, which runs off from it at right angles, besides having the stock exchange, is being rapidly occupied at its upper end by handsome buildings of vast proportions intended for the offices of merchants and bankers. After the city had spread beyond Wall Street, the well-to-do portion of the population and the leading retailers seem to have clung to Broadway as the great line of traffic and trade. For one hundred years the wealthy residents built their houses along it, or, if in the streets running off from it at right angles, as near it as possible; and the shops followed them up closely. As population grew during this period the private dwellings of the better class simply moved up farther on Broadway and the adjacent streets, leaving the old houses to be converted into shops. The farther from Broadway, and the nearer the river on either side, the cheaper land was, and the poorer the class of houses which sprang up on it. This fondness for Broadway in a great degree explains the aspect of the city. About a mile and a half from the Battery, or southernmost point of the island, the cross



New York in 1728.

streets which up to this line are mostly named after local notables of the colonial period, become designated by numbers, and are separated by equal intervals, known as "blocks," of which twenty form a mile. Up to Eighth Street, Broadway divides the streets which cross it into east and west. After Eighth Street, Fifth Avenue, which begins at a handsome square, known as the Washington Square, lying a short distance west of Broadway, becomes the dividing line, and continues to be so out to the Harlem River, a distance of 8 miles. Broadway at Fourteenth Street runs into Union Square, which contains statues of Washington (equestrian), La Fayette, and Lincoln, and is surrounded by large shops; it then trends westerly towards the Hudson River, and thus crosses Fifth Avenue (which runs due north) at Twenty-Third Street, where it enters Madison Square, another open space, on the west side of which are clustered several of the largest hotels in the city. Fifth Avenue has played for the last forty years the same part, as the fashionable street, which Broadway played in the preceding period. It was long the ambition of wealthy men to live in it. It is lined from Washington Square to the Central Park, a distance of 3 miles, with costly houses, mostly of brown stone and red brick, without much architectural pretension, and producing from the preponderance of the brown stone a somewhat monotonous effect, but perhaps unequalled anywhere as the indication of private wealth. Fashion has long permitted, and of late has encouraged, resort to the side streets as places of abode, but the rule is nevertheless tolerably rigid that one must not go beyond Fourth Avenue, two blocks on the east side, or Sixth Avenue, one block on the west side, if one wishes to live in a good quarter. Within the district thus bounded the city presents a clean and orderly appearance, but mainly owing to the exertions of the householders themselves.[1]

Harbour Defence.—For this the city depends on forts situated at the western entrance to Long Island Sound, at the Narrows (a passage between the upper and lower bays), and in the harbour itself. All these are confessedly powerless against a fleet armed with modern ordnance. The forts at the entrance of the Sound are Fort Schuyler, situated on Throgg's Neck, and a fort on Willett's Point on the opposite shore. The defences at the Narrows consist of Forts Wadsworth and Tompkins and several detached batteries on the Staten Island shore, and of Fort Hamilton and several batteries on the opposite Long Island shore. The forts in the bay are small and weak structures, and comprise Fort Columbus, Castle William, and some batteries, all on Governor's Island, and Fort Gibson on Ellis Island. Fort La Fayette, made famous during the war of the rebellion as a prison, was destroyed by fire in 1868, and Bedloe's Island, on which stood Fort Wood, is now given up for the reception of Bartholdi's statue of Liberty.

History.—The history of the first Dutch settlements at Manhattan, and of their transference to England, is sketched in the article on NEW YORK STATE. Down to the Revolution the history of the city is to all intents and purposes that of the province at large. The population grew slowly but steadily, and so did the trade of the place,—the Dutch language and influence, however, gradually giving way to the English. During the Revolution the city, while containing a large body of loyalists, shared in the main in the feelings and opinions of the rest of the country, but was cut off from active participation in the struggle by being occupied at a very early period of the war by the British troops, and it was the scene of their final departure from American soil on November 25, 1782. Since the Revolution its history has been principally the record of an enormous material growth, the nature and extent of which are described in other parts of this article. It was the capital of the State of New York from 1784 to 1797, though the legislature met several times during this period at Albany and Poughkeepsie. From 1785 to 1790 it was the seat of the general Government, and there the first inauguration of Washington to the presidency occurred on the 30th of April 1789.

Population.—The population of New York, in spite of the great attractions of the site, increased very slowly for the first century after its settlement. When the Revolution began it amounted to less than 22,000, and the city stood far below Boston and Philadelphia in importance. It was, too, dominated to a degree unknown in the other Northern States by the landowners whose estates lined the Hudson as far up as Albany, and who played the leading part in society and politics. The original constitution of colonial society was thoroughly aristocratic, and it was maintained almost intact until after the Revolution, the large landed estates along the Hudson being still held by the descendants of the original Dutch grantees, and let on tenures which were essentially feudal in their character. In spite of the large influx of settlers from New England and other parts of the country, the Revolution found the Dutch elements in New York society still strong, if not dominant, and the political ascendency of the territorial families on the Hudson on the whole but little diminished. After the Revolution the growth of the city population became more rapid, but it did not reach 100,000 until 1815, nor 160,000 until 1825. From this date it grew by leaps and bounds until it reached, in 1880, 1,206,299,[2] although a large body of persons whose business lies in New York reside in Brooklyn or Jersey City, on the other side of the East and Hudson Rivers respectively, or in the lesser suburbs, and are not included in the census return. At the end of 1883 the population was estimated at 1,337,325. The impetus which the population received in 1825 was due to the opening of the canal connecting the Hudson with Lake Erie, which made New York the commercial entrepot for a vast and fertile region such as lay behind no other port on the eastern coast. The tendency of foreign trade to concentrate at New York, which has since reduced many small but once flourishing ports along the Atlantic coast, and has taken away from Boston and Philadelphia a good deal of the chief source of their early prosperity, at once began to show itself, and has apparently lost none of its force since the railways came into use to supplement or supersede the canals.

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[1] When the present street plan was adopted, no arrangement was made for back entrances to the houses as in Boston and Philadelphia, and the consequence is that all ashes and refuse have to be removed by a front door, and are placed in barrels on the sidewalk in the morning to await the arrival of the municipal scavenger carts, which is very uncertain as to time. The streets, consequently, are defaced for half the day by these unsightly accumulations. In the better quarters the inhabitants avoid this by having their refuse removed at their own cost by dustmen who enter the houses for it. They have the streets in front of the houses swept in the same way to make up for the defects of the municipal street cleaning. When we pass out of this favoured region we find the garbage and ashes heaped in front of the doors, and the streets impeded by carts and waggons which their owners, in disregard of the municipal ordinances, are allowed to keep standing out of doors, thus saving themselves the expense of coach-houses. Consequently, all that portion of New York which does not lie within a quarter of a mile of Broadway or Fifth Avenue presents a spectacle of dirt and disorder and bad pavement for which it would be difficult to find a parallel in other great capitals. The fine and well-kept part of the city nowhere touches on the rivers or approaches them, but runs in a long central line north and south, and the river banks are lined by wooden wharves. Some part of this neglect to beautify the city is due to the rapidity of its growth, some to defects in the plan on which it is laid out, but more to the badness of the municipal governme

[2] The following are the numbers given in the different United States census returns:—in 1790, 33,131; in 1800, 60,515; in 1810, 96,373; in 1820, 123,706; in 1830, 202,589; in 1840, 312,710; in 1850, 515,547; in 1860, 813,669; in 1870, 942,292; in 1880, 1,206,299

In considering New York as a commercial port, the population of several suburbs within 10 or 15 miles radius should be taken along with it. Including only that of Brooklyn (556,663) and of Jersey City (120,722), the total would be 1,883,684. Of the 1,206,299 forming the population of the municipality of New York proper in 1880, 478,670, or nearly one-third, were of foreign birth. Of these 163,482 were Germans and 198,595 Irish, forming together by far the largest and most important part of the foreign element. Of the total population, 336,137 are males above the voting age, and the females exceed the males by about 25,000. In the native American population, amounting to 727,629, there are 647,399 natives of the State of New York, only 80,330 coming from other States. New Jersey furnishes the largest contingent, Pennsylvania, Massachusetts, and Connecticut following next, though every State and Territory in the Union contributes something. There are no means of ascertaining the proportion of the inhabitants born within the city limits; it is probably smaller than even in London or Paris.

The heterogeneous character of the population, however, so largely composed of persons who come from widely different parts of the globe to seek their fortune, while infusing great energy into commercial and industrial operations, has had an unfortunate effect on the municipal life of the place. It has prevented the growth of a healthy local pride among the successful men of business, many of whom labour with the intention of passing their closing years elsewhere, a sentiment particularly strong among the prosperous New Englanders, whose affections are very apt to be fixed on the place of their birth. The result is that, considering the very large fortunes which have been made in the city during the last century, it has profited but little, compared with others in America, by the gifts or endowments of its wealthy men. The same cause has operated to some extent to prevent hearty co-operation in municipal affairs. The inhabitants of the different nationalities live much apart, both in politics and in society. The Germans, whose social life is very active, give but little attention to local politics, although they form, owing to their intelligence, order, and industry, a very valuable element in the population. Germans head a good many of the principal banking and commercial houses. A considerable proportion of those settled in New York are skilled artisans; cabinetmaking and upholstering in particular are largely in their hands. They supply also most of the music of the city, do nearly all its brewing and a considerable portion of its baking, and furnish a very large contingent in the work of all the leading manufactures. They supply comparatively few of the domestics of either sex, or of the manual labourers. Difference of language, combined with the absence of political training at home, keeps the Germans from taking a very active part in politics, except to resist some of the attempts at restrictive legislation directed against their beer drinking and Sunday amusements, which the American temperance advocates frequently make. As a rule it may be said that the prominent Germans in the city, like the Catholic Irish, belong to the Democratic party.

The port of New York is the great gateway for immigrants coming to the United States. Of the 7,892,783 immigrants who have come to the country from the years 1855 to 1882 inclusive, 5,169,765 have landed at New York city. The largest number landed there in one year was 476,086 in 1882. Germany sends the greatest number, Ireland coming next, England third, and Sweden fourth. From 1847 to 1881 inclusive the German immigrants arriving in New York have numbered 2,498,595; the Irish, 2,171,982; the English, 834,328; and the Swedish, 208,505. The total number of immigrants landed at New York during the years 1858 to 1862 inclusive was 404,918; from 1863 to 1867 it was 1,009,641; from 1868 to 1872, 1,209,011; from 1873 to 1877, 614,219; in 1878 it was 75,347; in 1879, 135,070; in 1880, 327,371; in 1881, 455,681; in 1882, 476,086; and in the first six months of 1883 it was 257,635. The Irish emigrants who settle in New York are to a considerable extent a deposit left by the stream of emigration which enters the country at that port. The more energetic and thoughtful, and those who have any money, push on to the west; the penniless and the shiftless are apt to stay where they land, and furnish the city with most of its unskilled labour, although of late years they have been exposed to considerable competition from Italians, mainly from southern Italy. The resource of a large number of the more pushing is apt to be liquor dealing, which generally brings them influence in ward politics, and secures recognition from the party leaders as a means of communicating with and controlling the rank and file. The great body of the porters and waiters in the hotels and second-class restaurants, of the carters and hackney-coach drivers, a large proportion of the factory workers, and almost the entire body of household servants are Irish also, and for the most part a saving and industrious body.

The social life of New York in the earlier days, and, in fact, down to 1825, took its tone from the landholding aristocracy. Social traditions were, however, principally Dutch, and were characterized by the simplicity and frugality of that people. As the place grew in wealth and population, the ascendency of the old Dutch families was gradually lost. The successful commercial men who came to New York from all parts of the country became the real local magnates, and business prosperity became the chief sign and cause of social distinction. This state of things still exists. There is no other city in the United States in which money gives a man or woman so much social weight, and in which it exercises so much influence on the manners and amusements, and meets with so little competition from literary, artistic, or other eminence. The luxury of domestic life is carried to a degree unequalled in any other city. The entertainments are numerous and costly, and the restaurants, of which Delmonico's is the chief, have achieved a world-wide fame. The number of horses and equipages has greatly increased within twenty years under the stimulus given by the opening of Central Park, the drives of which on fine afternoons in April and May and the early part of June present a scene of great brilliancy. The city is, however, almost completely deserted during the summer months by the wealthy, who fly to country houses along the coast from New Jersey as far up as the province of New Brunswick, or to the mineral springs of Saratoga, or to Europe. Thirty years ago it was the ambition of rich men to own country houses along the Hudson river, the scenery of which possesses great grandeur, but its banks have of late been infested by malaria, and for this and other reasons the tide of fashion has been turned to the seaside, and more particularly to Newport in Rhode Island, which is now a city of marine villas. For people of small means New York is slenderly provided with summer entertainments, except such as are afforded by the beauty of the suburbs and by the many water-side resorts within easy reach on the Hudson, the New Jersey coast, and Long Island Sound, and especially at Coney Island, which is really a continuation of the sandy beach that extends all along the south side of Long Island. Its western extremity is distant from the Battery about 8½ miles in a straight line, and its extreme length is about 5 miles. Since 1874, when capitalists suddenly woke up to the capabilities of the spot, a number of favourite resorts have sprung up on the island, with monster hotels, in one of which as many as four thousand people can dine at once, conveniences for surf-bathing, and a great variety of amusements. The island is reached by steam and horse cars, by steamboats, and by carriages. The Germans have beer gardens on a grand scale, both on Manhattan Island and elsewhere which they frequent in vast numbers. The Irish organize picnics to groves and woods along the Hudson and East Rivers, which are let for that purpose. Excursions by water down the harbour and up Long Island Sound are very numerous. For this species of amusement there are few cities in the world so well situated.

New York has about thirty places of amusement using scenery, not including a few small variety theatres of little importance; of all these the Metropolitan Opera House is much the largest. Its stage is 96 feet wide, 76 feet deep, and 120 feet high. There are seventeen outside entrances, six of them 10 feet wide; and the whole structure is fire-proof. The chief foyer is 34 feet wide and 82 feet long, with a parlour so connected that the foyer can be used as a lecture-room, the parlour giving place for a stage. The seating capacity of the auditorium is about three thousand. Of the other theatres the largest are Miner's Bowery, Miner's Eighth Avenue, Academy of Music, M'Kee Rankin's, Niblo's, Fourteen Street Theatre (Haverly's), Thalia, Criterion, London, Harrigan and Hart's, Cosmopolitan, Fifth Avenue, Star, Twenty-third Street, Union Square. Beside the theatres there are two fine concert and lecture-rooms—Steinway Hall and Chickering Hall.

The clubs of New York may be divided into two classes,—the political and social, and the purely social. To the former belong the Manhattan and the Union League; to the latter the Century (1847), Harmonie (1852), Knickerbocker (1871), Lotus (1870), New York, St Nicholas, Union (1836), and University (1865). The Manhattan Club (with some 570 members) is the local club of the Democratic party, founded during the closing years of the civil war, and reorganized in 1877. The Union League Club was founded in 1863, in order to give to the Federal administration during the war the organized support of wealthy and influential men in the city, and it has been ever since the Republican social organization of the city. The Century Club represents literature, art, and the learned professions, and owns a valuable collection of pictures and a well-selected library. All the members of the Harmonie Club speak German. The original plan of the Lotus Club looked to a membership of literary men and artists, and members of the musical and dramatic professions.

Education.—The Dutch West India Company, which settled the island of Manhattan, was bound by its charter to provide schoolmasters as well as ministers for its colonists. The company consequently maintained schools from the beginning, and private schools were also soon established, and drew pupils even from other colonies. When the colony passed into the possession of England, the schools of the city still continued in the hands of the Dutch Church and ministers, and were supported by them, receiving little or no aid from the Government. At a later period, the desire of the new rulers to hasten the substitution of the English for the Dutch language in the colony led to an attempt by the colonial Government to reserve to itself the appointment of the schoolmasters, but it was not successful. Down to the middle of the 17th century the bulk of the population remained Dutch, and the support and control of the schools remained with the Dutch Church. The only outward sign of the growth of English influence during this period was the establishment of the still existing Trinity school, in 1710, in connexion with the Anglican Church. About the middle of the century the tide of English emigration, which has never since ceased, began to flow in, and English influence in educational matters began to gain the ascendency. In 1754 King's College, afterwards Columbia College, was established, and, after a short struggle to preserve it from denominational control, became distinctively an Anglican institution. Before the Revolution the English language had practically carried the day, and taken possession of the schools, colleges, and churches; but the political troubles which preceded the outbreak of the war, and the occupation of the city by the royal army during the war, closed them all, and for nearly ten years suspended all educational progress.

It was not until over ten years after the Revolution that the State legislature took any steps for the establishment of a system of popular education in the State at large. But within three years after the peace the beginnings were made in New York in the form which has made the educational history of the city so peculiar namely, as a charitable organization. In 1785 the Manumission Society established free schools for the poor coloured children of the city, and they were continued under the same auspices until 1794. A Quaker society, known as the "Female Association for the Relief of the Poor," in like manner opened a school for white girls in 1802, and the organization extended its operations and continued them until 1846. It was the means of suggesting the formation in 1805 of the association known as the "Free School Society," and afterwards as the "Public School Society," which has played so important a part in the education in New York. These were both charitable societies, and at first only sought to provide for children unconnected with the churches of various denominations, all of which maintained schools of their own. Of the Free School Society the mayor, recorder, aldermen, and assistant aldermen were made *ex-officio* members, and membership was open to all citizens offering contributions to the funds. This society was in 1826 converted into a still larger and more powerful one with a new charter, called the Public School Society, which continued to have charge of popular education in the city until 1853. It was supported in part by voluntary contributions, in part by subscriptions from those who desired to share in its management, and in a small degree by a contribution from the school fund of the State. For fifty years it may be said to have done all that was done for popular education in New York city, and its existence caused the exemption of the city for nearly thirty years from the operation of the common-school system established in the rest of the State, under which the schools were managed by trustees elected by the voters of each school district. During its existence 600,000 children passed through its schools, and it expended every year a large and increasing revenue, and when dissolved turned over $600,000 to the city. It gradually became plain, however, that the work of popular education in a large city was too great to be carried on by a charitable association, however able or energetic. In 1842 New York was brought under the system prevailing in the rest of the State, but the Public School Society was permitted to continue its existence and retain control of its own schools. It was found, after a few years' trial, that the society could not flourish in competition with the official organization, and in 1853 it was voluntarily dissolved, and its schools and property handed over to the city authorities, by whom the work of popular education has ever since been carried on.

The municipal board of education was at first composed of representatives elected by the different wards, but in 1864 the city was divided into school districts of equal school population, each of which sends three commissioners to the board. The ward schools were left in the control of elected trustees, subject only to a somewhat ill-defined power of supervision at the hands of a central board. This was found to work so badly, owing to the low character of many of the elected trustees, that in 1873 the whole system was reorganized. The power of appointing the twenty-one commissioners of the board of education, and three inspectors for each of the eight school districts, was given to the mayor, and to the commissioners the power of appointing five school trustees for each ward. The commissioners and inspectors hold office for three years, and trustees for five. As an outgrowth of the common-school system there is a normal college for the education of teachers, with a model school connected with it, and also the college of the city of New York, which began in 1848 as a free academy for the advanced pupils who had left the common schools. It was empowered to grant degrees in 1854, and was formally converted into a university in 1866.

The total number of scholars attending the city schools in 1882 was 289,917, and the number of professors and teachers employed was 2544. An Act providing for compulsory education was passed by the legislature in 1874, and came into operation in the city in 1875. It compels every person in the control or charge of any children between the ages of eight and fourteen to cause them to attend some public or private school at least fourteen weeks in each year, eight weeks of which are to be consecutive, or the pupils are to be instructed regularly at home at least fourteen weeks in each year in spelling, reading, writing, English grammar, and arithmetic. The law is enforced in the city by the city superintendent, who has twelve assistants known as "agents of truancy."

The schools, colleges, and other institutions not connected officially with the Government are very numerous, beginning with Columbia College, founded in 1754, and now the oldest university in the State, and the richest in the United States. Though not formally denominational, it is managed chiefly by members of the Protestant Episcopal Church. It has well-equipped law, medical, and mining schools, besides its academic department, a library of about 20,000 volumes, and a rapidly growing income from advance of its property in the city. There are also several denominational colleges belonging to Catholics, which offer a full course from the primary to the most advanced stage; and two theological seminaries, one the Protestant Episcopal, and the other the Union Theological Seminary, belonging to the Presbyterians. The endowment of the non-sectarian University of the City of New York is small, so that it makes but little figure in the educational field. There are also numerous medical colleges, and a large number of private schools frequented by children of the wealthier classes.

Libraries.—The principal public libraries are the Astor Library, the Mercantile Library, and the New York Society Library, which have been described in vol. xiv. pp. 535, 536.

Periodical Press.—There is probably nothing in which New York more nearly occupies the place of a metropolis than in the position of its periodical press towards that of the rest of the country. See NEWSPAPERS, *supra*, p. 434. The modern American newspaper may indeed be said to have originated in New York, which is naturally the chief centre for foreign news, as well as the chief financial and commercial centre, and the chief entrepot of foreign goods. In fact, as early as 1840 it had become plain that any one proposing to address the whole country through the press could address it more effectively from New York than from any other point. As population has spread and other cities have grown in wealth and numbers, New York newspapers have of course lost more or less of their early superiority, but they are still more widely read than any others, and absorb more of whatever journalistic talent there may be in the country. In the field of literary and artistic and musical criticism they are exposed to but little competition from any quarter. The periodical literature of the city is now very large; there is hardly an interest or shade of opinion, religious or political, which does not possess a New York organ, as the subjoined table will show:—

Periodicals published in New York City, May 1, 1883.

Class.	Daily.	Semi-Weekly.	Weekly.	Bi-Weekly and Semi-Monthly.	Monthly.	Bi-Monthly.	Quarterly.	Total.
Commerce, finance, and trades	11	4	62	15	49	1	1	143
Religion	...	...	33	4	35	1	4	77
General literature	...	...	31	...	27	...	...	58
News and politics	14	4	27	1	...	...	...	46
Science and mechanics	...	...	13	4	19	...	...	36
Medicine and surgery	...	...	4	...	15	1	4	24
Society and fashions	...	...	3	...	13	...	2	18
Education	...	...	1	4	11	...	1	17
Music, art, drama	1	...	7	1	4	...	...	13
Juvenile literature	...	...	7	1	4	...	...	12
Agriculture, &c.	...	...	2	...	10	...	...	12
Sporting	...	...	8	1	1	...	...	10
Law	2	...	4	...	1	...	1	8
Humorous	...	...	4	...	...	...	...	4
Sanitary subjects	...	...	2	...	...	...	...	2
Politics and literature	...	...	1	...	...	...	...	1
Class, secret society, and miscellaneous	...	...	10	...	4	...	1	15
In foreign languages	11	1	42	7	16	...	...	77
	39	9	261	38	209	3	14	573

Churches, Religion, and Charities.—In the absence of official returns as to churches and religious denominations, the most trustworthy statistics are those of the City Missionary Society, which puts the number of places of religious worship in the city, including halls, chapels, and missions, at 489. Of these, 349 are churches properly so-called, each with a fixed congregation, and a settled pastor and a building appropriated to its own use. They are divided as follows among the various denominations:—Protestant Episcopal, 72; Roman Catholic, 57; Methodist Episcopal, 48; Presbyterian, 41; Baptist, 38; Jewish synagogues, 25; Lutheran, 21; Dutch Reformed, 20; African Methodist Episcopal, 7; United Presbyterian, 6; Congregational, 5; Universalist, 4; Unitarian, 3; Quakers, 2; "miscellaneous," 23. This last term covers spiritualists and radicals of various shades, who, without having any fixed creed, or definite object of worship, meet on Sunday for speculative or ethical discussion.

The Roman Catholic Church lays claim to 500,000 worshippers, or nearly half the population, which is probably a considerable exaggeration, as its hold on the natives is, beyond question, very slight, and the total foreign population of the city does not reach 500,000. The Irish are almost wholly Catholic, as are the majority of the Germans, and nearly all the French, Italians, and other persons of foreign birth. The Catholic increase, too, is derived almost exclusively from foreign immigration. The priests are mainly Irish and German, the higher clergy being almost exclusively Irish either by birth or parentage. There is, too, a considerable Catholic element in social life, composed of the well-to-do French and German and Irish and Spanish, who, however, confine themselves very much to the company of persons of their own creed.

All the places of worship in the city of one sort or another, taken together, are supposed to contain 375,000 sittings. The Protestant denominations lay claim to 83,400 communicants and 400,000 attendants or supporters. The value of all the church buildings, including the ground on which they stand, is estimated at $40,000,000. The annual church expenses, including the ministers' salaries, are supposed to be $3,000,000. There are connected with the churches 418 Sunday schools, with an average attendance of 115,826 pupils. There are also in the city 326 local charitable institutions, of which 261 are Protestant, 38 are Roman Catholic, 18 are Jewish, and the rest are not classified. They disburse annually about $4,000,000. The most remarkable and successful of those charities is undoubtedly the Children's Aid Society, which was founded in 1853 by Mr Charles Loring Brace, the present secretary, for the purpose of helping friendless street children, especially street boys, both by sending them to the west and by opening schools and lodging-houses for them in the city. Since it began its work 67,287 children have been, by its agency, sent away from the city to country homes. During the year 1882 the society gave 14,122 boys and girls 230,968 lodgings in its six lodging-houses, of which 173,152 were paid for by the lodgers themselves; and it furnished them with 305,524 meals at low rates or free. The income of the society has risen from $4,732·78 in 1853 to $237,624 in 1882 from subscriptions and endowments.

The richest and most fashionable denomination is the Protestant Episcopal, and it is the one which seems to grow most by accretion from the native population. On the other hand, while the Baptists and Methodists have always flourished in New York, the two denominations which owed their origin in the United States chiefly to New England—the Unitarians and Congregationalists—have never taken deep root in the city.

Municipal Charities.—The municipal charities are in the hands of a department of the city government called the Commissioners of Charities and Correction, consisting of three commissioners appointed by the mayor, who have charge of all prisons for persons awaiting trial, of all city hospitals, almshouses, workhouses, and lunatic asylums, and of the penitentiary and city prisons. Most of these institutions are situated on small islands in the East River, known as Blackwell's, Ward's, Randall's, and Hart's Islands, the last-named containing a municipal industrial school.

Two charities are, however, exempt from the control of the department. One, the House of Refuge on Randall's Island, which is the property of a private corporation that receives vagrant and disorderly children, and gets its income partly from the labour of the inmates, partly from the proceeds of theatrical licences granted by the city, and partly from State grants. The other is the Juvenile Asylum, which also is managed by a private association, and partly supported by State grants. The influence of political partisanship on the appointment of the officers under the control of the department of charities and correction has been found to result in such serious defects of management, as regards the hospitals and charities especially, that a voluntary association, composed mainly of ladies, and known as the State Charities Aid Association, was formed in New York some years ago, and has obtained from the legislature powers of compulsory inspection. Its volunteer visitors are thus enabled to visit and examine all the institutions belonging to the city, as well as those of the State at large, and report on their condition both to the public and to the superiors of the officers criticized. The emigrants, of whom by far the greater portion pass through New York, are also placed in charge of Commissioners of Emigration, appointed by the mayor, whose duty is to afford all information and assistance which helpless strangers are likely to require on their first arrival in a foreign country. Their duties include also the discovery on shipboard, and detention for return to the country of their origin, of all paupers, cripples, and insane persons or others who are likely to become a charge to the city. These functions are discharged in a huge wooden structure known as Castle Garden, on the southernmost point of Manhattan Island, at the lower end of Broadway. Their magnitude varies from year to year. In 1883 about 405,000 emigrants of all ages and both sexes passed through the hands of the commissioners.

Government and Administration.—During the first stage of the colony the government was to all intents and purposes a military one. The governor, or director-general, appointed by the Dutch East India Company, exercised virtually absolute power, subject, of course, to the distant control of the directors in Holland. In 1652 the town received municipal magistrates appointed for one year by the director-general. They held office at his will, and were liable to have their decisions overruled by him on appeal; but, subject to those conditions, they possessed the powers and exercised the functions of corresponding officers in the Dutch municipalities at home. This form of government continued until after the conquest of the colony by the English, when the so-called "Duke's Laws" were proclaimed, and, on June 12, 1665, all the inhabitants of Manhattan Island were declared a body politic and corporate. The first formal charter, known as the Dongan charter, was bestowed on the city in 1686. The recorder, mayor, aldermen, and assistants were to constitute the body corporate, but the mayor, recorder, sheriff, and other superior officers were to be appointed yearly by the lieutenant-governor of the province, while the aldermen and assistants (who together with the mayor and recorder constituted the common council) and the petty constables were to be elected by a majority of the freemen and freeholders of each ward. In 1730 the charter was again amended, and took the form known as the Montgomery charter, reserving the appointment of a mayor and recorder still to the crown, and providing for the annual election by the people of the aldermen and assistants, constables, assessors, and collectors. The freedom of the city was purchasable from the corporation for five pounds, and was necessary to the pursuit of any trade or handicraft within its limits. This charter continued in force for nearly a century. It was confirmed by the State constitution of 1777 adopted after the outbreak of the Revolution, and again by the revised constitution of 1821, and has furnished, in fact, the framework of the city government down to the present day. The power which it gave the corporation of fixing the price of all articles sold in the city market was exercised till the Revolution. It was not essentially altered until 1831, when among other minor changes the common council was divided into two boards. The appointment of the mayor remained in the hands of the governor and council until the Revolution, when it was transferred by the State constitution to the governor and council of appointment which shared with him the appointing power. By the amended State constitution of 1821, the duty of electing the mayor annually was imposed on the common council, and so continued until 1834, when provision was made by statute for his election by a vote of the qualified city electors. This charter continued in force without material modification until 1857.[1]

The revised State constitution of 1846 introduced manhood suffrage, and its effect on the city government during the first ten years gave considerable dissatisfaction. It came into operation simultaneously with a great increase in the stream of foreign immigration, most of which passed through New York on its way westward, but not without leaving behind a sediment, composed of the poorest, the most ignorant, and the most vicious. The result was that a very inferior class of men began to find their way into the mayoralty and the common council. The liquor dealers and others of a similar stamp, whose occupations gave them access to, and influence over, the more ignorant voters, began to assume increasing importance in municipal politics, becoming able to impose conditions on candidates for office and to exercise considerable control over the distribution of municipal patronage. The police force was gradually converted into a refuge of political partisans, and was employed without scruple in electioneering. Every political department of the city government suffered more or less from the same causes. The great political club known as the Tammany Society, which was formed in 1789 as a non-political patriotic organization, professedly to counteract the aristocratic tendencies of the Order of the Cincinnati, and which had long been the managing body of the Democratic party in the city, was much strengthened by the increase of the immigrant vote, and its government was also affected for the worse by the same influences to which the city government was exposed. During these years, however, the Republican party, as the opponent of slavery, was slowly rising into prominence in State and Federal politics on the ruins of the old Whig party. By the year 1857 it had gained a majority of the voters of the State outside of the city, secured the control of the State legislature, and elected a governor. It was not very long in power in the State at large before it determined to take the government of the city of New York, to a certain extent, out of the hands of the local majority by giving portions of it to commissions appointed by the governor. There was perhaps reason enough for the experiment to be found in the condition of the municipal administration, but it was unfortunate that it had to be made by a political party to which the local majority did not belong. This gave it an air of partisanship, and exposed it to the charge of being simply an attempt to put the Republican party in possession of a portion of the city patronage, which it could not get hold of in any other way, and to punish the city voters for being Democratic and standing by the South in the slavery controversy. It was in reality, however, an effort on the part of the native-born and the property holders to escape the inevitable result of a sudden increase in the power of the ignorant and poor in a great commercial city.

Accordingly, in the spring of 1857, the charter was so modified by the legislature as to give the construction of a park, known as the Central Park, for which provision had just been made, to a commission appointed by the governor. The police was in like manner taken out of the hands of the mayor and given to a similar commission. The mayor then in office, Fernando Wood, attempted forcible resistance to this change on the ground that the statute was unconstitutional. He barricaded himself in the city-hall surrounded by his policemen, and had to be ousted and arrested by the aid of the militia. Ever since 1857 interference of the State in the city government has been frequent, and alterations of the charter have been made or attempted almost every year with the view mainly of effecting a new distribution of the city patronage, sometimes as the result of a change in the majority of the legislature, and sometimes as the result of a bargain between the Republican leaders in the legislature and the Democratic leaders in the city. But the policy of withdrawing or withholding power from the common council has through all these changes been steadily adhered to on both sides, owing to distrust of the persons now usually elected to that body.

During the war, and for several years afterwards, the art of managing the city voters of the Democratic party through the political club known as the Tammany Society was continually improved under the leadership of William M. Tweed, who had succeeded Fernando Wood as the municipal chief of his party. Before 1870 he had brought the city majority under his control through a very perfect organization, and had filled the mayoralty and all the leading administrative offices as well as the common council with his creatures. He thereupon began an elaborate system of plunder, of which the main feature was the presentation of enormous bills for work done on a new court-house then in process of erection by city tradesmen acting as his confederates. To these he paid a portion only of their demands, retaining the balance, which he divided in certain proportions with his principal followers. The total amount taken from the city treasury in this and similar ways was never clearly ascertained, but the city debt, which was apparently a little over $73,000,000 in 1870, was, when the liabilities were fully ascertained in 1876, found to be nearly $117,000,000. These frauds, which had been long suspected, were finally brought to light by the treachery of one of the conspirators, who was dissatisfied with his share. But their success and the length of time which had elapsed before their detection were, considering the very large number of persons who had been made privy to them, and who had been admitted as partners in their results, a remarkable illustration of the perfection to which the system had been brought. The overthrow and punishment of the leading perpetrators of them greatly purified the municipal administration, and led to a watchfulness on the part of the public regarding municipal affairs which promises, as long as it lasts, to make a repetition of them impossible. In fact, they could not have been perpetrated without a combination which included all the chief city officers; and this could not have been effected, and as a matter of fact was not effected, without many years of careful, and, to a certain extent, unobserved preparation. The great source of corruption in the city government is the practice of treating places in the municipal service as what are called party "spoils," or, in other words, as rewards for electioneering services. This practice, which has prevailed in the Federal as well as in the State service all over the country, is of older growth in the State of New York than elsewhere, having shown itself there very soon after the Revolution. It has been much weakened, however, in New York by an Act of the legislature, passed in 1878, which forbids the removal of any regular clerk or head of bureau in the service of the city government, except for cause, and after an informal trial. The police and fire departments are protected in a similar way; but this does not relieve the elected officers from the necessity of purchasing their nominations by such promises as still remain in their power to carry out, such as contributions from their salaries, or the filling of vacancies occurring within their departments, or the employment of labourers in any public work of which they may have charge. A more recent Act of the legislature (1883) prescribes competitive examination as a basis for appointment to all State offices, and forbids, under heavy penalties, all assessments on salaries for political purposes; but its application to the large cities as regards competitive examinations is left optional with the mayor, and with the heads of certain departments. As the charter stands at present, the legislative power of the board of aldermen is restricted to the regulation of the traffic in the streets, the granting of licences to street vendors, the opening of new streets, and similar matters. Their confirmation is, however, necessary to the mayor's appointment to office. The amount of taxes for each year is fixed by the board called the board of apportionment, composed of the mayor, the comptroller, the president of the board of aldermen, and the president of the department of taxes and assessments. The estimate so made is laid before the board of aldermen for their approval, but this is a mere form, for, if the aldermen refuse such approval, the board of apportionment disregards the refusal and goes on to levy the taxes, after having placed on file their reasons for so doing. Moreover, the aldermen are expressly forbidden by the charter to impose taxes, or borrow money, or contract debts, or lend the credit of the city, or to take or make a lease of any real estate or franchise save at a reasonable rent and for a period not exceeding five years.

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[1] The legal title of the corporation is now the "Mayor, Aldermen, and Commonalty of the City of New York," and the legislative branch consists of a board of twenty-four aldermen, who constitute the common council, and are elected by a majority vote, one from each electoral district, within the city limits, which sends a member to the State assembly.

Taxation.—For purposes of taxation New York is a county as well as a city, the two being conterminous. The city taxes, when settled by the mayor, comptroller, president of the board of aldermen, and president of the board of assessments and taxes, forming the board of apportionment, are levied by the same officers, forming the board of county supervisors, upon all the real and personal property in the county, and in this levy is included the amount needed for State purposes, the city's share of which is settled by a State board. The rule on which the New York taxes are levied is that which prevails with but little modification all over the United States, though applied with much more rigour in some States than in others, viz., that every species of property, visible and invisible, is liable to taxation. In New York city it is the custom of the appraisers to tax land and houses at about two-thirds of their market value. The amount assessed on personal property is generally increased in successive years, until the owner gainsays the assessor's guess, but his oath is sufficient proof for its reduction. In other words, it may be said that the attempt to tax personal property in the city, except in the case of corporations, has failed. The city tax levy for 1881 amounted to $31,071,840·19, and the rate of the tax was $2·62 per cent. on the valuation of all kinds of taxable property. There is a steady increase in the valuation of land and houses, but a nearly steady decrease in the valuation of personal property.

Courts and Police.—The city has three courts of record, of which two, the superior court and court of common pleas, possess concurrent jurisdiction with the supreme court of the State in all cases in which the cause of action has arisen within the county, or in which the property or other thing in dispute lies within the county, or in which the defendant is a resident. Each court has six judges, elected by popular vote for a term of fourteen years. The supreme court can, however, remove any cause from either of these courts by order on notice, and take jurisdiction of them itself, but in that case the trial must take place in another county. The third, formerly the marine court, now the city court, consists also of six judges. Its jurisdiction, however, is limited to cases not involving more than $2000 dollars in value, and to the enforcement against real estate of mechanics' liens, that is, of liabilities incurred to contractors or labourers who have been engaged in the construction of a house or other work of improvement on land. The only marine causes of which the court has cognizance are suits brought by sailors for wages, or by any person for assault and battery or false imprisonment on board a vessel. Below these are ten district courts which are not courts of record, and whose jurisdiction only extends to cases not involving over $250. The justice of each court is elected by popular vote, and holds office for six years, and must be a member of the bar. Appeals from his decisions, in certain cases specified by statute, lie to the court of common pleas. The surrogate, who has charge of the court of probate, is also elected, and holds office for six years.

The criminal courts of the city begin with the court of oyer and terminer, which consists of a single judge of the State supreme court belonging to the judicial district within which the city lies, and tries all such cases sent to it by the court of general sessions as it thinks proper to try, and is, in fact, intended to furnish relief to the latter. The working criminal court of the city is the court of general sessions, which consists of the recorder, the city judge, and the judge of the court of general sessions, each of whom tries cases sitting apart; but an appeal in all capital cases, and in all cases punishable with imprisonment for life, lies from them to the supreme court and court of appeals. All three judges are elected, and hold office for fourteen years. Below the general sessions there is the court of special sessions, composed of any three police justices, which tries all misdemeanours, unless the defendant prefers to be tried by the court of general sessions, or is sent before that court for trial by the special sessions. The police courts are held by eleven police justices possessing the usual jurisdiction of police magistrates, and appointed by the mayor, subject to the confirmation of the board of aldermen, for a term of ten years.

In addition to the courts of law there is an official arbitrator, appointed by the governor of the State, who, with or without two assessors chosen by the parties to the controversy, hears and decides, on short notice, all disputes between members of the chamber of commerce. His judgments have all the force of those of the courts of law, and are executed in the same manner, and are rendered without formal pleadings, on the oral or written statements of the litigants, and the submission of the necessary documents.

The police department is in the control of four salaried commissioners, who are nominated by the mayor and confirmed by the aldermen, and hold office for six years. The total force performing actual police duties consists of 2237 patrolmen, 165 roundsmen, 143 sergeants, 78 doormen, 36 captains, 40 detective sergeants, 4 inspectors, and 1 superintendent. The expenses of the department for the year ending January 1, 1882, were $3,209,960·65. The city is divided into thirty-five police precincts, each under the direction of a captain and subordinate officers. There is, in addition, a steamboat squad, whose duties confine them to the piers and the neighbourhood; a mounted squad, on duty in the uptown avenues; a central-office squad, on duty at the department headquarters; a special-service squad; a detective bureau; a sanitary company for the inspection of steam-boilers and tenement houses; four inspection districts; and six district-court squads.

About half of those arrested for various offences in the city are natives of the United States. The statistics of the police courts (including the court of special sessions) show that in the year ending October 31, 1882, they disposed of 66,867 prisoners, a decrease of 17,954 as compared with the year 1874.

The fire department is under control of three salaried fire commissioners, who are nominated by the mayor and confirmed by the aldermen. The working force of the department consists of 826 uniformed men, who are divided into fifty-one engine companies and nineteen hook-and-ladder companies. The city is thoroughly equipped with a fire-alarm telegraph system. The number of fires in the city in 1883 was 2168, with a loss of $3,517,326. The expenditure of the department in 1883 was $1,464,850. The department has other duties besides that of extinguishing fires. It has charge of the bureau which looks after the proper construction of buildings, seeing that they are erected in compliance with the Building Act, and that old buildings do not become in any way dangerous, and supervises the storage of combustibles and explosive materials.

An adjunct of the fire department, although under entirely independent control, is the fire-insurance patrol. This is an organization authorized by an Act of the legislature passed in 1865, and supported by the fire insurance companies doing business in the city. Its object is not to assist in extinguishing fires, but to remove goods from the burning buildings, and to protect them from damage by water.

Vital Statistics.—The situation of the city, surrounded as it is by tide water, renders the disposition of its sewage easy. This, combined with its excellent supply of fresh water, tends to make the city a healthy one. On the other hand its limited area causes an excessive crowding of its inhabitants into tenement houses; and, as a majority of the tenement population is foreign, with little appreciation of the value of cleanliness, the death-rate among this class is very large. This is especially true of young children in the very hot months. Quarantine inspection at the mouth of the harbour, and vigilant sanitary inspection throughout the city itself, have been very successful in warding off pestilence. Since 1822 there have not been more than one hundred deaths from yellow fever in any one year. Since 1831 there have been six outbreaks of cholera, but only two deaths occurred from that disease from 1875 to 1882 inclusive.

The sanitary condition of the city is in charge of a board of health, consisting of the president of the police board, the health officer of the port, and two commissioners of health, one of whom must have been a practising physician for not less than five years preceding his appointment. In the health department are two bureaus, one in charge of a sanitary superintendent, and the other in charge of a registrar of records. The board has authority to frame and enforce a sanitary code. The death-rate was 26·47 in 1880, 31·08 in 1881, and 29·64 in 1882.

Commerce and Manufactures.—New York owed its first rise in importance to the excellence of its situation as a seaport, and in this respect still maintains its pre-eminence over all American cities. Nearly 57 per cent. of all the foreign trade of the country passes through its harbour. Its exports during the fiscal year ending June 30, 1882, amounted to $344,503,775 out of a total for the whole country of $750,542,257. Its imports during the same period reached $493,060,891 out of a total of $724,639,574, but a very much larger proportion of this trade is done in foreign vessels than formerly. There is no line of steamers to Europe sailing from the port under the American flag. Its supremacy as a port naturally brought with it supremacy as an entrepôt of foreign goods; of these New York has been for the last half century the principal distributing agency, especially as regards dry goods. Of late this branch of business has to some extent migrated to Chicago and other western cities, owing to the growth of population west of the Mississippi; but east of the Alleghanies, and all through the Southern States, the hold of New York on the retail dealers is practically unshaken. New York is also the foremost city of the Union in manufactures, and no other city, except Philadelphia, can make any pretence of competing with it in this field.

The following table shows the growth of New York's manufactures since the census of 1860:—

	1880.	1870.	1860.
Establishments	11,339	7,624	4,375
Capital	$181,206,356	$129,952,262	$61,212,757
Raw material	$288,441,691	$178,696,039	$90,177,038
Hands employed	227,352	129,577	90,204
Wages	$97,030,021	$63,824,049	$28,481,915
Value of products	$472,926,437	$332,951,520	$159,107,369

In number of establishments the boot and shoe industry leads in 1880, the number in this case being 839. Then, in order, come—bakery products, 782; cigars, 761; men's clothing, 736; carpentering, 460; printing and publishing, 412; plumbing and gasfitting, 401; furniture, 299; painting and paper-hanging, 293; foundry products, 287; jewellery, 240; machinery, 240; women's clothing, 230; blacksmithing, 205. The whole number of industries enumerated in the census table is 164. In the value of products, men's clothing leads, the total being $60,798,697. Next in order come—meat packing, $29,297,527; printing and publishing, $21,696,354; malt liquors, $19,137,882; women's clothing, $18,930,553; cigars, $18,347,108; lard (refined), $14,758,718; foundry products, $14,710,835; sugar and molasses (refined), $11,330,883. Then come furniture, bakery products, machinery, silk and silk goods, boots and shoes, carpentering, musical instruments (pianos and materials), grease and tallow, flouring and grist-mill products, coffees and spices (roast and ground), marble and stone work, shirts, iron castings, oleomargarine, millinery and lace goods, jewellery, all with annual production ranging from $10,000,000 to $5,000,000.

Docks.—Until 1870 the docks of the city were not confided to the care of a special department of the city government, and there was no adequate attempt made to put them in practical and durable shape, and to extend the wharf line. In that year a separate dock department was authorized by the legislature, and it is continued under the present charter. It is in charge of three commissioners, nominated by the mayor and confirmed by the aldermen. They hold office for six years, and receive an annual salary of $3000 each. The bulkhead line of the city from the Battery to Sixty-First Street on the Hudson River, according to the new plan, measures 25,743 feet, and from the Battery to Fifty-First Street on the East River 27,995 feet. At the Battery a stone pier was completed several years ago. This is the only stone pier on the water front. The system which the department is trying to carry out proposes the construction of a new bulkhead wall, first along the Hudson River front, and eventually along the East River, and the widening of the street along the Hudson River to a width of 250 feet, and of that along the East River to a width of 150 feet in the lower part and of 100 feet in the upper part. A beginning of this work has been made along the Hudson River, but it makes slow progress, partly because the title to the water front in many places is disputed by private individuals, and this results in much tedious litigation. It is the intention to give 20 to 25 feet of water at every point along the new bulkhead. This bulkhead is now completed at detached points on the Hudson River, as from West Tenth Street to Canal Street, and from Jay Street to Warren Street, and the work is going on at other points. The allotment of wharfs and places in the harbour to vessels is not done by the dock or any other city department, but by the captain of the port and eleven harbour masters, all of whom are nominated by the governor of the State and confirmed by the State senate. The captain of the port holds office for three years, and the harbour masters for two years.

Ferries.—As New York is on all sides surrounded by water, ferry-boats form the principal means of communication between it and the opposite shores. The water-courses of its northern boundary—Harlem River and Spuyten Duyvel Creek—are narrow enough to be bridged; but, until the opening of the Brooklyn Bridge, steam ferry-boats supplied the only means of communication with New Jersey and Long and Staten Islands. These boats are arranged with cabins for passengers on both sides, and a roadway for horses, waggons, cattle, &c., in the middle. They are worked by the railroad companies and other private corporations. The principal ferries to New Jersey, running from the Hudson River side, have their piers at the foot of the following streets:—Liberty, Cortlandt, Barclay, Chambers, Desbrosses, Christopher, Twenty-Third, and Forty-Second. The principal ferries to Brooklyn, running from the East River side, have their piers at the foot of the following streets:—Whitehall (2), Wall, Fulton, Catharine, Roosevelt, Grand, and Houston. There are also two ferry lines to Staten Island, four to Long Island City, one to Astoria, L.I., one to Blackwell's Island, two to Greenpoint, L.I., and one to Governor's Island. The Brooklyn ferry-boats leave their piers every ten minutes (and those from Fulton Street every five minutes) during the business hours, lessening their trips afterwards to one every fifteen or twenty minutes. On the New Jersey side they run at intervals of from ten to thirty minutes. During certain of the busiest hours of the morning and evening the fare for each foot passenger on the leading Brooklyn ferries is 1 cent; during the rest of the day it is 2 cents. On the New Jersey ferries it is uniformly 3 cents.

Conveyances.—The rapid growth of the city in a long line to the northward has naturally led to great difficulties of transportation. The old omnibuses began to be supplemented in 1834 on all the leading longitudinal lines of thoroughfare by tramway cars drawn by two horses, but, though running in the most frequented routes at intervals of a minute, they became long ago unequal to the demands on them. As the dwelling houses became farther and farther separated from the business part of the city, the discomfort and delay of this mode of travel, especially in winter weather, grew very serious, and caused a considerable migration to Jersey City and Brooklyn of persons who would have remained on Manhattan Island but for the difficulty of getting to and fro. After a long period of clamorous discontent, the remedy was applied in 1878 by the construction of what is known as the Elevated Railroad, worked by steam locomotives on raised iron trestle work in four of the avenues, the Ninth, Sixth, Third, and Second, and running from the Battery to the Harlem River every three to four minutes, 10 cents being the ordinary fare for the entire distance of 10 miles, but with "commission" trains at 5 cents between certain hours of the morning and evening, for the accommodation of the working classes, the fare in these having been fixed by the State commission which settled the conditions of the charters. The result has been a very rapid increase of population in the upper end of the island.

Public Works.—There are but few public buildings of much architectural pretension. The principal are the city-hall, the general post-office, the custom-house, the barge office at the Battery for the accommodation of passengers landing from steamships, the new produce exchange, and the Roman Catholic cathedral in Fifth Avenue. The two great public works of the city are the Croton aqueduct and the suspension bridge, spanning the East River, connecting New York with Brooklyn. The former, which carries the water supply of the city over 40 miles from the Croton Lake in Westchester county, has a capacity of 115,000,000 gallons daily, and is now delivering 90,000,000 gallons daily. It has for forty years supplied the inhabitants with water with a profusion never seen elsewhere in the modern world, and with little or no restriction on its use. Of late the supply has begun to be inadequate, and provision has (1883) been made by the legislature for the construction of an additional reservoir and aqueduct.

The Brooklyn Bridge connecting New York with Brooklyn across the East River is much the largest suspension bridge yet constructed, measuring 5989 feet in length, while that at Kieff, the next largest, only measures 2562. The work on it began in 1870, and it was opened for traffic on May 24, 1883. The bridge consists of a central span 1595½ feet in length from tower to tower, two spans of 930 feet each from the towers to the anchorage on either side, and the approaches of ironwork and masonry, the one on the New York side being 1562½ feet, and that on the Brooklyn side 971 feet in length. The towers, between which the central span extends, are 276½ feet above high water, and rest upon a rock foundation 80 feet below the surface of the river and 40 feet below its bed. The cables, four in number, supporting the spans, are 15¾ inches in diameter, and 3757½ feet in length. They rest on movable "saddles" where they pass over the towers, exerting here a vertical pressure only, the stress (or lengthwise pull) being sustained wholly at the anchorages, masses of solid stone masonry weighing 60,000 tons each, and rising 90 feet above the river's edge. Each cable contains 5282 galvanized steel wires in nineteen separate strands, consisting of 278 lengths, each strand having over 200 miles of continuous wire. The wires are laid parallel (not twisted), and packed as closely as possible, the greatest care being necessary to secure perfect evenness of length, and are covered with an outside spiral wrapping of wire. The deflexion of the cables between the towers is 128 feet; the clear height of the bridge above high water is 135 feet in the centre and 118 feet at the towers, giving a free passage to shipping. The width of the bridge is 85 feet, divided between five passage ways. In the centre is a footway 15½ feet wide and raised 12 feet above the other passages, giving an open view on both sides; next this on each side are tracks for cars, worked by cables from a stationary engine at the Brooklyn terminus; and outside of these are waggon ways 19 feet wide. The entire cost of the bridge, $15,500,000, was borne by the cities of New York and Brooklyn, the latter paying two-thirds.

Hudson River Tunnel.—The width of the Hudson River along the city's front is so great that no engineer has yet proposed to bridge it there; but an engineering feat almost as difficult is now in progress. This is the excavation of a tunnel beneath the bed of the river large enough to permit the running of steam trains in it. The work is in the hands of private capitalists. The entrance of the tunnel in New York is at the foot of Morton Street; in Jersey City it is at the foot of Fifteenth Street, near the Hoboken line. Work was begun at the New Jersey entrance in 1874, and at New York entrance several years later. There are in fact to be two tunnels, about 25 feet apart, with connexions every 1000 feet. This mode of construction is easier than to make one tunnel of double width. The river from bulkhead to bulkhead at this point measures 5400 feet in width, and each entrance is about 60 feet back from the bulkhead. The tunnels will measure, inside, 17 feet in width and 17 feet in height. From Jersey City one tunnel had been, in August 1882, completed a distance of 1600 feet, and the other a distance of 640 feet; from New York 170 feet of one tunnel only is completed. Unfinished work has been pushed a considerable distance farther on each side. The material through which the tunnel is cut has made its construction very difficult—on the New Jersey side silt, and on the New York side a light sandy soil, through both of which the overlying water percolates freely, and it was necessary to keep this water out of the excavated sections as the work proceeded. The plan adopted consisted of the sinking, at each mouth, of a heavy caisson of timber to the required depth. In the river side of this, when it was completed, a hole was cut corresponding with the mouth of the tunnel. The caisson was air-tight, and into it the air was pumped until it reached a density sufficient to prevent the entrance of the water. As soon as a short section is excavated it is lined with iron plates firmly braced. The interior of the tunnel will therefore consist of an outer lining of iron, and an inner lining of bricks laid in mortar. Whenever one section is completed an iron bulkhead is moved to its further end, and a new air-tight chamber is formed beyond the bulkhead. The company has met with financial embarrassments, and the work has meanwhile been suspended.

Parks, Museums, and Galleries.—The city is well supplied with parks and public gardens. There are in all thirty of these, including small open squares. The principal are the Battery, at the southernmost point of Manhattan Island, containing 21 acres; the City-Hall Park, containing 6; Washington Square, 8; Union Square, 3½; Tompkins Square, 10½; Madison Square, 6¼; Reservoir Square, 4¾; Mount Morris Square, 20. The chief is, however, the Central Park, lying nearly in the centre of the island, and containing 843 acres; it is 2½ miles long by half a mile wide. It was laid out in 1858, and is considered a masterpiece of landscape gardening. It contains the building of the Metropolitan Museum of Art, immediately in front of which stands the obelisk brought in 1880 from Alexandria. Outside the Central Park, but within Manhattan Square, a small addition recently made to it on the west side, stands also the American Museum of Natural History, which, like the Museum of Art, is the property of a private corporation.

The National Academy of Design, situated at Fourth Avenue and Twenty-Third Street, has a frontage of 80 feet and a depth of 98 feet 9 inches. The exterior is Venetian; the material used is grey and white marble and blue stone. The first and second stories contain offices, lecture-rooms, and rooms for art schools. On the third are large exhibition rooms, lighted from above. Every year one exhibition of oil paintings and one of water colours are given, and in later years supplementary exhibitions have been added. The art schools are free, and are open to both sexes.

The Metropolitan Museum of Art was chartered by the legislature in 1870. It is managed by a board of officers, comprising the comptroller of the city, the president of the department of public parks, the president of the National Academy of Design, and certain private citizens who are members of its corporation. The museum building, opened in 1880, was erected by the park department, at a cost of about $500,000, and is situated in the Central Park, near Fifth Avenue and Eighty-Third Street. It measures 218 by 95 feet. The material is red brick with sandstone trimmings. Among its valuable possessions are the Blodgett collection of pictures, the Cesnola collection of articles taken from the Cypriote cities and tombs, two paintings by Rubens, two by Van Dyck, and many other works of eminent masters. The museum is open to the public free, on Wednesdays, Thursdays, Fridays, and Saturdays. On the other days an admission fee of 25 cents is charged.

The American Museum of Natural History was incorporated by the legislature in 1869, and its present building was opened in 1877. It is situated in Manhattan Square. The exterior is of red brick with yellow sandstone trimmings. It is four stories high, and each of its halls measures 170 feet in length by 60 in width. It is governed by a board of twenty-five trustees. The building was erected by the park department, which has charge of it and the surrounding grounds. It is open free. Among its possessions are the Veneaux collection of natural history specimens, the museum of Prince Maximilian of Neuwied, the Elliot collection of the birds of North America, the Jay collection of shells, the James Hall collection of geological specimens of New York State, the Bement specimens of the Stone Age of Denmark, the De Morgan collection of stone implements from the valley of the Somme in France, and the Squire and Davis collection from the Mississippi valley.

The Cooper Institute, or "Union for the Advancement of Science and Art," occupies a huge brown stone building at the junction of Third and Fourth Avenues, the gift of Peter Cooper, who erected it in 1857 at a cost of over $600,000, and further endowed the union with $200,000 for the support of a library, reading-room, and schools of science and art, all of which are free, and are largely attended by young men and young women of the working classes. Its evening schools are attended by over 3000 students annually, and in the women's art school instruction is given gratuitously to 350 pupils yearly. The library contains 15,000 volumes, a notable feature being a complete and fully indexed set of the reports of the United States patent office. The reading-room is supplied with about 300 periodicals and newspapers, and is frequented daily by over 2500 readers. No one instrumentality is doing more than the Cooper Union for the instruction of the working classes in the city.

The principal works relating to New York are—Thomas Jones, *History of New York during the Revolutionary War*, 1879; Mrs Lamb, *History of the City of New York*, 1877; Stone, *History of the City of New York*, 1872; Perge, *History of the City of New York*, 1859; Mary L. Booth, *History of the City of New York*, 1880; Valentine, *History of the City of New York*, 1853; *The City Charter*, with Chancellor Kent's notes, 1836; Bourne, *History of the Public School Society*, 1870; Newberry, *The Geological History of New York Island and Harbour*, 1878; Disturnell, *New York as it was and as it is*, 1876; C. L. Brace, *The Dangerous Classes of New York*, 3d ed., 1880; *The Laws of New York* (consolidated), 1882; Boese, *Public Education in the City of New York*, 1869; Cammann and Camp, *The Charities of New York*, 1868; Friedrich Kapp, *Immigration and the Commissioners of Emigration of the State of New York*, 1870. (E. L. G.)

NEW ZEALAND consists of two large islands, the North Island and the South Island, of another much smaller one named Stewart Island, and of islets around the coast. The colony includes also the Chatham Islands and the Auckland Islands. New Zealand extends from 34° 25′ to 47° 17′ S. lat., and from 166° 26′ to 178° 36′ E. long. The Chatham Islands lie between 43° 25′ and 44° 20′ S. lat., and 176° 10′ and 177° 15′ W. long., and are about 365 miles eastward of Cape Palliser, Cook Strait, New Zealand. The Auckland Islands, which are uninhabited, lie between 50° 30′ and 51° S. lat., and 165° 55′ and 166° 15′ E. long. The whole group comprised in the British colony of New Zealand is situated in the South Pacific Ocean, and is nearly antipodal to Great Britain. The area of New Zealand is about 100,000 square miles, or one-sixth less than that of Great Britain and Ireland. The area of the North Island is about 44,000 square miles, or 28,000,000 acres; that of the South Island is about 55,000 square miles, or 36,000,000 acres; and Stewart Island has about 800 square miles, or 512,000 acres. The Chatham Islands and the Auckland Islands are of inconsiderable dimensions. The North and South Islands together extend over twelve degrees of latitude, and vary from 46 miles to 250 miles in breadth, the average breadth being about 140 miles. The North Island is in area about three-fourths that of England and Wales. The South Island is larger; its area is about equal to that of England and Wales.

The mountains in the North Island occupy about one-tenth of the surface, and are covered with dense forests containing an almost inexhaustible supply of fine timber. In the northern half the mountains are not so frequent as in other parts, and do not exceed 1500 feet in height, with the exception of a few extinct volcanoes between 2000 and 3000 feet high. In the centre there are some higher volcanic mountains. Tongariro (6500 feet) is occasionally active. Ruapehu (9100 feet) and Mount Egmont (8300 feet) are extinct volcanoes. The main range of the island, beginning to the eastward of these mountains, is at its greatest height 6000 feet. The plains in the North Island lie chiefly on the western side of the range. Mount Egmont is surrounded by an extensive and very fertile district. Nearly four-fifths of the South Island is occupied by mountains. The greater part of them is open, well grassed, and adapted for pasture. The Southern Alps, as they are called, run close to the west coast the whole length of the island. Mount Cook, the highest peak, is 12,349 feet high, and has many glaciers. Its summit was for the first time reached in March 1882 by the Rev. W. S. Green, a member of the Alpine Club, and his two Swiss guides, Messrs Kaufmann and Boss. The main range is crossed at intervals by low passes. Extensive agricultural

plains lie on the eastern side. The rugged western slopes are rich in mineral wealth. On the south-western coast there are several fiords or sounds, long, narrow, and deep, surrounded by snow-capped mountains from 5000 to 10,000 feet in height. The scenery, especially in Milford Sound, is sublime.

There are countless running streams of the purest water throughout New Zealand, but not many rivers of depth and size. The Waikato is the chief river in the North Island. Its tortuous course is over 200 miles long, and it is joined by a fine tributary, the Waipa, at Ngaruawahia. The Waikato rises in the central part of the island, and flows into the sea on the west coast south of the Manukau. The Wairoa, discharging itself into Kaipara harbour, is large and deep, and is navigable for vessels of considerable tonnage. In the South Island, the chief river is the Clutha, rising north of Lake Wanaka, and 220 miles in length. It flows into the sea about 50 miles south of Otago Harbour, and a calculation has been made that it discharges 1,088,736 cubic feet of water a minute. Rivers in New Zealand have bars at their mouths, and are, with two or three exceptions, only navigable for small craft. Owing to the height and the precipitous nature of the mountain ranges, the rivers, especially in the South Island, are subject to sudden and dangerous floods.

The lakes in New Zealand are a characteristic feature. Lake Taupo, in the central part of the North Island, covers an area of about 250 square miles. In its neighbourhood, and in a line between it and White Island, in the Bay of Plenty, which is in constant volcanic action, there is the famous Lake District with its wonderful collection of geysers, sulphurous springs, palatial terraces, and lovely natural baths, formed as it were of tinted marble, and full of warm transparent water of a beautiful blue colour. Nor are these waters only astonishing to the sightseer. Their curative properties in cases of rheumatism, scorbutic and tubercular diseases, cutaneous eruptions, and nervous affections are well established. In the South Island there are numerous lakes, some of them of considerable extent, Lake Wakatipu covering 112 and Lake Te Anau 132 square miles. These and many others embosomed in the Southern Alps are scenes of great natural beauty, abound with objects of interest, and present strong attractions to the explorer and the tourist.

The coast-line is over 3000 miles. Cook Strait separates the two large islands, and Foveaux Strait separates the South Island from Stewart Island. Both straits greatly facilitate inter-navigation. The coastal features of the northern part of the North Island are remarkable. The waters of Auckland Harbour on the eastern side and of Manukau Harbour on the western side approach each other within a mile. A great number of natural harbours are included between the North Cape and Cape Colville. The harbours on the west coast of the North Island have shifting bars at the entrance; but Manukau, Kaipara, and Hokianga are excellently surveyed, and can, with due caution, be safely entered. Inside they are spacious and fine. Auckland and Wellington have excellent natural harbours. The South Island on its north side, from Cape Farewell to Cape Campbell, is indented with numerous good harbours; and on the eastern coast, Port Lyttelton, Akaroa, Port Chalmers, and the Bluff are all available for large vessels. On the south-western extremity the coast is iron-bound, but there are several deep fiords surrounded by lofty and precipitous mountains. Anchorage can rarely be obtained there, except at the head of remote coves. Northward there is Jackson's Bay; and between it and Cape Farewell, a distance of 300 miles, there is an open and exposed coast, with seven or eight small bar river harbours at intervals. Stewart Island is only 120 miles in circumference, and has several excellent harbours on its eastern side. There are some anchorages on the western side, but they are rather exposed to the prevailing westerly winds.

Meteorological statistics are collected at Auckland, Wellington, Christchurch, and Dunedin; and observations of rainfall, temperature, and wind-direction are received from thirty other stations. From the data thus obtained an isobaric map and a report are prepared for each day; and weather warnings are telegraphed to any part of the coast when necessary. A system of intercolonial weather exchanges has been agreed upon, and telegrams are daily exchanged between Sydney and Wellington.

In the *Handbook of New Zealand* (1883), Dr Hector makes the following observations:—

> "The climate resembles that of Great Britain, but is more equable, the extremes of daily temperature only varying throughout the year by an average of 20°, whilst London is 7° colder than the North and 4° colder than the South Island of New Zealand. The mean annual temperature of the North Island is 57°, and of the South Island 52° that of London and New York being 51°. The mean annual temperature of the different seasons for the whole colony is in spring 55°, in summer 63°, in autumn 57°, and in winter 48°. The climate on the west coast of both islands is more equable than on the east, the difference between the average summer and winter temperature being nearly 4° greater on the south-east portion of the North Island and 7° on that of the South Island than on the north-west, on which the equatorial winds impinge. This constant wind is the most important feature in the meteorology of New Zealand, and is rendered more striking by comparing the annual fluctuation of temperature on the opposite seaboards of the South Island, which have a greater range of temperature by 18° at Christchurch on the east than at Hokitika on the west."

Rain is frequent. In the north the greater fall is during winter; in the south it is more equally distributed throughout the year. There is a much greater rainfall on the west than on the east coast, especially in the South Island. The winter snow-line on the Southern Alps is 3000 feet on the east side, and 3700 feet on the west side. Periods of drought are very rare in New Zealand. Westerly winds prevail in all parts and throughout all seasons. The formation of the land, however, much modifies the winds.

The configuration of New Zealand, and its extension over twelve degrees of latitude, cause considerable variety of climate in different districts. The northern half of the North Island possesses a beautiful climate, and remarkably equable; that of the southern half is more variable. The climate of the west coast of the South Island is rainy, but temperate and salubrious; that of other parts of the South Island is generally similar to the English, but warmer in summer and not so cold in winter. In the North Island, sheep-shearing extends from September to November, and harvesting from November to January. In the South Island, sheep-shearing is from October to January, and harvesting from December to the end of February.

The following details are extracted from meteorological statistics published in the colony:—

Comparative Abstract for 1882 *and previous Years.*

Stations.	Barometer. Mean.	Temperature.		Mean Degree of Moisture (Saturation = 100).	Rain.	
		Mean in Shade.	Mean Daily Range.		Total Fall in Inches.	No. of Days on which Rain fell.
Auckland (1882)........	29·965	59·3	13·1	76	45·630	191
Previous 18 years	29·954	59·4	...	76	43·179	183
Wellington (1882)........	29·900	55·4	11·4	77	55·685	166
Previous 18 years......	29 921	54·8	...	72	51·790	158
Dunedin (1882)...........	30·037	50·9	13·7	76	41·796	187
Previous 18 years......	29·833	50·4	...	74	34·672	162

Average Temperature of Seasons.[1]

Stations.	Spring.		Summer.		Autumn.		Winter.	
	1881.	1882.	1881.	1882.	1881.	1882.	1881.	1882.
Auckland.........	58·0	56·9	65·2	65·4	61·9	61·9	53·4	52·8
Wellington.........	54·4	53·8	61·6	61·5	55·3	57·3	49·4	48·8
Dunedin.........	51·2	50·6	57·3	56·8	54·1	52·3	45·4	43·8

On the whole, the New Zealand climate is admirably suited to Europeans. In the *Colonial Office List* for 1883 it is stated that, according to the official reports of the medical department, whereas the annual mortality from all diseases out of every 1000 British soldiers quartered in the United Kingdom was 16, it was only 5 out of every 1000 in the troops quartered for more than twenty-five years in New Zealand. The true test of the comparative healthiness of countries is the rate of mortality distributed according to the ages of population; and different actuarial investigations show that this rate is light for New Zealand.

It is generally supposed that in the course of ages volcanic action has gradually, by an alternate process of subsidence and upheaval, left New Zealand as it is. There are lines of volcanic craters stretching across the North Island,—one at the Bay of Islands, another at Auckland, and a third from Mount Egmont near New Plymouth to White Island, an active volcano in the Bay of Plenty. There are evidences in the South Island of submarine volcanic action. Slight shocks of earthquake are often felt in different parts of New Zealand, but none of great severity has been felt since 1855. During 1882 twenty-eight shocks were recorded, only one being at all severe, while ten were described as "smart," and the other seventeen were slight tremors.

A description of the general geological structure of the islands, so far as it is at present ascertained, is contained in the sketch geological map of 1883 by Dr Hector, the director of the geological survey of New Zealand, who has kindly allowed an advance proof to be available for this article (see Plate XIV.). The classification adopted in this map is founded on a mass of palæontological data, but, owing to the unavoidable absence hitherto of minute surveys, is merely provisional. The following is an abstract of some of Dr Hector's remarks on this map:—

The post-Tertiary (Recent) deposits have accumulated with great rapidity in New Zealand, owing to the mountainous character of the country giving to the rivers, even when of large size, the character of torrents which are liable to occasional floods of extreme violence. The Pliocene formation belongs to a period when New Zealand was the mountain range of a greatly extended land area. The Upper Miocene beds are limited in their extent to the southern and eastern districts of the North Island, and in the South Island occur as patches. The New Zealand seas have yielded about 450 species of existing shells, of which 120 have been found in this formation, together with 25 forms which are now extinct. The Lower Miocene represents a period of great depression, and the deposits are remarkable for the absence of evidence of volcanic activity in any part of the region, and for the abundance of marine life. The Upper Eocene is a very marked formation of calcareous sandstone composed of shell fragments with corals and *Bryozoa*, and is a shallow-water and littoral deposit. Intense volcanic activity prevailed during this period in both islands. In the upper part of the Cretaceo-Tertiary formation occurs the valuable building stone, known commercially as the "Oamaru stone," a calcareous sandstone which is very easily worked, but which hardens when exposed to the weather. The principal coal deposits of New Zealand occur in the Cretaceo-Tertiary formation, but always at the base of the marine beds of the formation, in every locality where they occur. The Lower Greensand, which is confined to a few localities of limited extent, is very rich in fossils of the genera *Belemnites* and *Trigonia*, with a few saurian bones and large chimæroid fishes. It has been found necessary to include in the Trias a thickness of strata which is quite unusual in other parts of the world, but the close connexion which exists throughout, founded both on palæontological and on stratigraphical grounds, and the clearly defined Permian character of the next underlying formation, renders this classification absolutely necessary. Saurian remains are associated with the Permian beds at Mount Potts, which were referred by Dr Hector to *Ichthyosaurus* in 1871, but subsequently to the genus *Eosaurus* of Marsh. The further remains obtained of this saurian are, however, of such gigantic size as compared with the original types found in Nova Scotia, in which the vertebræ were 2½ inches in diameter, that the determination may be doubted. The Lower Carboniferous and Upper Devonian formation is of considerable importance from the large share it takes in the structure of the great mountain ranges, and from the occasionally great development in it of contemporaneous igneous rocks with which are associated metalliferous deposits. The igneous rocks (basic volcanic and acidic volcanic) have played an important part in almost every formation in New Zealand, marking great movements of the earth's crust at the different geological periods, while the superficial and later-formed volcanic rocks occupy nearly one-third of the area of the North Island. The geysers and boiling springs in the North Island give rise to the formation of siliceous sinter deposits, which must be included as the most purely acidic products of volcanic action, and are due to the decomposition of the older rocks by the action upon them of fresh water; but in the case of White Island and other localities where the decomposition is brought about by the agency of sea water, the sinter deposits are formed chiefly of sulphate of lime and not silica.

The census of 1881 shows that out of a total population (other than aboriginal) of 489,933 there were 14,273 miners, of whom 12,996 were returned as being engaged in gold mining, and 1087 in coal mining. The principal quartz mines for gold are in the Thames and Coromandel districts near Auckland in the North Island, but several auriferous reefs are extensively worked in the Otago, Westland, and Nelson gold-fields in the South Island. There is good reason to believe that quartz mining in New Zealand is still in its infancy, and that its indefinite extension can be ensured by the judicious application of more capital. Alluvial gold mining chiefly exists in the Otago, Westland, and Nelson districts. Gold drift, as it is called, is found in river-beds and on the sea-coast, where it can be worked with comparative ease, and also in thick deposits of gravel, the working of which requires mechanical water-power, and often large expenditure. The opinion entertained in many quarters that the auriferous resources of New Zealand will soon be exhausted, and that the gold mining industry is approaching a rapid decline, is certainly not based upon fact. There still, it is reliably stated, exist large areas, both in the North and South Islands, that on geological grounds are highly promising for the existence of original or primary auriferous deposits, namely, quartz lodes. With regard to secondary or derived auriferous deposits—namely, gold drift—the more easily and cheaply accessible of them have, no doubt, been worked out, more or less, but the South Island still contains tracts that offer profitable employment to the miner for generations to come. The total quantity of gold produced in and exported from New Zealand from 1st April 1857 to 31st March 1883 was 10,144,926 ounces, valued at £39,747,940. The quantity during the year ended 31st March 1883 was 248,362 ounces, valued at £994,555. Good coal is obtained in many parts of New Zealand. The number of coal mines in work in 1882 was 104; and the output during 1882 was 378,172 tons, being 215,954 tons more than the output in 1878. Silver is chiefly extracted from the gold produced in the Thames district, but other mines containing silver ores have been found. There are many other valuable ores—copper, iron, lead, zinc, antimony, chrome, and manganese—some of which are being worked. Several fine mineral oils also are obtained. Building stones of various kinds and of excellent quality abound. Marble and cement stones occur in many places. In 1881 there were 127 brick, tile, and pottery manufactories in work; and their lands, buildings, and machinery were valued at £105,765. There are extensive deposits of iron-sand on the west coast of the North Island.

The following official table, in Dr Hector's *New Zealand Handbook*, classifies the land according to the geological subsoil.—

	North Island.	South Island.	Totals
	Sq. miles.	Sq. miles.	Sq miles
1. Fluviatile drifts, one-third agricultural...	8,447	6,286	14,733
2. Marine-Tertiary, two-thirds agricultural (the rest pastoral)	13,898	4,201	18,099
3. Upper Secondary, coal-bearing, pastoral..	2,390	2,110	4,500
4. Palæozoic, pastoral	5,437	20,231	25,668
5. Schistose, pastoral........................	...	15,309	15,308
6. Granite, worthless........................	...	5,978	5,978
7. Volcanic, one-sixth agricultural (the rest pastoral)........................	14,564	1,150	15,714
Square miles........................	44,736	55,264	100,000

A study of this table, he adds, shows that "in the whole colony there are about 12,000,000 acres of land fitted for agriculture, and about 50,000,000 which are better adapted for pasturage; but from these estimates allowance must be made for about 20,000,000 of surface at present covered by forest."

Dr Hector also reports the prevalence, in the north of Auckland and in the lower part of the Waikato Valley, of light volcanic soil, interspersed with areas of clay marl, which in the natural state is cold and uninviting to the agriculturist, but which under proper drainage and cultivation can be brought to high productiveness. He adds valuable information, in substance as follows, respecting other districts. In Taranaki and Wanganui districts the soil is very rich, and on the surface is formed by the decomposition of calcareous marls intermixed with the debris from the lava streams and tufaceous rocks of the extinct volcanic mountains. The forest growth which generally covers the land proves its productiveness, although that growth greatly impedes the progress of settlement. From Lake Taupo towards the Bay of Plenty the surface soil is derived from rocks of a highly siliceous character, and large areas are covered with little else than loose friable pumice-stone. On the eastern side of the slate range which extends through the North Island, the surface is generally formed of clay marl and calcareous rocks; in the valleys there are shingle deposits from the back ranges, with occasional areas of fertile alluvium of considerable extent. The latter portions of the district are adapted for agriculture, and the remainder is very fine pastoral land. In the South Island the chief agricultural areas are in the vicinity of the eastern coast, but there are also small areas fitted for agriculture in the interior in the vicinity of the lake districts. The alluvial soils of the lower part of the Canterbury plains and of Southland are remarkably fertile. Scarcely less important are the low rolling downs formed by the calcareous rocks of the Tertiary formation which skirt the higher mountain masses, and often are improved by the disintegration of interspersed basaltic rocks. On the western side of the South Island, from the close vicinity of the mountain ranges, there are comparatively small areas of good alluvial soil, but these are made very fertile by the wetness of the climate.[1]

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[1] Spring begins with September, summer with December, &c.

New Zealand is singular in the absence of all indigenous land mammals except two small kinds of bat, and a rat which has already disappeared. A native dog is supposed to have been introduced by the natives on their original migration. There are no snakes. A few lizards are found, but they are harmless, though held in superstitious terror by the natives. A peculiar species of frog exists, but it is very rare. Insect life is not nearly so abundant as in Europe, though bloodthirsty sand-flies swarm on the sea-shore, and mosquitoes in the bush. There are between four and five hundred species of mollusca. Seals are numerous on some parts of the coast. New Zealand is also remarkable for its wingless birds, living and extinct. There are four species of *Apteryx*, or KIWI (*q.v.*), without wings and tail-feathers, and a little larger than a hen; they have short legs, snipe-bills, and bodies covered with long, brown feathers like hair. The gigantic wingless bird called the Moa (see DINORNIS) has been long extinct. The tradition of the natives is that their ancestors found these birds living, and hunted them for food till they exterminated them.[2]

The peculiar nature of the New Zealand fauna has given rise to much scientific speculation, and, in the opinion of able writers, points to a continental period as the condition of the country in remote ages, and to subsequent partial subsidence and partial elevation. The discovery and colonization of the country have completely changed the character of its animal life. Captain Cook introduced the English dog and the pig. Colonists have brought all kinds of domestic animals. Game and small birds have been imported and acclimatized; rabbits have become a formidable nuisance in many districts.

There are about one thousand species of flowering plants, of which about three-fourths are endemic. Most of those not peculiar to the country are Australian; others are South-American, European, Antarctic; and some have Polynesian affinities. Ferns and other cryptogamic plants are in great variety and abundance. There are a few indigenous plants and fruits used as food. *Phormium tenax*, or the New Zealand hemp, is a common and most useful plant. Forests covering from 11,000,000 to 12,000,000 acres are a characteristic feature in New Zealand vegetation. Much of the timber is of great value for building and for constructive works (see vol. ix. p. 407). The area of forest land is rapidly diminishing, and the rate of decrease in some large forests has been estimated at 4 per cent. per annum. The rapid decrease is stated to be due to reckless and wasteful consumption of the best timber without regard to the conservation of the young trees, to fires, and to other avoidable causes.

The following return, compiled from a report, in 1875, by Professor Kirk, F.L.S., on New Zealand timbers, specifies those of great durability, and adapted for general building purposes and for constructive works, &c.:—

Name.	Uses.	Height and Diameter.
Kauri (*Dammara australis*).	Ships, houses, &c.	120 to 160 ft.; 5 to 12 ft.
Totara (*Podocarpus Totarra*).	Piles, sleepers, &c.	40 to 70 ft.; 4 to 6 ft.
Matai (*Podocarpus spicata*).	Piles, sleepers, &c.	50 to 70 ft.; 2 to 4 ft.
Kawaka (*Libocedrus Doniana*).	Fencing, cabinet work.	60 to 100 ft.; 3 to 5 ft.
Pahautea (*Libocedrus Bidwillii*).	Fencing, bridges.	60 to 80 ft.; 2 to 3 ft.
Tanekaha (*Phyllocladus trichomanoides*).	Sleepers, planks, bridges.	50 to 60 ft.; 3 ft. (max.).
Manoao (*Dacrydium Colensoi*).	Houses, piles.	30 to 40 ft.; very durable.
Dacrydium westlandicum.	Piles, bridges, &c.	40 to 80 ft.; 1 to 2 ft.
Dacrydium intermedium.	Piles, bridges, &c.	40 to 45 ft.; 1 to 2 ft.
Tawai (*Fagus Menziesii*).	... ...	Handsome tree.
Puriri (*Vitex littoralis*).	Posts, piles, sleepers.	40 to 60 ft.; 3 to 5 ft.
Hututawhai (*Fagus fusca*).	Posts, sleepers, bridges.	60 to 90 ft.; 3 to 8 ft.
Pohutukawa (*Metrosideros tomentosa*).	Ships, dock gates, &c.	Short trunk; massive arms.
Rata (*Metrosideros robusta*).	Ships, sleepers.	60 to 100 ft.; 5 to 12 ft.
Rata (*Metrosideros lucida*).	Ships, trucks.	30 to 60 ft.; 2 to 5 ft.
Rawiri (*Leptospermum ericoides*).	Wharves, marine works.	40 to 50 ft.; 1 to 2 ft.
Kowhai (*Sophora tetraptera*).[3]	Piles, sleepers.	
Maire-raunui (*Olea apetala*).	Valuable, but little known.	50 to 70 ft.; 2 to 4 ft.
Maire-tawhake (*Eugenia maire*).	Fencing, piles, &c.	About 40 ft.; 1 to 2 ft.

There are many other kinds of trees which are less durable, but of considerable value. Some have barks largely used for tanning purposes. Kauri gum, a valuable product of the kauri tree, is found in the soil on the sites of old kauri forests, and at the base of growing trees. It is much used in Europe and America as a base, instead of gum mastic, for fine varnishes, and for other purposes. There are now many flourishing plantations of English and foreign trees.

The New Zealand flora, like the fauna, has been cited in support of the theory of the remote continental period. Sir Joseph Hooker, in his *Introductory Essay*, wrote that the botanical relationship of the New Zealand flora is not to be accounted for by any theory of transport or variation, but that it is agreeable to the hypothesis of all being members of a once more extensive flora, which has been broken up by geological and climatic causes.

The following comparative table, which does not include native cultivations, shows the rapid and continuous development of agriculture in New Zealand during the last twelve years:—

	Estimated Population.	Number of Holdings.	Acres under Grain Crops.	Acres under Green and Other Crops, excluding Sown Grasses.	Acres under all kinds of Crop, including Sown Grasses; and of Land broken up, but not under Crop.
1872	256,936	Not given.	261,210	45,355	1,226,222
1877	398,938	18,750	320,011	160,100	2,940,711
1882	500,063	26,298	638,910	363,573	5,189,104
1883	509,052	27,352	738,823	394,473	5,651,255

In 1880 the estimated average produce of wheat per acre was 28 bushels, in 1881 25 bushels, in 1882 22½ bushels, and in 1883 26½ bushels. The estimated average of oats was 36½ bushels to the acre in 1880, 32 bushels in 1881, 22¼ bushels in 1882, and nearly 33 bushels in 1883. Barley was estimated in 1880 at 30¼ bushels to the acre, in 1881 at 26, in 1882 at 22¼, and in 1883 at 26. Potatoes were estimated to produce 4¾ tons to the acre in 1880, in 1881 5½ tons, in 1882 5 tons 17 cwts., and in 1883 5 tons 2 cwts. The number of horses in 1881 was 161,736, having doubled since 1871. The number of cattle increased during the same ten years from 436,592 to 698,637, and sheep from 9,700,629 to 12,985,085. The yearly production of butter in 1881 was 8,453,815 lb, and of cheese 3,178,694 lb. The produce of wool will be stated in the summary of exports for 1882. Pigs, goats, and poultry abound.

Except eels and a few small fishes of little worth, there are no indigenous fish in the rivers. Dr Hector states that thirty-three kinds of sea fish are used as food. Among the constant residents on the coast or on parts of it, he names hapuku, tarakihi, trevally, moki, aua, rock cod, wrasse, flounder, snapper, mullet, gurnet, trumpeter, butter fish, and red cod. Of the edible fish irregularly visiting the coast, much the largest number come from warmer latitudes, namely, the frost fish, barracouta, Norse mackerel, king fish, dory, waichou, mackerel, and gar fish. He adds that of 140 species of fish found in New Zealand 67 species are believed to be peculiar to New Zealand, 75 are common to Australia and

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[1] In 1880 Messrs S. Grant and J. S. Foster, delegates to New Zealand from the tenant farmers of Lincolnshire, travelled over and inspected the chief agricultural districts in both islands. Their impression was, as stated in their report, that the soil is, as a rule, much lighter than farmers in England are accustomed to work, and that it does not require half the working that English land does. One double-furrow plough, they say, will turn up about 18 acres a week. They saw very little really heavy clay-land in the colony, and such soil, they think, will not be worth cultivating for some time to come. "The labour required to work it," they write, "is far too great, and there are no frosts in winter sufficient to pulverise it, while it is perfectly possible to consolidate any soil which may be a little too light by stocking it sufficiently heavily." And they add—"But of one thing we are certain, that, whatever the quality of the soil, there were splendid crops on it in almost every part of the country that we saw."

[2] Dr Buller, in his *Manual of the Birds of New Zealand* (1882), gives one hundred and seventy-six species, belonging to the *Accipitres*, *Passeres*, *Scansores*, *Columbæ*, *Gallinæ*, *Struthiones*, *Grallæ*, and *Anseres*. Mr W. T. L. Travers, F.L.S., in a paper read before the Wellington Philosophical Society, on October 21, 1882, states that out of 88 species 18 are peculiar to both islands, 8 to both islands and the Chathams, 3 to both islands and the Aucklands, 22 to New Zealand and habitats outside, 9 to the North Island, 16 to the South Island, 6 to the Chathams, 2 to the Aucklands, 1 to the North Island and the Chathams, 2 to the South Island and the Chathams, and 1 to all.

[3] Varies from shrub to tree 20 to 40 ft. high, with trunk 1 to 3 ft. diameter.

Tasmania, whilst ten are found in New Zealand and other places, but not in the Australian seas. "New Zealand ichthyology," he states, "presents a very distinct character, the thorough deciphering of which affords a wide field for future observation and scientific investigation." Oyster fisheries exist, and are protected by law. Cray-fish are in abundance. Whaling formerly flourished on the coast, but since New Zealand has become a colony whaling stations have disappeared. Whales, however, of valuable kinds are numerous in the adjacent ocean, and a few whaling ships are owned in New Zealand. Efforts have, for several years past, been made by the Government, but chiefly by local acclimatization societies, private and self-supported bodies, to introduce and acclimatize European and American edible fish. Ova, in considerable quantities, of British salmon, of Californian salmon, of brown trout, and of American whitefish have been imported, and the fish hatched from them distributed.[1] No instance of the survival of British salmon has as yet been authenticated; but three or four cases of grown Californian salmon having been found are reported. The success of brown trout in many streams has been great, and fish of 11, 14, and even 21 lb weight have been caught. Trout-fishing has become a common sport in many places. Salmon trout fry hatched in 1870 spawned in 1875. The Canterbury Acclimatization Society in 1880 liberated nearly 25,000 American whitefish in Lake Coleridge. The acclimatization of other fish has also been successful.

The natural features of the country were, for a long time after its colonization, a bar to overland internal communication, but good coach roads now traverse the country in every direction, and railways especially have enabled solitudes to be peopled, and wastes to be made productive. The total length of railways opened for traffic in March 1883 was 1443 miles. In the North Island, the chief working lines are—Kaipara to Waikato, 141 miles; Wellington to Napier, 138 miles open; Foxton to New Plymouth, 169 miles open; in the South Island—Hurunui to Bluff, 671 miles, and Invercargill to Kingston, 89 miles. £10,400,000 in round numbers have been expended on opened lines of Government railways from 1870 to March 31, 1883, and the net earnings as a whole were yielding £3, 8s. 10d. per cent. on that expenditure. In addition to road and railway communication, intercourse between the chief ports is carried on two or three times a week by swift and commodious steamers. The telegraph wire runs through every settled district, and is extended to Australia and England.

The following table shows the value of imports and exports for five years respectively:—

	Imports.	Exports.
1878	£8,755,663	£6,015,700
1879	8,374,585	5,743,126
1880	6,162,011	6,352,692
1881	7,457,045	6,060,866
1882	8,609,270	6,658,008

The total exports for 1882 included the following values:—from mines, £956,803; from fisheries, £5693; from forests, £390,242; animals and animal products, £3,601,242, of which wool alone was £3,118,544; agricultural products, £1,140,839; and colonial manufactures, £96,628. The export of frozen sheep to Europe seems likely to become very valuable. In an able paper on the *Public Debt of Australasia*, read before the Royal Colonial Institute in London on November 21, 1882, Sir Francis Dillon Bell, K.C.M.G., agent-general for New Zealand, stated that 5000 frozen sheep had recently come in good condition in one lot from New Zealand, that "the meat was readily taken into consumption," and that "the sheep netted 21s. 9d. a-piece, a return eminently satisfactory to their owners, because they would not have sold for more than 12s. in New Zealand."

The total shipping inwards during 1882 was 795 vessels of 461,285 tons, as compared with 765 vessels of 420,134 tons during 1881. The total outwards during 1882 was 764 vessels (436,793 tons), as compared with 762 vessels (413,487 tons) in 1881. The number of vessels on the New Zealand register, on 31st December 1881, was 572, altogether 72,387 tons, of which 443 (56,751 tons) were sailing vessels and 129 (15,636 tons) were steamers. There were in 1883 twenty-three coastal light-houses, among which six were of the first and twelve of the second order of apparatus.

New Zealand was not colonized in the ordinary manner around one centre. There were in its early years six distinct settlements—Auckland, Wellington, Nelson, New Plymouth, Canterbury, and Otago—between which communication was for several years irregular and infrequent. To meet their political wants, the Constitution Act of 1852 created them into provinces, with elective councils and superintendents respectively,—subordinated to one colonial legislature. In 1876 the provincial system was abolished by that legislature. The general assembly, as it is called, is composed of the governor, the legislative council, and the house of representatives. The governor is appointed by the crown. The legislative council consists of members appointed for life by the governor; the number of legislative councillors in 1883 was 50. The house of representatives consists of 95 members chosen by the electors. The franchise is manhood suffrage, conditional on a previous residence in the colony for a year, including six months in the electoral district for which a claim to vote is registered. Every elector is qualified for election. Four members of the house must be Maoris elected by their own race. The duration of the house is for three years, but it is subject to re-election whenever the governor dissolves the general assembly. Legislation is subject to disallowance by the crown, but practically that power is seldom if ever exercised. Executive administration is conducted on the principle of English responsible or parliamentary government. Its seat is at Wellington. Local administration is vested in local elective bodies, such as municipal councils, county boards, road boards, and others, with power to levy rates. The colonial revenue is chiefly derived from customs, stamp duties, property tax, postal and telegraphic services, railways, and crown land sales. The proceeds of land sales are applied to surveys and public works. Crown lands are acquired at auction, or by selection, or on deferred payment, or by lease with right to purchase on certain conditions. The price is rarely less than £1 an acre.

The chief feature of public policy in New Zealand from 1871 to 1883 has been to borrow and expend large sums on railways, immigration, main roads, native land-purchases, telegraphs, and other important public works. During that time about £19,000,000 has been expended on those objects collectively, and there are good grounds for the general conclusion that, as a whole, this policy of investing loans in large reproductive services has been, and will be, if prudently continued, a substantial success. The gross public debt of the colony on March 31, 1883, was £30,357,111, subject to a deduction of £2,571,829 for accrued sinking funds. The annual charge, including sinking fund, was £1,525,281. The loan of £1,000,000, raised in January 1883, for railways and other works was a 4 per cent. loan inscribed in stock at the Bank of England. Another similar loan was raised in January 1884.

The New Zealand state has encouraged public thrift by a system of Government life insurance, which is working with remarkable success. On 31st December 1882, when the population may be estimated at 505,000, the total sum assured on 23,439 policies in force in both branches (ordinary and industrial) of the department, exclusive of insurance in private offices, was £5,355,900. The Government post-office savings banks, at the end of 1882, had 57,517 open accounts, amounting altogether to £1,470,950.

Under the Education Act of 1877 state schools are established, in which teaching is free, secular, and compulsory, with certain exceptions, for children between the ages of seven and thirteen. A capitation grant is given for every child in average daily attendance at the schools. Grants are also made for scholarships from primary to secondary schools, for training institutions for teachers, and for school buildings. Large reserves of public lands have been made for primary, secondary, and university education. The progress in the education of children is shown in the census of 1881. In 1874 the number of children attending school was 66·78 per cent. of the population between five and fifteen years; in 1878 it was 73·64 per cent., and in 1881 80·76 per cent. Native schools are also provided by the state in native districts. There are, moreover, industrial schools, orphanages, and an institution for the deaf and dumb. There are several secondary schools with public endowments. The university of New Zealand is an examining body, and grants honours, degrees, and scholarships. It is empowered by royal charter to confer degrees entitled to rank and consideration throughout the British dominions, as fully as if they were granted by any university in the United Kingdom. It has also the privilege of nominating one of its students in each year for a cadetship at the Royal Military College at Sandhurst. The Canterbury College and the Otago University, both academical institutions of a high order, are affiliated to the New Zealand University. Provision made by the legislature in 1882 for a university college at Auckland has been given practical effect to. The state in no way controls or interferes with religious administration. Each denomination attends to the religious instruction of its own adherents. State school-buildings can be used for such instruction on days and at hours other than those fixed by law for ordinary school work; but no child can be required to attend, except at the wish of its parent or guardian. The average daily attendance of scholars at the state schools throughout the year 1882 was 68,288. In 1881 the number returned as attending private schools was 13,538; Sunday schools, 78,891; and receiving tuition at home, 7348.

Exclusive of the aboriginal population, the estimated population of New Zealand on December 31, 1883, was 515,000. The census of 1881 returns the number in April of that year as 489,933 (269,605 males and 220,328 females). The average number of persons to an inhabited dwelling was 5·12. The population under twenty-one years of age was 258,774, of whom 128,791 were females. The number of those born in the colony was 45·60 per cent. of the whole population; of those born in England,

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[1] According to a paper read by Mr W. Arthur before the Otago Institute in 1881, the numbers distributed by the various societies were—British salmon, 4000; Californian salmon, 417,000; brown trout, 332,000; salmon trout, 1000; and American whitefish, 34,000.

24·33 per cent.; in Scotland, 10·77; in Ireland, 10·08; in Wales, 0·40; in Australia and Tasmania, 3·53; in British America, 0·73; in other British possessions, 0·82; in Denmark, Sweden, and Norway, 0·97; in Germany, 0·9°; in United States, 0·35; in China, 1·03; and elsewhere, 0·41.

The excess of immigration over emigration for the ten years 1872–81 was 4973, 8811, 38,106, 25,270, 11,955, 6376, 10,502, 18,723, 7231, and 1616 persons respectively. The great decrease in the last two years is owing to the stoppage, almost wholly, of immigration at public cost.

The proportionate number in 1881 of occupied European holdings of land, exclusive of crown pastoral leases, classified according to size is as follows:—holdings over 1 acre and up to 10 acres inclusive, 7680; thence up to 50 acres, 6498; to 100, 4462; to 200, 5066; to 320, 2453; to 640, 2258; to 1000, 828; to 5000, 1697; to 10,000, 185; to 20,000, 169; to 50,000, 111; to 100,000, 18; and above 100,000, 7; total, 30,832.

It has always been difficult to collect the number of the aboriginal population. In 1878 the number returned was 43,595; in 1881 44,097, of whom 19,729 were females. Those residing in the North Island were 22,872 males, and 18,729 females. The apparent increase in 1881 is believed by the registrar-general to be attributable to omissions in 1878. His conclusion is that on the whole there was a decrease from 1878 to 1881. If former estimates, partly conjectural, are at all correct, the decrease during the last forty years has been considerable. The comparatively small proportion of females under fifteen years of age to the total population of both sexes in 1881, given as 15·35 per cent., renders future increase improbable. Generally, Maoris are in form middle-sized and well-made. They show great aptitude for European habits. The Maoris are of Polynesian race; and the probability is that they migrated from the Navigators' Islands to Rarotonga, and thence to New Zealand. Their tradition is that they came originally from "Hawaiki." This may be the Hawaiian or Sandwich Islands; but there is also "Savii," which is a dialectical form of the other name, in the Navigators' Islands. Dr Thomson, in his *Story of New Zealand*, quotes a Maori tradition, among those published by Sir George Grey, that certain islands, among which it names Rarotonga, Parima, and Manono are islands near Hawaiki. The natives of Rarotonga state that their ancestors came from Hawaiki; and Pirima and Manono are the native names of two islands in the Navigators' group. The almost identical languages of the Rarotonga natives and the Maoris, as well as other circumstantial evidence, strengthen the supposition. The distance from Rarotonga is about 3000 miles; and, with the aid of the trade wind, large canoes could traverse the distance within a month. A comparison of genealogies of Maori chiefs of different tribes shows that about eighteen generations, or probably not much more than five hundred years, have passed since the first migration. The origin and distribution of the Polynesian race cannot be discussed here, but there is in some respects a remarkable likeness in the customs, appearance, and character of Maoris and of Malays.

The Maoris, before their conversion, had no idea of a Supreme Being. Their notion was that all things had been produced by process of generation from darkness and nothingness. They believed that the spirit survives the body, and retires to some place under the earth, whence it occasionally returns to advise and sometimes punish the living. The Maoris are divided into tribes, which respectively had their chiefs and priests. Land was held by tribal tenure, and small plots were cultivated. Each tribe had its unwritten laws regarding land, cultivation, and other social matters. "Tapu," or the practice of making certain things sacred,—a rule, the breach of which was severely punished by spirits and men,—was an essential element in their code of law. Tribes were constantly fighting with each other; and the chief causes of strife arose from alleged wrongs to property and person. Cannibalism was practised from vindictive feelings. Slaves were captives in war. The dead bodies of chiefs were put away on stages; and in course of time the bones were collected and hidden in secret places. The Maoris have a genius for war, and show great ability in building, fortifying, and defending stockades.

The Maori language is a Polynesian dialect. It closely approaches that of the Sandwich Islands, of the Navigators' group, and of Rarotonga. Natives of these mutually understand each other.

The first European discoverer of New Zealand was Tasman, in 1642, who did not, however, land there. Captain Cook, in 1769, was the first European who set foot on its shores, and he took formal possession of the country for King George III. Cook visited New Zealand several times, and circumnavigated the coasts in the course of his three voyages of discovery, exploring and partly surveying the general outline. He introduced several useful animals and plants; and pigs, fowls, potatoes, turnips, and cabbages, first brought by him, increased and multiplied. From the time of Captain Cook's final departure from New Zealand in 1777 to 1814, little is known of the country, except that, owing to the ferocity and cannibalism of its aborigines, it was a terror to sailors. In 1814 the Rev. Samuel Marsden, colonial chaplain to the Government of New South Wales, first established his church mission in New Zealand at the Bay of Islands. He was followed by others; and both Protestant and Roman Catholic missions were formed. In the course of the following thirty years almost the whole native population was converted, nominally at least, to Christianity. There was in after years a considerable relapse; but the results of missionary teaching were, as a whole, great and permanent. Cannibalism ceased, and the barbarous nature of the race became softened and capable of civilization. The missionary paved the way for the colonist.

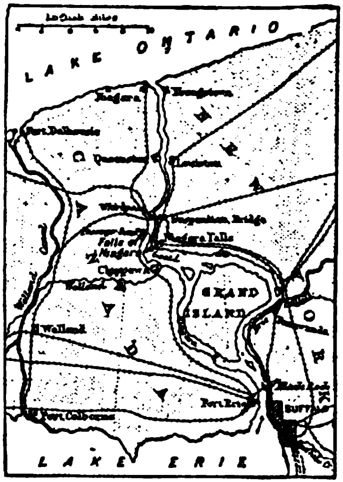
In February 1840 an assemblage of chiefs at the Bay of Islands signed the treaty of Waitangi acknowledging their submission to the queen of England; and Her Majesty guaranteed their possessions, extended to them her protection, and imparted to them the rights and privileges of British subjects. This treaty was shortly afterwards signed by many other chiefs in other parts of both islands. Cavil as persons may at the treaty, there is no doubt that it is the honourable and equitable agreement on which New Zealand first became a British colony. The leading features of the colonization of the country, so far as the natives are concerned, can only be most briefly summarized here. The rights of the natives to their lands have been fully recognized by the crown; and no land has been alienated from them without their consent except in the case of the confiscated blocks which were taken under the authority of a special law from rebellious tribes. The native title to land has not been confined to that in actual use, but has extended over waste territory. The Government and the legislature have always been disposed to consider favourably native interests; and special action has often been taken for that object. Mistakes have, no doubt, often been made on both sides; and serious disputes have arisen. Native tribes, here and there, have been in active insurrection, but at no time have the natives, as a race, been arrayed in arms against Britain. A large majority has either been passive or friendly. The most serious disturbances took place in 1863 and 1864. During that time several British regiments and ships of war were, in common with the colonial forces, actively engaged in their suppression. No imperial soldiers have been stationed in New Zealand since 1869. The colony has from that date altogether provided for its internal defence. The present state of native affairs is peaceful, and likely, with ordinary prudence, to remain so. In many districts the gradual amalgamation of the two races is hopeful, natives and Europeans co-operating with each other in a common civilization. (W. GI.)

NEY, MICHEL (1769–1815), one of the bravest of Napoleon's marshals, was born at Saarlouis on January 10, 1769. His father, who had been a soldier, gave him a fairly good education, and obtained for him an appointment in some neighbouring mines. But his heart was set on the army, and in 1787 he went to Metz and enlisted in a regiment of hussars. But for the Revolution he could never have become more than a sergeant, but in the new state of things he was elected lieutenant, and afterwards (1792) captain of his regiment. He was aide-de-camp to General Lamarque in March 1793, and soon after became lieutenant-colonel, when Kléber perceived his eminent military ability, and made him adjutant-general in August 1794. He was promoted colonel in September, and his merits were so great that Jourdan and Kléber actually quarrelled which should have the advantage of his services. In February 1795 he might have become general of brigade, but modestly refused the rank, alleging his own unworthiness. He commanded the advanced guard of Kléber at the battle of Altenkirchen, and was made general of brigade on the field of Forchheim. He then commanded the right wing of Hoche's army, and in 1798 took Mannheim. Sent next to Switzerland, he there reorganized Masséna's cavalry, and immensely distinguished himself in Masséna's great campaign, in which he was three times wounded, and after which he was made general of division. In 1799 he commanded on the Rhine, and by his skilful operations obtained the armistice during which the coup d'état of Brumaire took place. In 1801 he was present at Hohenlinden, and in May 1802 he married Mademoiselle Auguié, whom Josephine had chosen for him at Bonaparte's request. He became inspector-general of cavalry, and, after a short residence as minister in Switzerland, commandant of the camp of Montreuil. It was while there that in the name of the army he begged Napoleon to declare himself emperor, and on the establishment of the empire he was made marshal of France and grand cross of the Legion of Honour. In 1805 he commanded the 6th corps of the grand army, and by his victory at Elchingen, for which he was made duke of Elchingen, secured the surrender of General Mack at Ulm. He was then ordered to the upper Adige, and missed the battle of Austerlitz, but was present at Jena and Eylau, and was so instrumental in winning the battle of Friedland that Napoleon called him the *brave des braves*, and gave him the grand eagle of the Legion of Honour. In 1808 he was ordered to Spain with the 6th corps, and received the command of Galicia, which he managed to keep in subjection to the French in spite of the mountainous nature of the country. In 1810, in command of a corps d'armée under Masséna, he advanced into Portugal, but he was so disgusted at being under Masséna's command that perpetual quarrels resulted, and not only were the French defeated at Busaco, but Ney, when conducting the last column on the retreat from Torres Vedras, received more than one repulse from Lord Wellington at Pombal, Redinha, and Foz d'Aronce. For his opposition to Masséna Ney was recalled from Spain, but received the command of the 3d corps in the grand army of 1812. At the battle of the Moskva he so distinguished himself that he was made Prince de la Moskowa on the field, and in the disastrous retreat from Moscow it was Ney who commanded the rear-guard, and kept the relics of the grand army together. He served at Lützen and Leipsic, and in the last defensive campaign of 1814, and with Macdonald remained faithful to Napoleon to the last. At the Restoration he was made a peer, and in 1815 was given the command of the army sent to check Napoleon on escaping from Elba. But the sight of the old colours and of his old master was too much for him, and he led his troops over to Napoleon's side. In the Flemish campaign he fought the battle of Quatre Bras against the English on the same day that Napoleon defeated the Prussians at Ligny, and at Waterloo he commanded in person the last charge of the Old Guard. He made no attempt to leave France, and was arrested as a traitor; on December 5 he was found guilty of high treason by the House of Peers by 169 votes to 17, and two days later he was shot in the gardens of the Luxembourg. His execution caused a cry of horror; while no one would have regretted the death of Fouché or many another of the innumerable traitors, it is to be lamented that Ney was chosen to suffer, whose honesty was well known, and had only once failed him.

The character of Ney was that of a simple soldier; intensely brave, though without the rash impetuosity of a Murat, he was yet as modest as he was brave; as a general his conduct of the two retreats from Portugal and Russia are his chief titles to fame; and, if he was not faithful to the Bourbons, he paid with his life for his defection.

See *Mémoires du Maréchal Ney, publiés par sa famille*, Paris, 1833, which go down to the capitulation of Ulm, and were translated into English in 1833; *Vie du Maréchal Ney*, Paris, 1816; *Histoire complète du procès du Maréchal Ney*, 1815, English translation, 1816; A. Delmas, *Mémoire sur la révision du procès du Maréchal Ney*, 1832; and *Military Studies by Marshal Ney written for the use of his officers*, translated by C. H. Caunter, with notes by Major A. James, London, 1833.

NIAGARA, a river in North America forming a portion of the great lake and river system known as the St Lawrence (*q.v.*), flows northward from Lake Erie (573 feet above sea-level) to Lake Ontario, separating the State of New York from the province of Ontario in Canada, and within the 33 miles of its course makes a total descent of 328 feet. On issuing from Lake Erie the river is only about three-fourths of a mile broad, and for the first two miles is somewhat swift; it then divides and passes round Grand Island, broadens and assumes the tranquillity of a lake until the commencement of the rapids, where it suddenly narrows and makes a descent of about 52 feet in the mile before its hurried and troubled waters are precipitated over a lofty chasm forming falls of unexampled grandeur. The breadth of the river immediately before making the leap is 4750 feet, but the centre is occupied by Goat Island, rising about 40 feet above the water, and occupying a breadth of about 1000 feet, a distance of about 1400 feet separating it from the American side and about double that distance from the Canadian side, while the length of the verge line between the island and the Canadian side is moreover increased by an inward horseshoe curve. The height of the fall on the American side is about 164 feet, and on the Canadian side about 150 feet; the discharge is about 18,000,000 cubic feet per minute. The waters plunge into an abyss about 1000 feet wide, and during the next seven miles make a descent of about 104 feet through a deep ravine with perpendicular banks rising to a height of from 200 to 350 feet, the breadth of the river varying from 250 to 400 yards. Three miles below the great falls the whirlpool rapids are formed by a sudden turn in the channel causing the waters to impinge against the Canadian shore, where they have made a deep indentation, and to rush back to the American side in a great whirl or eddy, rendered more furious by the uneven bed of the river, and the narrow space into which it contracts. After issuing from the gorge at Lewiston the river enters on a tranquil course, which continues to Lake Ontario. The point where the gorge ceases marks the termination of a table-land in an escarpment facing northwards; and it has been generally held that the falls were situated here at the time when the river first began to flow, that is, subsequently to the great Ice Age. Recent study has suggested a much more complicated theory, making a great part of the gorge older than the Ice Age, and thus reducing the period for which the modern river has flowed from several hundred thousands of years to one-tenth of that time. The rate of recession is very uncertain; while it would appear from the best maps that some parts have receded at least 100 feet since 1841, others have remained more or less stationary. At the present site of the falls the edge of the cataract is formed by strata of hard limestone reaching to a depth of about 80 feet; and by the action of the spray the softer shaly strata below have been hollowed out so as to form the "Cave of Winds," which may be entered from the Canadian side. The river is crossed by a suspension bridge for foot passengers, about 250 yards below the falls, and a mile and a half farther down by two railway bridges about a hundred yards apart,—one of which has a carriage way 18 feet below; the other, a cantilever bridge, completed in December 1883, carries a double line of rails.



Niagara River.

The name Niagara ("thunder of waters") is the invention of an Indian tribe who adopted it as their own designation, from the fact that it was descriptive of the remarkable natural phenomenon situated within their territory. This tribe, on account of their peaceful proclivities, were also called the Neuter Nation; but, to avoid the fury of the Iroquois, they finally joined them in 1723 against the Hurons, and from this time they ceased to exist as a separate tribe. The first printed allusion to the cataract is in the record of a voyage by Jacques Cartier in 1535. Its position was first mentioned by Samuel Champlain in a map attached to his voyages published in 1613. The earliest description is that by Father Hennepin, who visited it in 1678, and published an account of it accompanied with a sketch giving a view of a third fall on the north side caused by the presence of a large rock on Table Rock. The rock and cascade are mentioned by Kalm the Swedish naturalist, who visited Niagara in 1750, but they had disappeared a few years previously. Some writers indeed mention as many as six falls, and there can at least be no doubt that within the last two hundred years the aspect of the falls has been greatly altered. Goat Island extended, up to a comparatively recent period, for about another half mile northerly in a triangular prolongation; and the number of small islands was perhaps larger than at present. Large masses fell in 1818, 1828, 1843, and 1847, and in June 1850 Table Rock disappeared.

See Sir Charles Lyell, *Travels in North America*, 1845; George W. Holley, *Niagara*, 1880; paper by Professor Tyndall on "Niagara" in *Macmillan's Magazine*, vol. xxviii. (May 1873); paper by G. W. Holley in *Scribner's Magazine* (August 1876); Dr Julius Pohlmann, *Life History of the Niagara River*, 1883.

NIAGARA FALLS, a village of Niagara county, New York, situated at the Niagara falls, opposite Drummondville (on the Canadian side), and a mile and a half above the contiguous village of Suspension Bridge, formerly Niagara City, which is connected by a suspension bridge with Clifton (on the Canadian side). At Niagara Falls there are grist mills and machine shops. In 1880 the population of Niagara Falls was 3320, and that of Suspension Bridge 2476. Both villages are largely frequented by visitors.

NIAM-NIAM, a numerous and widespread Central African race, who were first visited by John Petherick in 1858, and have since been more fully described, especially by Piaggia, Dr Schweinfurth, Dr W. Junker, Potagos, and G. Casati. But none of these explorers have penetrated more than a few miles from the upper Nile and Welle basins into the Niam-Niam domain, which consequently still remains for the most part an unknown land. Its limits are determined on the east by the Bongo and Monbuttu territories, about 28° E. long., and on the north as far as 20° E. long. by Dar-Fertit and Dar-Banda, about 7° N. lat. But in other directions they extend for unknown distances on the south towards the middle Congo, westwards along the Kuta (upper Shari?) probably to the Fan country, which is now known to stretch from the Ogoway basin for a vast space towards the north-east. Nearly the whole of equatorial Africa, from the neighbourhood of Lake Albert Nyanza to the Atlantic, east and west, and from the Congo to the headwaters of the Shari, south and north, would thus appear to be divided between the two great cannibal nations of the Fans on the west and Niam-Niam on the east. Their common cannibalism, combined with some other characteristics, has suggested a possible ethnical relationship of these two peoples, which, however, has not been confirmed by a close examination of the respective physical types. The Fans, like the Fulahs of Soudan, seem to be fundamentally distinct from the Negro stock, although more or less affected by Negro elements, whereas the Niam-Niam, notwithstanding certain marked peculiarities, cannot be severed ethnically from that connexion.

Affinities have also been sought for them amongst the neighbouring Krej tribes, amongst the Nubas of Kordofan and the Nile, and even amongst the Soudanese Fulahs, but, in the absence of more ample details, any attempt to determine the relations of the Niam-Niam to the surrounding peoples must be regarded as premature.

The term Niam-Niam, by which they are best known[1] to the neighbouring populations, appears to be of Dinka origin, meaning in that language "great eaters," with reference, as is supposed, to their cannibalistic propensities. The most general national name is Zandey (pl. A-Zandey), which seems to be current throughout the eastern Niam-Niam domain, a region estimated by Schweinfurth (ii. p. 4) at about 48,000 square miles, with a population of at least two millions. But these by no means constitute a uniform ethnical group, for within this area is the large A-Madi nation,[2] differing altogether in speech and even in some respects physically from the ordinary Niam-Niam type. Apart also from numerous tribal divisions, the eastern Niam-Niam proper form three very distinct branches, presenting considerable varieties in appearance, language, usage, and general culture. The bleak, northern highlands bordering east on the Bongos and north on Dar-Fertit are occupied by the Banda Niam-Niam, a rude and savage people, rather of a black-brown than of a red complexion, omnivorous in taste, devouring apes, reptiles, insects, and apparently human flesh, practising circumcision, and wearing a broad strip of bast or even mere foliage round the loins. These are succeeded southwards by the more civilized Belanda Niam-Niam, who hold the fertile hilly territory about the headwaters of the Abu-Dinga, Beri, Dembo, and other western tributaries of the White Nile. They are of a very dark red or coppery colour, of middle size, and somewhat regular features, betraying distinctly Negro blood chiefly in their woolly hair and thick lips. Their costume is even more scanty than that of the Banda, but special attention is paid to the hair, which often presents the most elaborate designs, more picturesque than conducive to the comfort of the wearer. They cultivate durrah, maize, sesame, bananas, batatas, and are skilled wood and ivory carvers, and workers in iron, producing knives, spears, chains, bracelets, and other ornaments in this metal, which abounds in their country. Very different from either of the foregoing are the so-called "White" Niam-Niam, neighbours of and probably often confounded with the already mentioned A-Madi of the Makua-Welle river basin. The complexion seems to be more of a bronze tint, and they are distinguished from the other branches of the family by their tall stature, symmetrical figure, long kinky hair and beard, and higher social culture. They wear cotton garments, obtained by barter for ivory, copper, and iron, are fond of music and dancing, occasionally form powerful political states, which, however, are liable to disintegration at the death of the founder,[3] and in many respects present certain affinities with the Baghirmi and other Negroid peoples of the Chad basin. But so little is yet known of the institutions and internal condition of the Niam-Niam race that these divisions cannot be accepted as finally established. At the same time there can be no doubt at all about the existence of a very distinct Niam-Niam type, which is one of the most marked in the whole of Africa. "These beings," remarks Schweinfurth, on his first introduction to them,

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[1] Not exclusively, for they are called Babungera by the Mangbattus (Monbuttus), A-Madyaka by the Dyurs, Mundo or Manyanya by the Bongos, Makkarakka or Kakkaraka by the Mittus. But Niam-Niam, pronounced Gnam-gnam (Ital. *gn*), has been adopted and generalized by the Soudan and Nubian Mohammedans.

[2] Visited by Dr W. Junker in 1882–83, and described by him in *Petermann's Mittheilungen* for May 1883.

[3] About the middle of this century most of the eastern Niam-Niam lands appear to have been subject to Yapaty, son of Mabengeh. But after his death they were distributed amongst his seven sons, Renjy, Balia, Perkye, Tombo, Bazimbey, Manuba; and in 1870 there were already fourteen reigning princes of this dynasty, besides several others of doubtful relationship with the line of Mabengeh. In the Niam-Niam districts visited by the traders from Egyptian Soudan there were at that time altogether as many as thirty-five independent chiefs. But reports were current of a very powerful "sultan" named Mofio, whose empire lay some 300 miles farther west. Another large state, founded in the Welle region by Kipa (Kifa), brother of Yapaty, also fell to pieces after his death in 1868. The powerful chiefs Bakangoi and Kanna, visited in 1883 by Casati, are sons of this Kipa, whose grave near Kanna's village is still watched by twenty-five "vestals," bound, under penalty of death, to keep a fire constantly burning, and to preserve their chastity inviolate (*Esploratore*, August 1883).

"stood out like creatures of another world . . . a people of a marked and most distinct nationality, and that in Africa and amongst Africans is saying much" (i. p. 437).

Their most salient characteristics appear to be—great space between the orbits, giving them at once a peculiarly savage and frank expression; very short nose, with correspondingly long upper lip; woolly hair much longer than that of any other Negro people; head of a pronounced brachycephalous type, agreeing in this respect with the Bongos of the White Nile, but differing from the great majority of the other African dark races, who are distinctly dolichocephalic; features generally round, less prognathous, and altogether more regular than the typical Negro; ruddy brown or chocolate colour, like that of a cigar, scarcely ever black, but occasionally bronze and even olive (Petherick); symmetrical figures, about the middle size, robust and active. These points seem to indicate a large commingling of Negro and foreign elements, but in what proportion and from what source it would be unsafe to conjecture in the absence of trustworthy anthropometrical data. At present all that can be said with any certainty is that the A-Zandey are to be regarded as rather of mixed Negroid than of pure Negro stock.

Their traditions, customs, political and religious institutions, and general culture seem to point at the same conclusion. The savagery of most tribes, their pronounced cannibalism, agricultural and hunting rather than pastoral habits, universal belief in sorcery and fetichism, may be credited to the Negro element, while to foreign influences may be attributed their great intelligence, shown especially in the skilful structure of their dwellings and in the remarkable taste and proficiency displayed in the native industries. Prominent among these are their earthenware vessels of faultless symmetry; iron-smelting and metal works such as scimitars, knives, and spears; wood carvings such as stools, benches, bowls, tobacco pipes of varied and intricate design, and often "admirable works of art" (Schweinfurth). It may also be stated that their reputation for extreme ferocity appears to have been greatly exaggerated by early report, although on the other hand the charge of cannibalism in its very worst forms has been fully confirmed by the latest European observers. Nevertheless the A-Zandey, who everywhere present those sharp contrasts of habits and temperament so characteristic of mixed races, are distinguished by some excellent qualities, such as frankness, courage, an instinctive love of art, and above all a genuine and lasting affection for their women, such as is betrayed by no other African race. "A husband will spare no sacrifice to redeem an imprisoned wife; and the Nubians, being acquainted with this, turn it to profitable account in the ivory trade. They are quite aware that whoever possesses a female hostage can obtain almost any compensation from a Niam-niam" (Schweinfurth, i. p. 472).

Beyond a few meagre vocabularies no materials have yet been collected for the study of the Zandey language, which, except in the A-Madi country, appears to be everywhere spoken with considerable uniformity in the eastern Niam-niam lands. Its phonetic system, such as initial *mb* and vowel *auslaut*, affiliates it, not to the Libyan, as has been asserted, but to the Negro linguistic type. Within this order of speech its pronominal prefix inflexion points to affinity rather with the southern Bantu than with the Soudan group of languages. Thus the personal plural *a-*, as in A-Zandey, A-Madi, A-Banga, &c., would appear to be identical in origin and meaning with the Bantu *wa-*, as in Wa-Ganda, Wa-Swaheli, Wa-Zambara, &c. There is also the same dearth of abstract terms, which renders the translation of Scripture into the Negro tongues such a hopeless task. Compare *gumbah*, an expression for the deity, really meaning "lightning," with the Chinyanja *chuuta—thunder—God* (?) and the Zulu *Unkulunkulu—great-grandfather*, also adopted by the missionaries as the nearest equivalent for the deity in that language.

Bibliography.—John Petherick, *Egypt, the Soudan, and Central Africa*, 1861; Piaggia's "Account of the Niam-Niam," communicated by the Marchese O. Antinori to the *Bollettino* of the Italian Geographical Society, 1868, pp. 91-168; Schweinfurth, *Heart of Africa*, English edition, 1873; G. Casati's "Journey to the Niam-Niam Country," in *Esploratore* for August 1883; Dr W. Junker, "Rundreise in dem südlichen Niamniam-Lande," in *Petermann's Mittheilungen* for May 1883. (A. H. K.)

NIAS ISLAND. See SUMATRA.

NIBELUNGENLIED, or **NIBELUNGE NÔT**, a great epic poem written in a Middle High German dialect. The story told in this poem belonged in its primitive form to the whole Teutonic race, and was composed originally of purely mythological elements. It is touched upon in *Beowulf*, and forms the most important subject of the old Norse poems, in which it is presented in fragments,—the poets having apparently assumed that the tale as a whole was known to every one, and that their hearers would be able to put each incident in its proper place. It is also set forth in the prose *Edda* and in the *Thidrekssaga*, which belongs to the 13th century. The substance of the story in its Norse form is as follows. Beside a waterfall the three Anses—Odin, Loki, and Hönir—see an otter devouring a salmon. They kill it, and taking its skin with them seek shelter for the night in the house of Rodmar. He recognizes the skin as that of his son Otter, and demands that as much gold as is necessary to cover it shall be delivered to him as "wergild." In a net Loki catches the dwarf Andwari in the shape of a pike, and compels him to pay for his ransom a great treasure, which covers the whole of the skin except one hair. In order to cover this hair Loki takes from the dwarf a magic ring which breeds gold, and Andwari, enraged, curses the hoard. His curse attends it to the last, and begins to operate immediately, for Rodmar, who claims for himself the whole of the "weregild," is slain by his sons, Fafnir and Regin. Fafnir takes possession of the hoard, and in the form of a snake guards it on Glistenheath. Regin, indignant at being deprived of his share, calls to his aid Sigurd, a young hero for whom he makes the sharp sword Gram; and, armed with Gram, Sigurd goes to Glistenheath and kills Fafnir. While Sigurd is roasting Fafnir's heart, which Regin has cut out, the fat dropping into the fire burns his finger, and putting the hurt part into his mouth, he finds that he has suddenly obtained the power of understanding the language of birds. He thus learns that Regin intends to act treacherously towards him. Sigurd therefore slays Regin, and rides away with the hoard in two bundles on his horse Grani. In a house on a hill he finds the Walkyrie Brunhild in an enchanted sleep, from which she awakes, and plights her troth to Sigurd, who loves her ardently. Coming to the court of Giuki, a king of the Rhineland, Sigurd forms a friendship with Giuki's sons, Gunnar, Högni, and Guthorm. Gudrun, Giuki's daughter, being fascinated by the stranger, gives him an enchanted drink which causes him to forget Brunhild, and then he and Gudrun are married. Gunnar wishes to make Brunhild his wife, and asks Sigurd to go with him in quest of her. Flames encompass her tower; and she will accept as her husband only the hero who shall succeed in riding through them. Gunnar makes the attempt in vain; but Sigurd, mounted on Grani, has no difficulty in passing to Brunhild, with whom he exchanges rings, giving her the ring of the dwarf Andwari. Sigurd, however, has assumed the form of Gunnar, and Brunhild supposes that it is by Gunnar she has been won. All of them return to Giuki's court, Sigurd having taken his own form again, and Brunhild having become Gunnar's wife. Here a quarrel breaks out between Brunhild and Gudrun, the former contending that Sigurd's position is inferior to that of her husband, while Gudrun retorts by telling her rival that it was Sigurd who rode through the flames. Brunhild, maddened by jealousy, incites Guthorm, Gunnar's brother, to murder Sigurd; and twice Guthorm glides into Sigurd's chamber to accomplish her will, but departs when he finds Sigurd awake and gazing at him with flashing eyes. The third time Sigurd is asleep, and Guthorm stabs him. Sigurd, before dying, has just strength enough to throw his sword after the murderer, whom it cuts in two. Brunhild laughs at the desolation she has wrought, but all the time she has loved Sigurd, and she kills herself with the sword that has slain him, and is burned with him on his pyre. By and by Gudrun takes as her second husband Atli, Brunhild's brother, king of the Huns. Atli asks her brothers, Gunnar and Högni, to visit him; and, notwithstanding her warnings, they accept his invitation. He demands of them Sigurd's hoard, which he claims as Gudrun's property; but before leaving home they have buried it beneath the Rhine, and they refuse to say where it is concealed. After a fierce contest in which all the followers of

Gunnar and Högni fall, Atli renews his demand, promising to spare Gunnar's life if he will reveal the secret. Gunnar declines to do so until he sees the heart of his brother Högni. The heart of a slave is laid before him, but he declares that it cannot be Högni's, since it quakes. Högni's heart is then cut out, the victim laughing in the midst of his pain; but Gunnar is still resolute, proclaiming that he alone knows where the hoard is, and that no one shall share the knowledge with him. His hands being bound, he is put into the court of serpents, where he plays so sweetly on a harp with his toes that he charms all the reptiles except an adder, by which he is stung to death. Gudrun avenges the murder of her brothers by killing the sons she has borne to Atli, and causing him unwittingly to drink their blood and eat their hearts. In the night she kills Atli himself, burns his hall, and leaps into the sea, by the waves of which she is carried to new scenes, where she has adventures not connected with those recorded in the *Nibelungenlied*.

The tale of which this is one version, pieced together from many poetical fragments, assumed different forms until it was put into its final shape in the *Nibelungenlied*. The heroine of the German poem is Kriemhild, who represents Gudrun. She lives at Worms, the capital of the Burgundian kingdom, with her brothers Gunther, Gernot, and Giselher, of whom the eldest, Gunther, is king of the Burgundians. To Worms comes Siegfried (an older form than Sigurd), the son of Siegemund and Siegelind, the king and queen of the Netherlands. Siegfried possesses the magic hoard, but he does not obtain it as Sigurd obtains it in the Norse form of the tale. He takes it from two princes of Nibelungen-land, to whom it has been bequeathed by their father, King Nibelung. Quarrelling as to their respective shares, they appeal to Siegfried to decide between them; and he, irritated by their unreasonableness, kills them and seizes the treasure, together with the sword Balmung and the Tarnkappe, or cloak of darkness, which renders the wearer invisible and gives him the power of twelve men. Although this is how the hoard comes into his hands, he is still represented as slaying a dragon, in whose blood he bathes, being thus rendered invulnerable except in one spot between the shoulders, on which a leaf falls before the blood is dry. At the Burgundian court Siegfried wins the hand of Kriemhild; but before their marriage he establishes a claim to the gratitude of King Gunther, the lover of Brunhild, the young and stalwart queen of Iceland, who requires that any one wishing to be her husband shall surpass her in three games. Gunther and Siegfried with their followers sail to Iceland; and with the aid of Siegfried, who during the trial of skill and vigour makes himself invisible by donning the Tarnkappe, Gunther overcomes the powerful maid. On the night of the wedding Brunhild scoffs at Gunther, struggles with him, binds him, and lets him hang on the wall ignominiously until the morning. Next night, without the knowledge of Brunhild, Siegfried goes to the help of his friend, and as a token of his conquest takes her ring and girdle, after which she is incapable of giving Gunther further trouble. Siegfried and Kriemhild then go to the Netherlands, where they live for some years in perfect happiness and with great splendour, the Nibelungen hoard being sufficient to provide them with the means of lavish display. Invited to visit the Burgundian court, they quit Santen, the capital of the Netherlands and Siegfried's birthplace, and, attended by a brilliant retinue, make for Worms. Up to this point the tone of the poem is bright and cheerful; we now begin to see the working of tragic forces which from petty complications lead to strife and disaster. Brunhild, who is of a proud and sullen temper, has always shown bitter animosity towards Siegfried, whom she is represented as recognizing when they meet in Iceland. She insults Kriemhild by vaunting the superior greatness of Gunther, and by claiming precedence. Kriemhild resents these pretensions, and in an animated scene before the cathedral of Worms asserts her right to enter first with her attendants. The quarrel becoming furious, Kriemhild pretends that Siegfried had taken an unfair advantage of Brunhild on the night when he had fought with her in her bridal chamber, and produces the girdle and ring (of the seizure of which Brunhild had been unconscious) as evidences of her disgrace. In vain Siegfried tries to restore harmony by rebuking his wife for this malicious invention: Brunhild is too deeply wounded to forgive so bitter a wrong, and meditates a fearful vengeance. At last she decides that Siegfried shall die; and Hagen, one of Gunther's bravest warriors, undertakes to do her bidding. Inducing Kriemhild to tell him where her husband is vulnerable, he achieves his purpose during a hunting expedition, from which Kriemhild, warned by a dream, has entreated Siegfried to stay away. Kriemhild is overwhelmed with grief and rage, and the rest of the story relates chiefly to her thirst for revenge, and the manner in which she slakes it. For thirteen years she remains quietly at Gunther's court. Then Rüdiger, margrave of Bechlaren, appears as the ambassador of Etzel (Attila), king of the Huns, and entreats Kriemhild to become Etzel's wife. She consents, and again thirteen years pass without any important incident. At the end of that time Gunther and his followers are invited by Etzel and Kriemhild to the land of the Huns; and, despite supernatural intimations and Hagen's presentiments, they resolve to go. The ultimate result is that in a terrible conflict the Burgundian visitors are destroyed. When all of them have fallen save Gunther and Hagen, these survivors are overcome by Dietrich, a resident at Etzel's court, and delivered by him to Etzel and Kriemhild. The closing scenes are complicated by reference to the hoard of the Nibelungen, which had been taken after Siegfried's death by Gunther as Kriemhild's brother. In virtue of his possession of it he and his people are called Nibelungen; but he possesses it only in name, for Hagen, who had brought it to Worms, fearing that it would work evil, had buried it (as Gunnar and Högni are represented to have done) beneath the Rhine. Kriemhild commands Hagen to reveal its resting-place, but he answers that he has sworn not to tell the secret as long as the king lives. The head of Gunther being exhibited to him, he still refuses; whereupon, snatching the sword Balmung, which Hagen has used since Siegfried's death, Kriemhild rids herself of her enemy by beheading him. Immediately afterwards she herself is killed by Hildebrand, a Hunnish warrior, who is horrified by her savage cruelty.

Many elements embodied in the Norse rendering of the primitive tale are retained in the *Nibelungenlied*; and, indeed, it is impossible to understand the latter thoroughly without reference to the former. For instance, the recognition of Siegfried by Brunhild in Iceland, and her misery in beholding his happiness with Kriemhild, are unintelligible until we know that Siegfried and Brunhild are supposed to have been lovers before the action of the poem begins. Again, we cease to be puzzled by the malign power of the hoard only when we learn how an evil fatality has been associated with it by the wrath of Andwari. After all, however, the points in which the later version agrees with the earlier one are not more remarkable than those in which they differ. In the Norse poems the only historical character is Atli or Attila; but in the *Nibelungenlied* Attila (Etzel) is associated with Theodoric the East Goth (Dietrich), while the relations of Gunther to Siegfried seem to be a reminiscence of the absorption of the Burgundian kingdom by the Franks. Moreover, almost all the mythological features of the tale have disappeared, ethical influences having become more prominent. The curse on the hoard is little more than a picturesque survival, for although it symbolizes, sometimes very effectively, a kind of mysterious fate in the background, the destinies of the various characters would not have been different if it had been altogether omitted. If the characters are less grand, they are more human; and their motives have a closer resemblance to those represented in modern poetry. It is true that Kriemhild works as much desolation as Gudrun, but her cruelty is not so revolting, and it does not spring, like Gudrun's, from passions excited by a blood-feud, but from wounded love.

The *Nibelungenlied* is composed of stanzas of four lines, the first line rhyming with the second, the third with the fourth. Each line is divided into two parts by the cæsura, the first part having four accents, the second part three, except in the last line, where the second part has also four accents. Some of the rhymes indicate poverty of resource, and the diction is very simple; but the poet displays much artistic skill in the handling of the traditions which it was his task to weave into a continuous narrative. He selects his incidents with fine tact, and almost invariably places them in relations which are fitted to bring out their full significance. Character he is able to conceive powerfully and vividly. Perhaps the only character who loses anything by his mode of treatment is Brunhild, who is certainly far less impressive in the *Nibelungenlied* than in the Norse poems. Kriemhild, on the other hand, is a splendid creation of imaginative genius. First we see her as a simple maid, gentle and modest; then her powers are awakened by love; and when the light of her life is suddenly quenched all her tenderness dies. She has then but one end, to avenge her husband's death; and for its accomplishment she sacrifices everything—repose, the possibilities of new happiness, and at last existence itself. The transitions are startling, but not unnatural in a rude age; and in the earlier stages of Kriemhild's career they are lightly and delicately touched. Towards the close, when her vengeance is being sated, the style is intensely concentrated, vivid, and impassioned; but the change does not take the reader by surprise, for he is prepared for it even in the brightest scenes of the poem by hints of inevitable ruin. Siegfried is less complex than Kriemhild, but not less poetically presented. He is a flawless hero, strong, brave, loyal, and generous; and it is possible, as some critics suppose, that in the original myth he personified the radiance of summer in conflict with the approaching gloom of winter. Hagen is as sombre and tragic a figure as Siegfried is bright and genial; and, notwithstanding his guilt, he commands a certain admiration, for his crimes are only a manifestation of his fidelity to the royal house he serves. Another character wrought with great imaginative power is Rüdiger, who was probably introduced into the tale for the first time by the author of the *Nibelungenlied*. His part is subordinate, but it suffices to evoke the expression of all the most brilliant and attractive qualities of the age of chivalry.

There are twenty-eight manuscripts of the *Nibelungenlied*, some of them complete, others in fragments, and they date from the 13th to the 16th century, so that the poem must have been studied until about the time of the Reformation. It had been entirely forgotten when, in the middle of the 18th century, Bodmer, the Swiss poet and critic, issued some portions of it along with the "Klage," a poem of the same period describing the lamentations at Etzel's court over the fallen heroes. In 1782 C. H. Myller published the first full edition, using in the latter part Bodmer's text. Very little attention, however, was given to the recovered epic until the writers of the Romantic school began to interest themselves in mediæval literature. Then the *Nibelungenlied* was read with enthusiasm; and in 1807 Von der Hagen provided an improved text with a glossary. An epoch in the study of the poem was marked by Lachmann, who in various writings contended that it consisted of twenty ancient ballads, that these ballads had been put together about 1210, that the collector or editor had connected them by stanzas of his own composition, and that in the ancient ballads themselves he had inserted unauthentic verses. Lachmann held that the Munich manuscript (A), which is the shortest, contains the purest text, and that it was extended by the authors of the texts in the St Gall manuscript (B) and the Lassberg manuscript (C). This view guided his labours in preparing his edition of the *Nibelungenlied* (1826); and the theory was for some time generally accepted. Hahn, however, in 1851, and Holtzmann, in 1854, suggested doubts whether the critical canons by which Lachmann had distinguished authentic from unauthentic stanzas were valid; and Holtzmann sought to prove that C, the longest manuscript, not A, the shortest, is nearest the original form of the poem. This occasioned an animated controversy, in which many eminent scholars took part. In 1862 Pfeiffer gave a new aspect to the question by maintaining that in the 12th and the early part of the 13th century every poet considered it a point of honour to invent a new kind of stanza, and that, as we possess lyrics by the Austrian poet Von Kürenberg, which are in the same measure as the *Nibelungenlied*, we are bound to conclude that he was the author of the poem. Developing this hint, Bartsch argues that the *Nibelungenlied* was written about 1140; that in its original form the lines ended not in rhymes but in assonances; that about 1170 a younger poet introduced the principle of rhyme, although imperfectly, into his predecessor's work; that between 1190 and 1200, when rhyme was considered essential, two poets, independently of one another, completed the transformation which the second poet had begun; and that the work of the one is represented by manuscript C, the work of the other by manuscript B, of which A is an abbreviated form. Bartsch regards B (entitled *Nibelunge Nôt*) as that which approximates most closely to the work of the first poet; and this he has made the basis of his admirable critical edition, published separately in two volumes, and in one volume in the series of *Deutsche Classiker des Mittelalters*. If Bartsch's view be correct, the poem must have been greatly injured by its successive transformations. His theory is supported by the facts that assonances survive in all the manuscripts, and that the rhymes are not nearly so good as might have been expected from the creative energy with which the general scheme of the work is conceived.

The *Nibelungenlied* has been rendered into modern German, among others, by Simrock, Bartsch, Marbach, and Gerlach. See H. Fischer, *Die Forschungen über das Nibelungenlied seit K. Lachmann*; and Paul, *Zur Nibelungenfrage*. A full and interesting résumé of the poem occurs in the works of T. Carlyle (*Misc.*, vol. iii.). (J. Sl.)

NICÆA, or Nice, still called Isnik, *i.e.*, εἰς Νικαίαν, was an important town of Asia Minor, in Bithynia, on the lake Ascania. Antigonus built the city on an old deserted site, and soon afterwards Lysimachus changed its name from Antigonia to Nicæa, calling it after his wife. Under the Roman empire Nicæa and Nicomedia disputed the title of metropolis of Bithynia. After Constantinople became the capital of the empire Nicæa grew in importance, and the Byzantine walls, which are still well preserved, are very extensive. On the council held there in 325 A.D. see Creeds and Council. The possession of the city was long disputed between the Greeks and the Turks. It remained an important city for some time after its final incorporation in the Ottoman empire, but has decayed till it is now a poor and insignificant village. Strabo describes the ancient Nicæa as built regularly, in the form of a square, with a gate in the middle of each side. From a monument in the centre of the city all the four gates were visible at the extremities of great cross-streets.

NICANDER, a Greek poet, physician, and grammarian, succeeded his father Damnæus or Xenophanes as hereditary priest of Apollo at Clarus, the famous temple in the territory of the Colophonians. Hence he is often called Colophonius. He wrote a great number of works both in prose and verse, of which two are preserved. The longest, *Theriaca*, is a poem in about 1000 hexameters on the nature of venomous animals and the wounds which they inflict. The other, *Alexipharmaca*, consists of 600 hexameters treating of poisons and their antidotes. The works of Nicander are praised by Cicero, and frequently quoted by Pliny and other writers. A Greek writer in the

Anthology celebrates the glory of Colophon as birthplace of both Homer and Nicander. The two works preserved do not justify this; they have, as Plutarch says, nothing of poetry about them except the metre, and the style is affected and obscure; but they contain some interesting information as to ancient belief on the subjects treated. Nicander flourished probably in the 2d century B.C.

NICARAGUA, one of the five states of Central America, between 10° 30′ and 15° N. lat. and 83° 11′ and 87° 40′ W. long., forms an irregular equilateral triangle wedged in between Honduras and Costa Rica north and south, with base stretching for 280 miles along the Caribbean Sea from Cape Gracias à Dios southwards to the San Juan delta, and apex at the Coseguina volcano, Gulf of Fonseca, which separates it on the Pacific side from San Salvador. The frontier towards Honduras, as laid down by the treaty of 1870, runs from the Gulf of Fonseca in a north-westerly direction along the Cordillera de Dipilto to 85° W., and thence a little north of and nearly parallel with the Rio Coco (Wanks) to the Atlantic above Cape Gracias à Dios. The still contested Costa Rica frontier may be taken as practically defined by the course of the San Juan river and the south side of Lake Nicaragua to within 14 miles of the Pacific, where it is marked by a conventional line drawn across the isthmus from the mouth of the Sapoa river to Salinas Bay on the Pacific. Within these limits, and including the Reserva Mosquita (Mosquito territory), the state comprises a total area of 58,500 square miles, with a population usually estimated at 400,000, but by the census of 1882 reduced to 275,816, and distributed over ten departments, as under:—

Departments.	Population.[1]	Chief Towns.	Population.
Rivas	16,875	Rivas	10,000
Granada	51,056	Granada	16,000 (?)
Managua	10,067	Managua	12,000 (?)
Leon	26,389	Leon	25,000
Chinandega	17,578	Chinandega	11,000
Nueva-Segovia	36,902	Ocotal	3,000 (?)
Matagalpa	51,699	Matagalpa	9,000
Chontales	27,738	Libertad	5,000 (?)
S. Juan del Norte	1,512	Greytown	2,000
Mosquitia	36,000	Bluefields	1,000

The low monotonous and swampy Mosquito Coast is broken by the two lagoons of Pearl Cay and Bluefields, and is fringed by a few cays (islets) and reefs, such as Great and Little Corn, Longreef, and Tangweera, which shelter no harbours, and serve only to obstruct the navigation. Here the only port is Greytown (San Juan del Norte), formed by the northern branch of the San Juan delta, and now nearly choked with sand. But the bold and rocky west coast, which extends for about 200 miles from Coseguina Point to Salinas Bay, although destitute of islands, presents a few convenient harbours, of which the chief are San Juan del Sur, Brito, and especially Realejo, which is designed as the terminus of Captain Bedford Pim's Transatlantic route, and which Dunlop declares to be "as good a port as any in the known world," although of somewhat difficult access.

In Nicaragua the great geographical feature is the remarkable depression stretching for about 300 miles north-west and south-east parallel with the Pacific coast, and transversely to the Central American plateau, which it almost completely interrupts. This depression, which lies at a mean elevation of scarcely 100 feet above the sea, is now flooded by the two great lakes Managua and Nicaragua (Cocibolca), which collect nearly all the drainage of the western provinces, discharging it through the desaguadero (outlet) of the Rio San Juan to the Atlantic. About midway between Lake Nicaragua and the Caribbean Sea, the San Juan entirely pierces the main chain of the Cordillera de los Andes, which here sweeps round the east side of the lacustrine basin at a mean height of 4000 or 5000 feet northwards to the Honduras highlands. Towards the lakes the descent is very precipitous; but on the opposite side the land falls in broad terraced plateaus down to the Mosquito coast.

Throughout its entire length the depression is traversed by a remarkable volcanic chain of isolated cones, which north of the lakes takes the name of the Maribios, terminating in the extreme north-west with Coseguina (4000 feet), and in the extreme south-east with the low wooded archipelagos of Solentiname and Chichicaste near the head of the desaguadero. Between these two extremes the chief cones, proceeding southwards, are—the Maribios chain, comprising El Viejo (6000 feet), Santa Clara, Telica, Orota, Las Pilas, Axosco, Momotombo (7000 feet, highest point in the state), all crowded close together between the Gulf of Fonseca and Lake Managua; Masaya or Popocatepec and Mombacho (5700 feet), near Granada; lastly, in Lake Nicaragua the two islands of Zapatera and Ometepec with its twin peaks Ometepec (4100 feet) and Madera (4190 feet). Several of these are still active, or at least quiescent, and in 1835 Coseguina was the scene of one of the most tremendous eruptions on record. The outbreak lasted four days, during which sand fell in Jamaica, Mexico, and Bogota. After a long repose Ometepec also burst into renewed activity on June 19, 1883, when the lavas from a new crater began to overflow, and continued for seven days to spread in various directions over the whole island. The eruption was accompanied by incessant rumblings and earthquakes, in consequence of which the whole population took refuge on the mainland. Mud, ashes, lavas, and rocks now cover the mountain slopes, which had been under uninterrupted cultivation for many centuries. In the Maribios district also occur several volcanic lakelets, such as that of Masaya, besides numerous "infernillos," low craters or peaks still emitting sulphurous vapour and smoke, and at night often lighting up the whole land with bluish flames. The *malpais*, or barren lava-fields, here extend for miles in some directions, and no other region of equal extent probably betrays so many or so marked traces of igneous action as that portion of Nicaragua intervening between its lakes and the Pacific (Squier). Here the departments of Rivas and Granada are traversed by a low range sometimes spoken of as the Coast Range, which seldom rises above 2000 feet, and merges northwards in the magnificent plains of Leon and Conejo, that is, in the northern section of the lacustrine depression. It is crossed by three low and easy passes—at its southern extremity along the Costa Rica frontier, again between the ports of La Virgen on Lake Nicaragua and S. Juan del Sur on the Pacific, and in the north between Lake Managua near Nagarote and Tamarinda Bay, while it disappears altogether south of Leon, where the depression reaches the coast at Realejo. Four alternative routes are thus afforded for the interoceanic canal which is destined one day to connect the two seas through this great depression (see vol. iv. p. 793).

No rivers of any size flow westwards to the Pacific, the western provinces discharging, as already stated, mainly through the San Juan emissary to the Caribbean Sea. Yet Lake Managua, which lies 16 feet above Lake Nicaragua, and 150 (?) above sea-level, may now be regarded almost as a land-locked basin. Although nearly 50 miles long by 25 broad, with a mean depth of 30 feet, it seldom sends any overflow through the natural outlet of the Estero

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[1] The figures given are official, but would appear to be understated. It will be observed that the population of the department is in one case closely approached and in two cases is actually exceeded by that of its chief town.

Panaloya (Tipitapa)[1] down to the lower basin. It does not appear to have undergone any perceptible change of level since the conquest; but some of its former feeders have probably been displaced by the violent earthquakes, of which this region is a chief centre. Thus the present inflow, except during high floods, is mainly carried off by evaporation. But the larger lake continues to receive the important Rio Frio from Costa Rica at its south-eastern extremity, besides numerous perennial streams, especially from the western slopes of the Cordillera de los Andes. Hence there is an abundant discharge through the Rio San Juan, a deep, sluggish stream 128 miles long, from 100 to 400 yards broad, 10 to 20 feet deep, but unfortunately obstructed by five dangerous rapids presenting insuperable obstacles to steam navigation.[2] The lake itself is the largest fresh-water basin between Michigan and Titicaca, being nearly 100 miles long by 40 broad and 240 feet deep in some places, but shoaling considerably, especially towards the outlet, where it falls to 6 or 8 feet. Under the influence of the intermittent trade winds it rises and falls regularly towards the south side, whence the popular notion that it was a tidal lake. It is also exposed to the dangerous Papagayos tornadoes, caused by the prevailing north-easterly winds meeting opposite currents from the Pacific.

The little-known region of rugged plateaus and savannas occupying fully one-half of the state between the lacustrine depression and the Mosquito Coast is watered by several unnavigable streams, all draining from the Cordilleras eastwards to the Atlantic, and all distinguished by a perplexing nomenclature. The chief are, coming southwards, the Coco (Wanks or Segovia, known in its upper course as the Telpaneca), the Wama (Sisin Creek), the Rio Grande (Great River or Amaltara), the Escondida (Bluefields, Blewfields, Rio del Desastre)

From the general relief of the land, as above set forth, its geological constitution is sufficiently obvious. In the west we have the lavas, tufas, sulphurs, pumice, and other recent volcanic formations of the Maribios system. These are succeeded east of the lacustrine basin by andesite rocks, trachytes, greenstone, and metalliferous porphyries of the Cordilleras, abounding in auriferous and argentiferous quartz, especially in Chontales and the uplands of north-west Segovia. Then come the older plutonic upheavals, crystallized schists, dolerites, &c., apparently stretching down to the Mosquito Coast region, where they appear to underlie the comparatively modern sedimentary formations and alluvia of the streams flowing eastwards to the Caribbean Sea. The Chontales gold mines, which have been intermittently worked for many years past, lie about midway between the Atlantic and Pacific between 11° and 13° N. lat. and 85° and 86° W. long., and the mining industry is centred chiefly about Libertad, capital of Chontales, and Santo Domingo in the Matagalpa district. There is very little gold washing in any of the eastern streams, the metal being found almost exclusively in the quartz lodes, which run generally east and west in close parallel lines, varying in thickness from 2 or 3 to 20 feet, and in productiveness from a few pennyweights to 2 or 3 ounces per ton. The chief silver mines are those of Matagalpa and Dipilto towards the Honduras frontier, but the total annual yield of the precious metals seldom exceeds £40,000.

Lying at a mean elevation of 2000 to 3000 feet above sea-level, the Chontales and Segovian uplands enjoy a mild climate, generally healthy and well-suited for European constitutions. But elsewhere the climate is distinctly tropical, with two seasons—wet from May to November, dry throughout the winter months—and a mean annual temperature of about 80° Fahr., falling to 70° at night and rising to 90° at noon in summer. Nicaragua comes within the zone of the wet north-east trade winds, which sweep inland from the Atlantic, unintercepted by any great elevations till they reach the lofty Ometepec and Madera peaks. Hence the heaviest rainfall occurs along the west side of the lacustrine basin, with an annual mean at Rivas of 102 inches. Elsewhere the summer rainfall is about 90, the winter from 8 to 10 inches. The flat, low-lying Mosquito region being exposed to the inundations of the numerous streams from the Cordilleras, and to the exhalations from the stagnant waters of the coast lagoons, is very malarious, and the fever here endemic is especially fatal to Europeans.

In the volcanic western provinces the soil is extremely fertile, yielding, where cultivated and irrigated, magnificent crops of sugar, cotton, rice, tobacco, coffee, cocoa, and maize. Much indigo was produced here formerly from an indigenous variety, the *Indigofera disperma*, L., but this industry has been neglected since the revolution. Sugar yields two or three crops, and maize as many as four, this cereal supplying a chief staple of food. Plantains, bananas, beans, tomatoes, yams, arrowroot, pine-apples, guavas, citrons, and many other tropical fruits are also cultivated, while the extensive primeval forests of the central provinces abound in mahogany, cedars, rosewood, ironwood, caoutchouc (*ule*), gum copal, vanilla, sarsaparilla, logwood, and many other dye-woods, medicinal plants, and valuable timbers. Conspicuous amongst the forest trees is the splendid Coyol palm (*Cocos butyracea*, L.), with feathery leaves 15 to 20 feet long and golden flowers 3 feet, and yielding a sap which when fermented produces the intoxicating *chicha* or *vino de Coyol*. In Chontales occurs the remarkable *Herrania purpurea*, a "chocolate tree," whose seeds yield a finer-flavoured chocolate than the cocoa itself. The forest growths are on the whole inferior in size to those of corresponding latitudes in the eastern hemisphere; the tropical vegetation, especially about Nindiri and elsewhere in the west, is unsurpassed for beauty, exuberance, and variety.

The Nicaraguan fauna differs in few respects from that of the other Central-American states. Here the jaguar, puma, and ocelot still infest all the wooded districts, alligators swarm in the lakes and in the San Juan and other rivers, while the vulture, buzzard, toucans, humming birds, and howling monkeys are almost everywhere familiar sights. Amongst the endless species of reptiles occur the harmless boba or "chicken snake," python, and black snake, the venomous corali, taboba, culebra de sangre, and rattlesnake, iguanas of great size, scorpions, edible lizards, and others said to be poisonous (Boyle). Of useful animals by far the most important are the horned cattle, large herds of which are bred on the savannas of the central and northern provinces. Their hides form one of the staples of the export trade, the other chief items of which are gold and silver bullion, coffee, and gums, amounting to a yearly sum of about £400,000, against £300,000 imports, mainly European and United States manufactured goods.[3]

From the numerous sepulchral mounds, monumental ruins, and other remains thickly strown over Chontales and all the western provinces, as well as from the direct statements of the early Spanish writers, it appears that most of Nicaragua was densely peopled at the time of the conquest. In many districts colossal monolithic statues of men and gods, crumbling temples, cairns, and tombs of all sizes are met in every direction, and in some places the inhabitants still supply themselves with pottery from the vast quantities of fictile vessels preserved below the surface, or piled up in heaps like that of Monte Testaccio near Rome. One explorer speaks of "mountains of earthenware," and another tells us that "around Libertad the tombs are in thousands, offering every possible variety of form, size, and thickness." Monuments of this sort have been found ranging from 20 to over 170 feet in length and 120 in breadth, built of huge stones piled up 5 feet in thickness, which must have been brought from great distances. Managua appears to have had a population of 40,000; mention is made of other cities four miles in extent; and when Gil Gonzalez penetrated into the country in 1522 he found in one district a cluster of six considerable towns all less than two leagues apart. But "a few years of Spanish rule sufficed to turn whole tracts of flourishing country into uninhabited wilds" (H. H. Bancroft), and, after making every allowance for the defective character of the last census returns, the present population of the whole state cannot be estimated at more than 400,000. A calculation based on the partial census of 1846 gave 300,000, of whom about 100,000 were pure-blood Indians, 150,000 half-castes (Mestizoes, Zambos, &c.), 20,000 Negroes, and 30,000 whites. Throughout the present century the whites appear to have shown a general tendency to diminish, and the indigenous element is by some now estimated at fully one half of the whole population.

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[1] According to Baily's survey this emissary is 16 miles long, with a fall of 7 inches per mile, and a depth of 6 to 12 feet during the rains, but at other times often quite dry. Other writers have represented it as completely interrupted by a break or ridge 4 miles wide in the centre, over which no water now ever flows from the upper lake (Boyle, i. p. 249). Fröbel also states that since the earthquake of 1835 the channel has been closed, although J. M. Cáceres, a native of Nicaragua, positively asserts that the two basins still communicate (*Centro-America*, Paris, 1880, p. 60).

[2] It is often asserted that these rapids were artificially formed by the Spaniards themselves to prevent the buccaneers from penetrating to Lake Nicaragua. But Herrera (*Dec.* iii., book 2, chap. 3) speaks of the "great rocks and falls" which prevented Cordova, the first circumnavigator of the lake, from descending the San Juan in 1522. On the other hand, the English traveller Gage tells us that in his time (17th century), vessels reached Granada direct from Spain. Nevertheless there can be little doubt that the rapids are natural obstructions, representing all that now remains of the Cordilleras which have at this point been pierced by the San Juan.

[3] The exports in 1880 amounted to £411,500, the imports to £295,000. For the same year the revenue was £487,000, the expenditure rather more; the public debt was £700,000.

With the exception of some wild tribes in the interior of Mosquitia, nearly all the natives are now in a more or less civilized state, and have generally adopted the Spanish language. At the time of the conquest Herrera tells us that five distinct languages were current in Nicaragua:—the *Caribisi* (Carib) on the east coast, now represented by the Rama, Toaca, Poya, and Waikna (Mosco); the *Chontal* of Chontales, Segovia, and parts of West Honduras and Salvador, now represented by the Woolwa in Chontales and Mosquitia; the *Chorotegan* (Dirian), mainly between Lake Managua and the Pacific and thence north to Honduras, now extinct; the *Orotiñan* between Lake Nicaragua and the Pacific (department of Rivas) and thence south to the Gulf of Nicoya, Costa Rica, also extinct; the *Cholutec* (Niquiran), a pure Aztec dialect spoken in the large islands of Lake Nicaragua, and about Masaya, Granada, and other districts, especially along the north-west side of the lake, where it still survives among a few scattered communities. The presence of Aztec settlements in this region, and at one time even amongst the Chontales of the opposite side of the lake, is abundantly established by this survival, by the archæological remains found in the islands and adjacent mainland, and especially by the Aztec geographical nomenclature widely diffused throughout the whole of West Nicaragua; *e.g.*, Popogatepec = Popocatepetl, the local name of the Masaya volcano; Ometepec or Ometepet = Ometepetl, *i.e.*, "Two Peaks," the largest of the islands in Lake Nicaragua; the ending *galpa*, common in Chontales (Juigalpa, Matagalpa, &c.), which is the Aztec *calpa*, group of houses, town, from *calli*, house. The euphonic changes *c* or *t* for final *tl*, *g* for *c*, &c., occur even in Mexico itself, and are important as showing that the Cholutecs are comparatively recent intruders from the Anahuac plateau, not the original stock of the Aztec nation, as has been suggested by some ethnologists.[1]

Besides the Caribisi, or continental Caribs of Herrera, the Mosquito Coast is occupied by other Carib communities, which are descended from the Caribs removed thither from the island of St Vincent by the English in 1796. To these alone the name of Carib is now applied, although they are not pure-blood Indians, but Zambos, in whom the Negro features greatly predominate. The Woolwas of the interior of Mosquitia and Chontales are divided into a great number of tribes collectively known as Bravos, that is, wild or uncivilized, who live chiefly on hunting and fishing, and are practically independent of the Nicaraguan Government. The term Bravo itself is the exact Spanish equivalent of the Aztec Chontal, Chondal, that is, "barbarian," which at the time of the discovery was applied by the Cholutecs to all the tribes dwelling east of the great lakes and on the Cordillera de los Andes as far north as Honduras and San Salvador. Here they seem to have supplanted a still more ancient race, who had attained a high state of civilization, as attested by the already-mentioned monuments and stone sculptures of Chontales, which are of a different type both from the Aztec and the Maya-Quiché remains of Yucatan and Guatemala.

According to the electoral law of 1858 Nicaragua forms a democratic republic modelled on that of the United States, with a legislative assembly of eleven members, a senate of ten, and a president elected for four years and assisted by a cabinet of four ministers. The seat of government, formerly Granada and Leon, has since 1858 been Managua on the south-west side of Lake Managua. Although Roman Catholicism is still recognized as the state religion, the free exercise of all others is guaranteed, together with freedom of the press and of education. Public instruction, which is provided for by one university, three colleges, two hundred schools, and an annual grant of £10,000, is still in a very backward state. The total attendance at the national schools in 1882 was 5000, or less than 8 per cent. of the whole population. The criminal charges in the same year were 1938, or 5 per 1000, showing a slight improvement on previous years. There are no railways, and very few good roads even between the large towns and seaports. But the telegraph system (800 miles) was completed in 1882, and in the same year Nicaragua joined the Universal Postal Union. The telegraph despatches forwarded through twenty-six offices numbered 81,000; letters and packages of all sorts, 1,119,000.[2]

First discovered and coasted by Columbus during his fourth and last voyage in 1502, Nicaragua was not regularly explored till 1522, when Gil Gonzalez Davila penetrated from the Gulf of Nicoya to the western provinces and sent his lieutenant Cordova to circumnavigate the great lake. The country takes its name from Nicaragua (also written Micaragua), a powerful Cholutec chief, ruling over most of the land between the lakes and the Pacific, who received Davila in a friendly spirit, and accepted baptism at his hands. Nicaragua's capital seems to have occupied the site of the present town of Rivas over against Ometepec, and soon afterwards the Spaniards overran the country with great rapidity, both from this centre northwards, and southwards from the Honduras coast. The occupation began with sanguinary conflicts between the two contending waves of intrusion, and down to the present day this region has had little respite from external attack and internal convulsions. Granada was founded in 1524 on the isthmus between the two lakes as the capital of a separate government, which, however, was soon attached as a special intendence to the general captaincy of Guatemala, comprising the whole of Central America and the present Mexican state of Chiapas. Hence, during the Spanish tenure, the history of Nicaragua is merged in that of the surrounding region. Of its five earliest rulers "the first had been a murderer, the second a murderer and rebel, the third murdered the second, the fourth was a forger, the fifth a murderer and rebel" (Boyle). Then came the hopeless revolts of the Indians against intolerable oppression, the abortive rebellions of Hernandez de Contreras and John Bermejo (Bermudez) against the mother country (1550), the foundation of Leon, future rival of Granada, in 1610, and its sack by Dampier in 1685, and, lastly, the declaration of independence (1821), not definitively acknowledged by Spain till 1850.

In 1823 Nicaragua joined the Federal Union of the five Central American states, which was finally dissolved in 1833. While it lasted Nicaragua was the scene of continual bloodshed, caused partly by its attempts to secede from the confederacy, partly by its wars with Costa Rica for the possession of the disputed territory of Guanacaste between the great lake and the Gulf of Nicoya, partly also by the bitter rivalries of the cities of Leon and Granada, respective headquarters of the Liberal and Conservative parties. During the brief existence of the Federal Union "no fewer than three hundred and ninety-six persons exercised the supreme power of the republic and the different states" (Dunlop's *Report*). Since then the independent government of Nicaragua has been distinguished almost beyond all other Spanish-American states by an uninterrupted series of military pronunciamientos, popular revolts, partial or general revolutions, by which the land has been wasted, its former industries destroyed, and the whole people reduced to a state of moral debasement scarcely elsewhere paralleled in Christendom. Conspicuous amongst the episodes of this sanguinary drama was the filibustering expedition of General Walker, who was at first invited by the democrats of Leon to assist them against the aristocrats of Granada, and who, after seizing the supreme power in 1856, was expelled by the combined forces of the neighbouring states, and on venturing to return was shot at Truxillo on September 25, 1860. A truce to these internecine troubles has been recently brought about by mutual exhaustion; and, should any of the schemes of interoceanic canalization be carried out, it may be hoped that a national revival will take place under more favourable prospects for the future.

One source of serious embarrassment has been removed by the settlement of the Mosquito reserve question. This territory, which stretches along the Caribbean coast from the Sisin Creek to the Rama river (from 10° 30′ to 13° N. lat.) and for about 40 miles inland, had enjoyed a semi-independent position under the nominal protection of Great Britain from 1655 to 1850. By the Clayton-Bulwer treaty of 1850, England resigned all claims to the Mosquito Coast, and by the treaty of Managua in 1860 ceded the protectorate absolutely to Nicaragua. The local chief was induced to accept this arrangement on the condition of retaining his administrative functions and receiving a yearly subvention of £1000 from the suzerain state for the ten years ending in 1870. But he died in 1864, and Nicaragua has never recognized his successor. Nevertheless the reserve continues to be ruled by a chief elected by the natives, and assisted by an administrative council, which assembles at Bluefields, capital of the territory.

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[1] It should be noted in this connexion that Buschmann has clearly traced a distinct Aztec geographical terminology throughout the whole of Central America from Guatemala to Comayagua in Honduras on the one hand, and on the other through San Salvador and West Nicaragua nearly to the Costa Rica frontier. The Pipil, an Aztec dialect rather more divergent than the Cholutec of Nicaragua, is still current in parts of Guatemala and San Salvador, but no evidence of Aztec settlements has been discovered either in Yucatan or in Costa Rica (*Ueber die Aztekischen Ortsnamen, passim*).

[2] *Official Report of the Minister of the Interior on the State of the Republic for the years* 1881-82, Managua, 1883.

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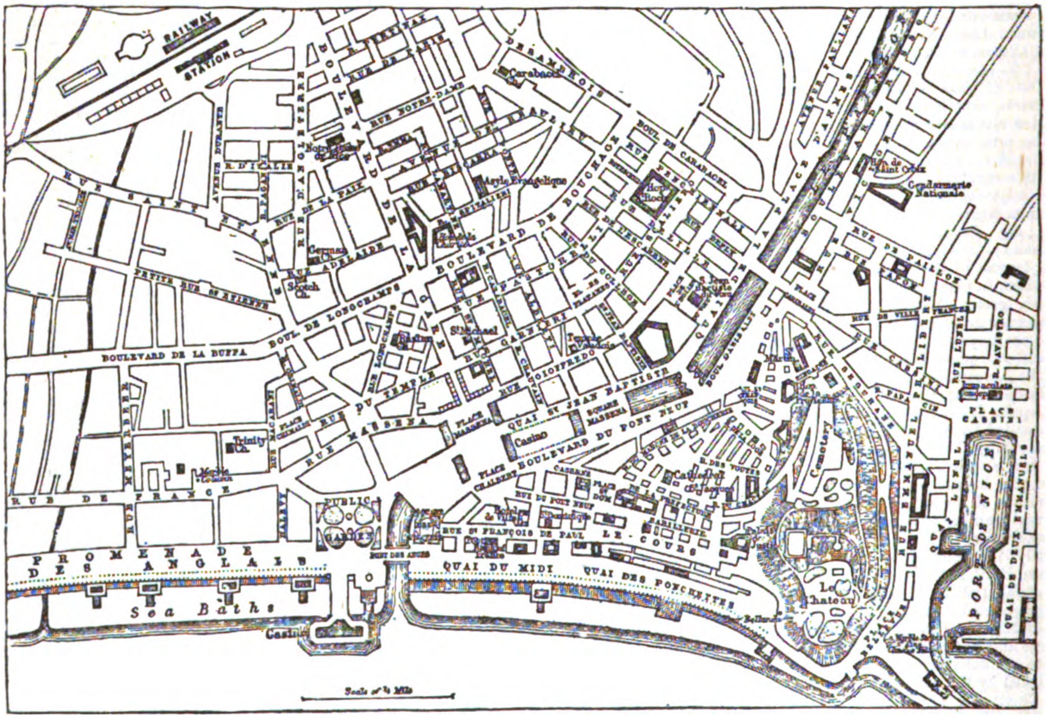
NICASTRO, an episcopal city of Italy in the province of Catanzaro, 16 miles west of Catanzaro and about 6 miles from the Gulf of Sta Eufemia. There are two large suburbs,—Zangaroma, founded by an Albanian settlement in the 15th century, and Bella, dating from 1782,—and the communal population is 14,067 (1881). In the castle of Ferrolito, whose ruins still look down on the city, Frederick II. imprisoned his rebellious son Henry. Nicastro suffered greatly from the earthquake of 1638, which also destroyed the famous Benedictine abbey of Sta Eufemia, about 3 miles to the west.

NICCOLO PISANO. See Pisano.

NICE, a city of France, the chief town of the department of Alpes Maritimes, and previous to 1860 the capital of the countship of Nice (Nizza) in the kingdom of Sardinia, is situated in 43° 42′ N. lat. and 7° 16′ E. long., 739 miles by rail from Paris, and occupies a fine position at the mouth of the Paillon (Paglione), a stream (often dried up in summer) which, after a course of 20 miles, enters the northern end of the Baie des Anges. A steep isolated limestone hill, 315 feet in height, running back for some distance from the shore, forms the historical nucleus of the town. Formerly crowned by a castle, which previous to its destruction by the duke of Berwick in 1706 was one of the strongest fortresses on the coast, it is now laid out as a public pleasure-ground, and planted with aloe, cactus, agave, and palm. Towards its south-west corner stands a tower (Tour Bellanda or Clérissy) dating, it is believed, from the 5th century. The old town stretches along the western base of the hill; the "town of the 18th century" occupies the ground farther west, which slopes gently towards the Paillon; and away to the north-east and north and west beyond the stream lie the ever-growing quarters of the modern city. To the east of the hill, and thus out of sight of the more fashionable districts, the commercial quarter surrounds the port. The whole frontage of Nice is composed of fine embankments: the Quai des Ponchettes, constructed in 1770 round the base of the castle hill, is continued westward by the Quai du Midi as far as the Pont des Anges, which crosses the mouth of the Paillon; and from the public gardens and the municipal casino on the other side of the stream the Promenade des Anglais, a boulevard 85 feet wide, extends for more than a mile to the mouth of the Magnan, and is likely to be prolonged to the Var. A pier projecting into the sea from the promenade contains a "crystal palace" and a sea-bathing establishment. The course of the Paillon also is embanked on both sides, and at one part the Place Masséna, one of the largest public squares in the city, and the principal resort of foreign visitors, has been laid out across the stream. Besides a Roman Catholic cathedral—Ste Réparate, dating from



Plan of Nice.

1650—Nice possesses a Russian church, two synagogues, and several Protestant chapels. Architecturally the most remarkable church is Notre Dame, a modern Gothic building with two towers 213 feet high, erected by the town in 1835 to commemorate its preservation from cholera. The secular buildings include the town-house, the prefecture, the theatres, the hospitals, the lycée (founded by the Jesuits in the 17th century), the natural history museum, the library (especially rich in theology), and, at some distance from the town, the astronomical and meteorological observatory on Mount Gros. The industrial establishments comprise perfume factories, distilleries, oil-works, furniture and wood work factories, confectionery works, soap-works, tanneries, and a national tobacco factory employing several hundred persons. Besides the vine, the trees principally cultivated in the neighbourhood are the olive, the orange, the mulberry, and the carob; and the staple exports are oil, agricultural produce, fruits, and flowers. The harbour, which as yet only covers 10 acres, is being enlarged. In 1881 the population of the city was 54,953, and of the commune 66,279,—an increase respectively of about 9000 and 13,900 since 1872. During winter there is a large proportion of strangers from all parts of the world.

Protected towards the north by hills which rise stage behind stage to the main ridge of the Alps, Nice is celebrated for the mildness of its climate. The mean temperature is 60° Fahr., that of winter being 49°, of spring 56°, of summer 72°, and of autumn 63°. For a few nights in winter the mercury sinks below freezing point, but snow is practically unknown, falling, on an average, only half a day in the year. The highest reading of the thermometer is rarely above 90°. There are sixty-seven days with rain in the course of the year; but it usually falls in heavy showers which soon leave the sky clear again, though the whole annual amount exceeds 32 inches. Fine days and rainy days are almost equally distributed throughout the different seasons. The winds are very variable, sometimes changing several times a day. Apart from the ordinary land and sea breezes, the most frequent is the east wind, which is especially formidable during autumn. The south-west wind is moist and warm; the north-east, which is happily rare, brings storms of hail and even snow in winter. The mistral (from the north-west) and the tramontane (from the north) are generally stopped by the mountains; but when they do reach the city they raise intolerable dust-storms. For two thousand years the climate of Nice has been considered favourable in chest complaints. Those who are requiring rest, and those suffering from gout, asthma, catarrhs, rachitic affections, scrofula, stone, also experience benefit; but the reverse is the case when heart disease, nervous disorders, or ophthalmia are concerned. Autumn is the best season; in spring the sudden changes of temperature demand great care. Means of passing the time pleasantly are fairly abundant. The city is at its liveliest during the carnival festivities, in which, as at Rome, battles are waged with sweetmeats and flowers.

Nice (*Nicæa*) was founded about two thousand years ago by the Phocæans of Marseilles, and received its name in honour of a victory (νίκη) over the neighbouring Ligurians. It soon became one of the busiest trading stations on the Ligurian coast; but as a city it had an important rival in the town of Cemenelium, which continued to exist till the time of the Lombard invasions, and has left its ruins at Cimiez (Italian, Cemella), 2½ miles to the north. In the 7th century Nice joined the Genoese league formed by the towns of Liguria. In 731 it repulsed the Saracens; but in 859 and 880 they pillaged and burned it, and for the most of the 10th century remained masters of the surrounding country. During the Middle Ages Nice had its share in the wars and disasters of Italy. As an ally of Pisa it was the enemy of Genoa, and both the king of France and the emperor of Germany endeavoured to subjugate it; but in spite of all it maintained its municipal liberties. In the course of the 13th and 14th centuries it fell more than once into the hands of the counts of Provence; and at length in 1388 it placed itself under the protection of the counts of Savoy. The maritime strength of Nice now rapidly increased till it was able to cope with the Barbary pirates; the fortifications were largely extended and the roads to the city improved. During the struggle between Francis I. and Charles V. great damage was caused by the passage of the armies invading Provence; pestilence and famine raged in the city for several years. It was in Nice that the two monarchs in 1538 concluded, through the mediation of Paul III., a truce of ten years; and a marble cross set up to commemorate the arrival of the pope still gives its name, Croix de Marbre, to part of the town. In 1543 Nice was attacked by the united forces of Francis I. and Barbarossa; and, though the inhabitants, with admirable courage, repulsed the assault which succeeded the terrible bombardment, they were ultimately compelled to surrender, and Barbarossa was allowed to pillage the city and to carry off 2500 captives. Pestilence appeared again in 1550 and 1580. In 1600 Nice was taken by the duke of Guise. By opening the ports of the countship to all nations, and proclaiming full freedom of trade, Charles Emmanuel in 1626 gave a great stimulus to the commerce of the city, whose noble families took part in its mercantile enterprises. Captured by Catinat in 1691, Nice was restored to Savoy in 1696; but it was again besieged by the French in 1705, and in the following year its citadel and ramparts were demolished. The treaty of Utrecht in 1713 once more gave the city back to Savoy; and in the peaceful years which followed the "new town" was built. From 1744 till the peace of Aix-la-Chapelle (1748) the French and Spaniards were again in possession. In 1775 the king of Sardinia destroyed all that remained of the ancient liberties of the commune. Conquered in 1792 by the armies of the French Republic, the countship of Nice continued to be part of France till 1814; but after that date it reverted to Sardinia. By a treaty concluded in 1860 between the Sardinian king and Napoleon III. it was again transferred to France, and the cession was ratified by nearly 26,000 electors out of a total of 30,700. Nice is the seat of a bishopric, at present dependent on the archbishopric of Aix, and the headquarters of a military division forming part of the corps d'armée of Marseilles. Masséna and Garibaldi were natives of the city.

See Roubaudi, *Nice et ses environs*, Turin, 1843; Tisserand, *Hist. de la cité de Nice*, Nice, 1862; Lacoste, *Nice pittoresque et pratique*, Nice, 1876.

NICEPHORUS I., emperor of Constantinople from 802 to 811, born at Seleucia in Pisidia, is alleged on very doubtful authority to have been a descendant of Jaballah, who had been monarch of the small Arabian kingdom of Ghassán in the time of Heraclius, and for a time had professed the Mohammedan religion. In the reign of Irene he rose to the office of logothetes, or lord high treasurer, and in 802 he was joined by her favourite eunuchs in a plot by which she was dethroned and exiled, while he himself assumed the crown (October 31). Soon after his accession, Bardanes, one of his ablest generals, rose in revolt against him and received much powerful support, including that of Leo the Armenian and Michael the Armorian (names which reappear in history), but the skilful diplomacy of Nicephorus soon brought the rebel to the position of a suppliant, willing to accept the seclusion of a monastery. The conspiracy headed by the patrician Arsaber in 808 had a similar issue. In 803 Nicephorus had entered into a treaty with Charlemagne by which the limits of the two empires were amicably fixed,—Venice, Istria, the maritime parts of Dalmatia, and South Italy being assigned to the East, while Rome, Ravenna, and the Pentapolis were recognized as belonging to the West; this treaty was renewed in 810. Shortly after the retirement of Bardanes, who had been appointed to march against the Saracens, Nicephorus in person took the field against Haroun al-Rashid, but sustained a great defeat at Crasus in Phrygia; and subsequent inroads of his conqueror compelled him to sue for peace, which was granted only on condition of an annual tribute of 30,000 pieces of gold, besides three additional pieces (perhaps, as Finlay suggests, medallions of superior size) for himself, and three for his son Stauracius. By the death of Haroun in 809 Nicephorus was left free to turn his attention to the Bulgarians, whose warlike king, Crumn, had begun to harass the empire in the north; but six days after it had crossed the frontier the powerful Byzantine army was attacked in force by night, and Nicephorus, along with six patricians, many officers of high military rank, and a large number of rank and file, was put to the sword. Crumn is recorded to have made a drinking cup of the emperor's skull. After a brief reign of two months, Stauracius, who had been proclaimed emperor by the soldiers, was deposed by his brother-in-law, Michael Rhangabe. Nicephorus, who "though a brave soldier was essentially a statesman," gave considerable attention to the finance department of the empire, but did not escape the imputation of avarice and oppression. Ecclesiastically his reign is noted for the comparative success with which he asserted the supremacy of the civil power, and gave effective preponderance to imperial over monkish opinion.

NICEPHORUS II. (Phocas), emperor of Constantinople from 963 to 969, was member of a brave Cappadocian family which had previously furnished more than one distinguished general to the empire. He was born about 912, joined the army at an early age, and under Constantine VII., Porphyrogenitus, attained the high rank of magnus domesticus, or general of the East (954). In the almost continual struggle with the Saracens which this post implied he sustained severe defeat in 956, but retrieved his fame in 958 and again in 959 in Syria; and in July 960 he led the expedition against Crete which compelled Candia to surrender after a siege of ten months, and again brought the whole island under Byzantine rule. The long extinct honours of a triumph were revived to reward him on his return to Constantinople. In 962 he again set out with a large army against Syria; after forcing his way through the narrow passes of Mount Amanus, and compelling the principal cities to open their gates, he was pushing on towards the Euphrates when intelligence reached him in 963 that the emperor Romanus II. had died, leaving the empress Theophano regent for her infant sons. Justly fearing the intrigues of the able minister Joseph Bringas, he returned to Constantinople, after having previously obtained from Theophano and the patriarch Polyeuctes a guarantee for his personal safety; he then, with the help of the patriarch, procured for himself the supreme command of the army during the minority of the princes, and, after gaining over the officers and soldiers to his interest, consented to allow himself to be proclaimed emperor. He was crowned on August 16, and soon afterwards married Theophano, though the union was discountenanced by the patriarch on the alleged ground of a spiritual affinity. In 964 he resumed the war against the Saracens, and, though compelled to raise the siege of Tarsus, was successful in capturing Adana and Mopsuestia; in the following year Tarsus also was forced to surrender to himself, while Cyprus was reconquered for him by the patrician Nicetas. In 966 and 967 the internal affairs of the empire and threatening troubles in Hungary and Bulgaria detained him in Constantinople; but the spring of 968 saw him once more in the field against the caliph, and Laodicea, Hierapolis, Aleppo, Arca, and Emesa were added to his conquests. In the following year Antioch also fell, in the emperor's absence, into the hands of the patricians Burtzes and Peter, but Nicetas was less successful against Sicily. Meanwhile Nicephorus had not made himself so popular on the throne as in the camp. The heavy imposts he found necessary for the support of his expeditions more than counterbalanced, in public estimation, the glory he gained by them. His retrenchment of court largesses and pensions naturally made him many enemies, and he incurred just odium by employing debased coinage to meet the public debts while continuing to exact money of the old standard in payment of the taxes. An accidental tumult in the hippodrome, which had resulted in the loss of many lives, further increased his unpopularity, and, last of all, his fickle wife joined the number of his enemies and began to plot his death. He was assassinated in his sleeping apartment on the night of December 10, 969. At the head of the conspirators was his nephew John Zimisces, who immediately succeeded him.

NICEPHORUS III. (Botaniates), emperor of Constantinople from 1078 to 1081, belonged to a family which claimed descent from the Roman Fabii. He served in the army, and rose to be commander of the forces in Asia. In 1078 he assumed the purple at Nicæa, almost simultaneously with Nicephorus Bryennius (father or uncle of the historian of that name), who had revolted against Michael VII. at Adrianople; the aristocracy and clergy of the capital supported the claims of Botaniates, who was crowned on March 25, 1078. With the able help of Alexius Comnenus, the recalcitrant generals Ursel, Bryennius, and Basilacius were successively driven from the field, but soon afterwards the wakeful jealousy of the emperor was turned upon their conqueror, who was compelled to flee the court. Alexius, however, had hold of the army, and on April 1, 1081, ascended the throne, Nicephorus being forced to abdicate and become a monk of St Basil. He died in obscurity.

NICEPHORUS BRYENNIUS. See BYZANTINE HISTORIANS, vol. iv. p. 613.

NICEPHORUS, surnamed CALLISTI, the last of the Greek ecclesiastical historians, lived at Constantinople, perhaps as a monk in connexion with the church of St Sophia. He was born about the close of the 13th century, and died not later than 1356. His *Historia Ecclesiastica*, in eighteen books, brings the narrative down to the death of Phocas in 610; for the first four centuries the author is largely dependent on his predecessors, Eusebius, Socrates, Sozomen, Theodoret, and Evagrius, his additions showing very little critical faculty; in the later period his labours, based on documents now no longer extant, to which he had free access, though he used them also with small discrimination, are much more valuable. A table of contents of other five books, continuing the history to the death of Leo the Philosopher in 911, also exists, but whether the books were ever actually written is doubtful. A Latin translation of the *Historia* of Nicephorus, by Lange, appeared at Basel in 1553; the Greek text was edited for the first time by Fronton le Duc (2 vols. fol., Paris, 1630).

NICEPHORUS GREGORAS. See BYZANTINE HISTORIANS, vol. iv. p. 613.

NICEPHORUS, one of the Byzantine historians (see vol. iv. p. 614), surnamed PATRIARCHA, was patriarch of Constantinople from 806 to 815. He was born about 758; from his father Theodorus, one of the secretaries of the emperor Constantine Copronymus, who for his zeal as an image-worshipper had been scourged and dismissed into exile, he inherited literary talent as well as strong religious convictions. He was present as secretary to the imperial commissaries at that second council of Nice in 787 which witnessed the triumph of his opinions; but court vicissitudes soon afterwards drove him again into private life. In 806 he was suddenly raised by the emperor Nicephorus I. from the condition of a monk to the patriarchate of Constantinople, and this office he held until 815, when he accepted deposition rather than assent to the iconoclastic edict promulgated by Leo the Armenian in the previous year. He retired to the cloister of St Theodore, which he himself had founded, and died there in 828. Nicephorus is the author of a valuable and well-written compendium (*Breviarium Historicum*) of Byzantine history from 602 to 770, first printed at Paris in 1616, of a much less important *Chronologia compendiaria*, and of one or two controversial writings against iconoclasm.

NICHOLAS, St, of Myra, according to the Roman breviary (December 6) was a native of Patara in Lycia, and was given to his parents in answer to their prayers. From his earliest infancy he signally displayed the piety for which his whole life was remarkable, on Wednesdays and Fridays regularly refusing to receive nourishment from his nurse except once only, and that after sunset. While still a youth he was deprived of his parents, and the wealth that he thus early inherited he forthwith distributed to the poor. To this period belongs what may be called the characteristic deed of his life,—his secret bestowal of dowries upon the three daughters of a citizen fallen into poverty, who, unable to procure fit marriages for them, was minded to give them up to a life of shame. Having given himself wholly to God, Nicholas made a pilgrimage to Palestine, and in his voyaging miraculously stilled a storm by his prayers. On his return to his native province he visited Myra, the capital, where, as it fell out, the bishop had just died, and the chapter had been divinely advised to select as his successor a man named Nicholas who should be the first to enter the church next morning. Nicholas, thus plainly indicated, was duly consecrated, and displayed throughout his whole term of office every episcopal virtue. Under Maximian and Diocletian he was seized for his constancy, removed far from his diocese, and thrown into prison, where he lay until the days of Constantine, when he returned to Myra. He afterwards attended the council of Nice, and died a natural death not long after his return. His remains were subsequently removed to Bari (Barium) in Apulia. So far the authoritative Roman legend, the documentary evidence for which, however, does not take us farther back than to the 9th century at the earliest (Simeon Metaphrastes). Nicholas is not mentioned among the Nicene fathers by any of the church historians of that or the succeeding century, and the earliest extant trace of his existence is in the fact that a church was dedicated to him in Constantinople by Justinian about the year 560. Before the 12th century his name had become very prominent both in the Eastern and in the Western Church, it is difficult to tell precisely why; and to this day he is one of the most popular saints in the orthodox Greek communion. Among the miracles assigned to him is that of restoring to life three youths who had been murdered and salted down by an innkeeper in whose house they had taken lodging; thus Nicholas figures as the patron saint not only of poor maidens and of sailors but also of travellers and merchants. Children, and especially schoolboys, are also regarded as being especially under his guardianship, and in Russia and Greece, as well as throughout the north of Europe, the liberality of Nicholas or Klaus is yearly appealed to by them on the eve of his festival (December 6). His protection is specially invoked against thieves and losses by robbery and violence. It may be well to note that the "Old Nick" belonging to another cycle of legend has no connexion, as has sometimes been supposed, with the subject of the present article, that designation being etymologically connected with such words as Nixie, Nickar, and perhaps even with the river-name Neckar (see Grimm's *Deutsche Mythologie*).

NICHOLAS I., sometimes called The Great, and certainly the most commanding figure in the series of popes between Gregory I. and Gregory VII., succeeded Benedict III. in April 858. According to the annalist "he owed his election less to the choice of the clergy than to the presence and favour of the emperor Louis II. and his nobles,"—who can hardly have foreseen with what ability and persistency the rights of the holy see as supreme arbiter of Christendom were to be asserted even against themselves by the man of their choice. Of the previous history of Nicholas nothing is recorded. His pontificate of nine years and a half was marked by at least three memorable contests which have left their mark in history. The first was that in which he supported the claims of the unjustly degraded patriarch of Constantinople, Ignatius; the history of the conflict cannot be related here, but two of its incidents, the excommunication of Photius, the rival of Ignatius, by the pope in 863, and the counter-deposition of Nicholas by Photius in 867, were steps of serious moment towards the permanent separation between the Eastern and the Western Church. The second great struggle was that with Lothaire, the king of Lorraine (second son of the emperor Lothaire I., and brother of the emperor Louis II.), about the divorce of his wife Theutberga or Thietberga. The king, who desired to marry his mistress Waldrada, had brought a grave charge against the life of his queen before her marriage; with the help of Archbishops Gunther of Cologne and Thietgand of Treves, a confession of guilt had been extorted from Thietberga, and, after the matter had been discussed at more than one synod, that of Aix-la-Chapelle finally authorized Lothaire, on the strength of this confession, to marry again. Nicholas ordered a fresh synod to try the cause over again at Metz in 863; but Lothaire, who was present with his nobles, anew secured a judgment favourable to himself, whereupon the pope not only quashed the whole proceedings, but excommunicated and deposed Gunther and Thietgand, who had been audacious enough to bring to Rome in person the "libellus" of the synod. The archbishops appealed to Louis II., then at Benevento, to obtain the withdrawal of their sentence by force; but, although he actually occupied Rome (864), he was unsuccessful in obtaining any concession, and had to withdraw to Ravenna. Thietberga herself was now induced to write to the pope a letter in which she declared the invalidity of her own marriage, and urged the cause of Lothaire, but Nicholas, not without reason, refused to accept statements which had too plainly been extorted, and wrote urging her to maintain the truth steadfastly, even to the death if need were, "for, since Christ is the truth, whosoever dies for the truth assuredly dies for Christ." The imminent humiliation of Lothaire was prevented only by the death of Nicholas. The third great ecclesiastical cause which marks this pontificate was that in which the indefeasible right of bishops to appeal to Rome against their metropolitans was successfully maintained in the case of Rothad of Soissons, who had been deposed by Hincmar of Rheims. It was in the course of the controversy with the great and powerful Neustrian archbishop that papal recognition was first given (in 865) to the pseudo-Isidorian decretals, which had probably been brought by Rothad to Rome in the preceding year. (For some account of these, see Canon Law, vol. v. p. 17.) At an early period in his reign Nicholas also had occasion to administer discipline to John of Ravenna, who seems to have relied not only on the prestige of his famous see but also on the support of Louis II. After lying under excommunication for some time he made a full submission. Nicholas was the pope to whom Bogoris, the newly converted king of Bulgaria, addressed himself for practical instruction in some of the difficult moral and social problems which naturally arise during a transition from heathenism to Christianity. The letter from the holy see in reply to the hundred and six questions and petitions of the barbarian king is perhaps the most interesting literary relic of Nicholas I. now extant. He died on November 13, 867, and was succeeded by Hadrian II.

NICHOLAS II., a Burgundian, whose Christian name was Gerard, was archbishop of Florence when he was chosen (December 28, 1058) at that place to succeed Stephen IX. in the papal chair. Some time previously the old Roman feudatory barons had caused to be consecrated, under the name of Benedict X., John, cardinal bishop of Velletri, who, however, was speedily deposed. The election of Nicholas had been brought about by Hildebrand (afterwards Gregory VII.), and his whole pontificate derived its character from that master-spirit. Its first act of historical importance was the framing by the second Lateran council (April 1059) of the decree which vested the election of popes in the cardinal bishops in the first instance, the assent of the cardinal priests and deacons being next required, then that of the laity, and finally that of the emperor. It was at the same council that Berengarius of Tours was temporarily induced to admit the doctrine of the corporeal presence in the sacrament. In the following June Nicholas visited Apulia, accepted the submission of the Normans, and removed the ban of excommunication, investing Richard in the principality of Capua and Robert Guiscard in the dukedom of Apulia, Calabria, and Sicily. He died at Florence in June 1061, and was succeeded by Alexander II.

NICHOLAS III. (Giovanni Gaetano), a member of the noble house of Orsini, succeeded John XXI. as pope on November 25, 1277. Though his election was doubtless largely due to family influence, he was also personally a man of good endowments, and the record of his brief pontificate has more than one touch fitted to recall the grander manner of some of the greatest popes. In 1278 he extorted from the newly-elected and insecurely seated Rudolph of Hapsburg an absolute cession of the Romagna and of the exarchate of Ravenna, and in the same year he deprived Charles of Anjou of his vicariate of Tuscany; in the following year he compelled Charles to renounce his dignity of senator of Rome also, declaring himself perpetual senator, and his nephew Orso his vicar. He was understood to be planning with Rudolph an entirely new distribution of the thrones of the empire, by which the royal dignity was to be conferred on more than one member of the house of Orsini, when a stroke of apoplexy brought his career to a sudden close on August 22, 1280. Towards the beginning of his reign he repaired and strengthened the Lateran palace, and greatly enlarged the Vatican. For his simoniacal nepotism he has been placed by Dante in the third "bolgia" of the eighth circle of hell (*Inf.*, xix. 31 *sq.*). The successor of Nicholas III. was Martin IV.

NICHOLAS IV. (Girolamo de Ascoli), pope from February 22, 1288, to April 4, 1292, was born at Ascoli, of humble parentage. At an early age he entered the Franciscan order, of which he rose to be general in 1274, after the death of Bonaventura. It was in this capacity that in 1278 he condemned Roger Bacon to imprisonment on account of his writings. He subsequently became bishop of Præneste; and he was created cardinal by Nicholas III. Repeated meetings of the conclave upon the death of Honorius IV. resulted, ten months after the vacancy had occurred, in the election of Ascoli, whose first and almost only historical act was to annul the solemn treaty by which Charles the Lame (of Anjou) had obtained from Alphonso III. of Aragon his release from prison,—"the most monstrous exercise of the absolving power which had ever been advanced in the face of Christendom" (Milman). The revival of the old and expiring enthusiasm of the crusading epoch was a cause he had much at heart; and it was partly at least with the object of stirring up the Mongols against the hated Saracens that he gave John of Monte Corvino and other members of his order their missions to China. The fall of Ptolemais, the last remnant of the Christian dominion in Palestine (1291), greatly affected him, and combined with other disappointments to hasten his death. Celestine V. succeeded.

NICHOLAS V. (Tommaso Parentucelli), the pope whose name is most intimately associated with the revival of learning, was the son of a physician, and was born at Sarzana, near Spezzia, in 1389. He received a good education at Bologna, became tutor in the Albizzi and Strozzi families at Florence, and ultimately entered into the service of Albergata, bishop of Bologna. He accompanied his patron on several embassies, and gained so high a reputation for diplomatic ability and for learning that shortly after Albergata's death he himself obtained the see of Bologna, was sent by Eugenius IV. on an embassy into Germany, and in December 1446 was made a cardinal. In less than three months he was pope in succession to Eugenius,—a small majority of the electors, indisposed to the strongest candidate, Cardinal Prospero Colonna, having united upon Parentucelli as a man who had made no enemies. His policy as pope seemed clearly marked out for him. The church was reaching the end of a period of strife and schism. The firmness of Eugenius IV. had at length almost beaten down the emperor, the antipope, and the council of Basel; the wisdom and moderation of Nicholas V. completed the work. Within two years the emperor made peace, the antipope abdicated, and the council dissolved itself. Nicholas hoped for a period of tranquillity, and determined to exhibit the papacy to the world as the protector of art and learning. "To the demand of Germany for reformation," says Mr Creighton, "he answered by offering culture." He aimed especially at making Rome architecturally a worthy capital of the Christian world: he repaired its fortifications, began the rebuilding of its cathedral, enlarged and adorned its thoroughfares, and traced much of the plan of restoration executed by his successors. But his great glory was his active co-operation in the revival of learning. He collected manuscripts from all quarters, caused them to be multiplied by transcription, commissioned the most competent scholars to translate Greek books into Latin, and gathered around him the most distinguished humanists of his day, Poggio Bracciolini, Valla, Filelfo. Under him the papacy regained much of its former lustre, and till late in his reign his administration was disturbed by no unfortunate events. In January 1453 the conspiracy of Stefano Porcaro was detected on the eve of breaking out. The pope and cardinals were to have been seized, their effects pillaged, and Rome declared a republic. Nicholas was terrified, and showed himself angry and cruel. On May 29 of the same year Constantinople was taken by the Turks. The fault was not the pope's, who had ineffectually sent his galleys to the rescue; yet he could not but feel that a stain had fallen upon his pontificate. He proclaimed a crusade, but this was an undertaking for which he was constitutionally unfit; he failed to kindle the zeal of others, and many doubted his own. Exhausted by repeated attacks of gout, he died on March 24, 1455. Before his death he summoned the cardinals, and enumerated the good works he had been enabled to perform, "by God's blessing of peace and tranquillity in my days." These last words sufficiently express the general scope of his policy. He was rather a scholar than an ecclesiastic or a statesman, yet enough of both to perform his part on the world's stage with sufficient credit; it is, however, his principal distinction to have been a learned and art-loving pope, and to have formed that alliance between the papacy and intellectual culture which subsisted for the next hundred years. He was succeeded by Calixtus III.

NICHOLAS V. (Pietro di Corvara), antipope in Italy from 1328 to 1330, during the pontificate of John XXII. at Avignon, was a native of the Abruzzi and a member of the Franciscan order. He owed his nomination to the papacy, and his election (May 12, 1328) by popular acclamation, to the influence of the excommunicated emperor Louis the German, on whose head he placed the crown after his own enthronement. After spending four months in Rome he withdrew along with Louis to Viterbo and thence to Pisa; but, on the revolt of that city from Ghibellinism, he was compelled to throw himself on the mercy of John. Carried to Avignon, on making full confession and abjuration of his heresies and impieties (September 6, 1330), he was kept in honourable imprisonment in the papal palace until his death in 1334.

NICHOLAS I. (1796–1855), czar of Russia, third son of Paul I., was born at Tsarkoe-Selo on the 25th June 1796. His elder brothers were Alexander and Constantine, of whom the former was twenty years his senior. Their father was murdered in 1801, and Alexander then became emperor. The education of Nicholas was conducted under the care of his mother, a pious but narrow-minded woman. He had not, like his eldest brother, whose education was directed by the empress Catherine, the advantage of associating in early life with men of culture and of modern ideas. Nor was he early introduced either to military or to political life. He was brought up in retirement, and even during the invasion of Russia by Napoleon in 1812 he was not permitted to serve in the army. His tastes, however, were all military, and his favourite studies mathematics and fortification. During the campaign of 1814 in France he was allowed to come to the allied headquarters, but not to take part in any engagement. He was present during the occupation of Paris in 1815, and in the following year was sent to travel on the Continent and to visit England, where his striking personal appearance excited the admiration of Sir Walter Scott. He married in 1817 Louise Charlotte, daughter of Frederick William III., king of Prussia, and this union had for half a century an important effect on the history of Prussia and Germany at large. After his marriage he received a military command from his brother, and from this time forward he gave his utmost attention to the mechanical part of military affairs, rejoicing in the occupations of a drill-sergeant, and identifying himself so completely with his soldiers that civil costume became insupportable to him, even when on visits to sovereigns who, like Queen Victoria, would have preferred to see him in less warlike guise. Alexander having no sons, Constantine was heir to the throne. This brutal and ignorant prince had, however, the sense to recognize his own unfitness for the task of governing an empire, and by a secret agreement with the reigning sovereign he renounced his rights in favour of Nicholas. Alexander died on December 1, 1825. Constantine, who was in Poland, showed no inclination to prefer his claims; the edict of the late emperor appointing Nicholas his successor was opened, and the younger brother was called by the highest authorities of Russia to assume the crown. He nevertheless refused, and, as it would seem, in perfect sincerity, until Constantine had formally confirmed his renunciation. The delay led to serious consequences. Conspiracies against the late emperor and in favour of a freer government had been formed in the army and among the nobles; and when the troops at St Petersburg were called upon to take the oath to Nicholas, revolt broke out. The young czar showed great nerve and courage, but the mutiny was not put down without bloodshed, and the impression which it left on his mind never passed away. Despotic by nature, trained in the midst of the monarchical reaction that followed the French wars, and accustomed to hear the earlier liberal tendencies of his brother Alexander spoken of as mere vagaries that had happily been abandoned, Nicholas saw in the outbreak of his soldiers in 1825 a warning never to relax the grasp of authority. The maintenance of despotic power was a duty to which he devoted himself with the deepest religious conviction. At the accession of Nicholas, Russia had been for some years on the brink of war with the Porte. Greece was in insurrection, and Russia had its own specific causes of complaint in consequence of the alleged infraction of the privileges of the Danubian provinces guaranteed by the treaty of Bucharest. It had long been the effort of European diplomatists to dissuade Alexander from interfering on behalf of Greece, and to find a peaceful solution for the difficulties in which Russia was more directly concerned. The Greek cause had, however, at length excited so much sympathy that the British Government took advantage of the accession of Nicholas to send the duke of Wellington to St Petersburg to propose some joint action on behalf of Greece. The attempt succeeded: England and Russia undertook to tender their mediation, requiring the sultan to grant the Greeks a modified independence, and the concert was subsequently joined by France. The result of this combination, and of Ottoman obstinacy, was the destruction of the Turkish fleet at Navarino by the allied squadrons, and the establishment of Greek independence. This, however, did not terminate the contentions between Turkey and Russia. The Porte itself challenged war, and in 1828 hostilities broke out. Nicholas took part in the first and unsuccessful campaign of 1828, but allowed his generals to act by themselves in 1829; and the march of Diebitsch over the Balkans was followed by the peace of Adrianople. A Persian war had already been successfully concluded, and Russia had gained thereby two provinces in the east. The peace of Adrianople gave it only an improved frontier on the eastern shore of the Black Sea. In 1830 the fall of the Bourbons made an end of the friendship which existed between France and Russia, and restored the union between the three despotic courts of St Petersburg, Vienna, and Berlin, which had been framed in 1814 and interrupted by the course of Eastern affairs. Nicholas did not refuse to recognize Louis Philippe, but he would never accord him the usual title of *Mon Frère*, and he lost no opportunity of treating him with contempt. The insurrection of Poland soon followed. Alexander had received the grand-duchy of Warsaw from the congress of Vienna as a separate kingdom, united with Russia only in the person of its ruler; and he had fulfilled his promise of granting it a constitution, and treating it as a distinct nationality. The violation of these rights by the grand-duke Constantine, who was governor of Poland, and the virtual establishment of dictatorial rule, caused the insurrection against Nicholas. The Polish leaders sent their demands to St Petersburg; Nicholas replied that he would only answer them with cannon. The diet now pronounced his dethronement as king of Poland, and the armed struggle began. It was a long and doubtful one, for Poland had a regular army of its own; but the victory was at length won by Nicholas, and he showed no mercy to his conquered enemy. Poland was made a Russian province; its liberties were utterly extinguished; its defenders were sent by thousands to Siberia. During the years that followed, the struggle between the sultan and his vassal, Mehemet Ali, pasha of Egypt, brought the Eastern question again to the front of European affairs. The treaty of Unkiar-Skelessi seemed for a moment to have placed Turkey in absolute dependence upon the czar, who guaranteed it his protection against all internal and external enemies; but France and England now made their influence felt, and the ultimate settlement was the work of all Europe. Nicholas visited England in 1844, and tried, but unsuccessfully, to frame some plan of joint action with that country in view of the possible collapse of the Ottoman empire. The revolutionary spirit which the czar so passionately abhorred, was now about to convulse Europe again. He watched the events of 1848, and strengthened his army. So long as revolution did not approach his own frontiers he was willing to hold his hand; but when Hungary rose against the Hapsburgs and established its national independence he felt that Poland would soon follow its example, and sent his soldiers to crush the Magyar armies which Austria had not been able to subdue. When the victory of despotism was secured, he joined with the Austrian Government in demanding from the Porte the surrender of the Hungarian leaders who had taken refuge in Turkey. But it was not long permitted to him to play the part of international autocrat. His aggressions upon the Ottoman empire, continued up to 1853, brought England and France into the field against him. His armies were defeated at Alma and Inkermann, his fortresses besieged; and in the bitterness of defeat death came upon him, and carried him from a world where, with the deepest conviction that he was doing God service, he had inflicted so much evil on mankind (February 18, 1855). He died as he had lived, a brave man, and his last words were those of simple prayer. Shortly before his death he is said to have laid two injunctions upon his successor,—to liberate the serfs, and never to grant Poland a constitution. (C. A. F.)

NICHOLAS OF BASEL, generally called by his friends the Great Layman or the Great Friend of God, was the founder of a singular widespread association of pious people who, in the age of monastic fraternities, lived in special religious fellowship in a fashion altogether different from the common usage of the time. They did not renounce their property, they took no vows of celibacy or of obedience, but they met together for pious conversation, they corresponded with each other, they had common ideas about conversion, holy living, and Christian faith and duty. They were the Quietists of the 14th century, and called themselves the "Friends of God."

Nicholas was the son of a rich merchant of Basel, and was born in that town about the year 1308. Left his own master at the age of twenty-four, by the death of his parents, and possessed of considerable wealth, he went out into the world to enjoy life and seek adventures. He became engaged, burgher as he was, to a maiden of noble rank. The night before his betrothal, as he was praying, he had a vision which resulted in his breaking off his marriage, leaving home and friends, and devoting himself to an ascetic life. After some years spent in solitude, severe bodily mortifications, and deep soul struggle, Nicholas gained the religious peace he sought, and from this time devoted himself to turning men around him from sin to God. He did not enter any religious order; he remained, what he loved to call himself, a layman; he neither preached nor heard confessions, but by means of a singular gift of personal influence he drew round him disciples from all classes of society. His followers did not form themselves into a sect or into an order. Some of them were priests, monks, and nuns, but some of them lived in the world, were nobles, knights, rich merchants, and their wives. Their religious opinions were what are commonly called mystical; and indeed all the more notable mystics of the 14th century were under the influence of Nicholas and belonged to the Friends of God. They did not break loose from the outward order of the church; they observed, though with no great scrupulosity, sacraments, fasts, and festivals; but they looked on all such things as unimportant compared with that absolute resignation to the divine will in all things which was their leading principle.

The most striking event in the life of Nicholas is his meeting, in 1346, with Tauler, the Dominican preacher of Strasburg, which had the result of entirely changing the character of Tauler's religious views and of his preaching.

In the society of the Friends of God there came to be a small inner circle of thirteen, who attached themselves to Nicholas, lived in community, and were sent by him on long journeys to maintain communication among the brethren in the different countries of Europe. In 1380, two years after the beginning of the "Great Schism," these thirteen friends met together for the last time, coming from Italy, Hungary, and different parts of Germany. The state of the church at the time seemed to fill them with despair. Nicholas had long, by the many secret means he had at his command, exercised a great though invisible influence on church appointments and ecclesiastical affairs, but now he seemed to feel it hopeless to strive any longer against the increasing wickedness of the times, and he broke up the society he had formed, releasing his followers from their obedience, and went with two friends into Austria. Ten years later one Martin of Mainz, a follower of Nicholas, was burnt as a heretic, and in the act of accusation there are allusions to Nicholas which show that he was still living. But, as he must have been then nearly eighty-five years of age, it cannot have been much later, though the actual date is unknown, when, with two companions, he was burnt as a heretic at Vienna, the chief crime of which he was accused being that "he audaciously affirmed that he was in Christ and Christ in him."

Our information about Nicholas comes to us chiefly through Rulmann Mérswin, a banker of Strasburg, who with his wife belonged to the Friends of God. Merswin collected many leters and documents relating to the society, and bequeathed them to a convent of the Knights of St John which he founded in Strasburg. They lay hid for centuries, while the memory of Nicholas perished; even his name was forgotten, and mediæval students were aware only of a mysterious presence who was sometimes referred to as "the Great Friend of God." At last Professor C. Schmidt discovered the documents in the library of the university, and was able to identify Nicholas with Tauler's mysterious visitor and with the Great Layman.

See Carl Schmidt, *Nicolaus von Basel, Leben und Wirken*, Vienna, 1866; *Die Gottesfreunde im vierzehnten Jahrhundert*, Jena, 1854; and Miss Winkworth, *History and Life of Johann Tauler*, London, 1857.

NICHOLS, JOHN (1745–1826), a printer, ranks among the most industrious and voluminous of English antiquaries and collectors. He was editor of the *Gentleman's Magazine* for nearly half a century, from 1778 till his death, and, partly in his magazine and partly in his numerous volumes of *Anecdotes* and *Illustrations*, made invaluable contributions to the personal history of English men of letters in the 18th century. The project of compiling these volumes grew gradually out of his business as a printer. Born in London in 1745, he had been the apprentice and successor of Bowyer, a learned and accomplished printer, a graduate of Cambridge, who had printed for many distinguished men; and on the death of this revered master, in 1778, he issued a brief memoir. This he afterwards expanded into biographical and literary anecdotes of Mr Bowyer and his friends; and, materials accumulating upon him, he expanded his design into a sort of anecdotical literary history of the century, many important letters being placed at his disposal. Large as this work is, it formed but a small part of the indefatigable collector's activity, of which a full account is given in a memoir by Chalmers accompanying the extension of the *Illustrations* by Mr J. B. Nichols. One of his favourite works was an antiquarian history of the town and county of Leicester; and another, on which he himself set great value, a collection of documents illustrating the manners and expenses of ancient times in England. He produced six volumes concerning the progresses, processions, and festivities of Elizabeth and James. In the days of his apprenticeship he wrote and published two volumes of poetry, but had the good sense to throw his genial energies afterwards into other channels. Vol. xcvi. of the *Gentleman's Magazine* contains a portrait of him at the age of eighty and several well-earned tributes to the worth of his busy and fruitful life. He died November 26, 1826.

NICHOLSON, William (1753-1815), a writer on natural philosophy, was born in London in 1753, and after leaving school made two voyages as midshipman in the East India service. He subsequently entered an attorney's office, but, having become acquainted, in 1775, with Wedgwood, he resided for some years at Amsterdam as agent for the sale of pottery. On his return to England he was induced by Holcroft to devote himself to the composition of light literature for periodicals, assisting that writer also with some of his plays and novels. Such work was little in accordance, however, with his scientific tastes, and he employed himself on the preparation of *An Introduction to Natural Philosophy*, which was published in 1781, and was at once successful. A translation of Voltaire's *Elements of the Newtonian Philosophy* soon followed, and he now entirely devoted himself to scientific pursuits and philosophical journalism. In 1784 he was appointed secretary to the general chamber of manufacturers of Great Britain, and he was also connected with the society for the encouragement of naval architecture, established in 1791. Besides his literary labours, he bestowed much attention upon the construction of various machines for comb-cutting, file-making, cylinder printing, &c.; he also invented an aerometer. In 1800 he commenced in London a course of public lectures on natural philosophy and chemistry, and about this period he made the discovery of the decomposition of water by the agency of galvanism, which was said to be the foundation of Sir Humphrey Davy's discoveries in the decomposition of the alkalins. In 1797 the *Journal of Natural Philosophy, Chemistry, and the Arts*, generally known as *Nicholson's Journal*, the earliest work of the kind in Great Britain, was begun; it was carried on till 1814. During the later years of his life Nicholson's attention was chiefly directed to engineering works at Portsmouth, at Gosport, and in Southwark; these with his other employments placed him in an affluent position, which, however, from domestic and other causes, he was unable to maintain. He died in poverty in 1815.

A memoir was written by his son long after his death, but it never was published. Besides considerable contributions to the *Philosophical Transactions*, Nicholson wrote translations of Fourcroy's *Chemistry* (1787) and Chaptal's *Chemistry* (1788), *First Principles of Chemistry* (1788), and a *Chemical Dictionary*; he also edited the *British Encyclopædia, or Dictionary of Arts and Sciences*, 6 vols. 8vo, London, 1809.

NICHOLSON, William (1784–1844), portrait-painter, was born at Newcastle-on-Tyne in 1784. Having settled in Edinburgh, he became, along with Thomas Hamilton the architect, one of the founders and most vigorous promoters of the Scottish Academy, of which in 1826 he was appointed the first secretary, a position which he held for about seven years. He is known by his life-sized portraits in oils, and still more favourably by his very delicate and faithful likenesses in water-colours. In 1818 he published a series of etchings entitled Portraits of Distinguished Living Characters of Scotland. They are executed in an effective and painter-like fashion, mainly from the artist's own water-colours, and include portraits of Sir Walter Scott, Lord Jeffrey, Robert Burns, and Professor Wilson. Nicholson died at Edinburgh on August 16, 1844.

NICIAS was the leader of the aristocratic party at Athens and one of the foremost figures in Athenian history during the Peloponnesian War. Although he opposed the democratic tendencies which gave the tone to Attic politics at this time, his high character for piety and honesty, combined with his wealth and influence, gained the confidence of the people, and raised him to the highest offices in their gift. His abilities were not equal to the duties he was called on to perform, and in the severe trial of the Sicilian expedition his conduct showed such timidity in critical situations, such wavering in the general plans of warfare, such obstinacy in details where piety or superstition were concerned, that the disastrous end of the siege of Syracuse must be mainly laid to his charge. It is unnecessary here to write his life, a task which would be almost equivalent to writing the history of Athens for a number of years. See Greece, vol. xi. p. 102.

NICKEL, a chemical term, designating a metallic element which was discovered by Cronsted in 1751. In 1754 he succeeded in isolating it (in an impure state), and found it to be a "halbmetall" (semi-metal). Afterwards finding it to be present largely in "kupfer-nickel,"[1] he borrowed from that mineral the name for his new element.

Nickel (Ni) is one of the less abundant of elements. It is contained in the sun's atmosphere and in all meteoric iron. Of nickel minerals the following are of metallurgic importance:—nickel-blende, NS; arsenical nickel glance, $Ni(As.S)_2$; niccolo-cobaltic pyrites, $(Ni, Co, Fe)_3S_4$; garnierite, $5(Ni, Mg)O . 4SiO_2 + \frac{3}{2}H_2O$. Almost invariably part of the nickel is replaced by cobalt, and not unfrequently part of the arsenic by antimony, or occasionally bismuth. Nickel ores are in general complex mixtures of one or more of these minerals, with sometimes very large proportions of copper, iron, and other foreign metallic ores and gangue. The metallurgy of nickel accordingly is a complex subject which cannot be fully treated here.

As an example of a sulphureous ore may be quoted that niccolo-cupreous pyrites which is being worked at Dillenburg in Nassau. The process employed is closely analogous to the old process of copper-smelting as explained in Metallurgy (vol. xvi. p. 61). The fully refined mat ("Concentrations-Stein") consists of 35 per cent. of nickel, 43 of copper, 2 of iron, and 20 of sulphur. The article Metallurgy (*ut sup.*), under arsenides, describes a process which, when applied to arseniferous cobalt and nickel ores, yields the cobalt as smalt, the nickel as part of a "speis" (an alloy of arsenides). The same process serves occasionally for (so to say) collecting small proportions of nickel diffused throughout oxidized ores, the arsenic requisite being introduced in the form of native arsenide of iron.

If an arseniferous ore contains copper, the process sometimes is modified by addition of iron pyrites or some other sulphureous material, and so conducted that, in addition to a nickelous speis, a cupreous mat is produced. The speis and mat do not mix, but form separate layers, the mat, as the lighter of the two, going to the top.

All sulphureous, arsenical, or poor oxidized nickel ores are being wrought by methods analogous to the above, in so far at least as they all aim, in the first instance, at the production of a speis or mat from which the metal has to be extracted by subsequent operations. Direct methods are being used only in conjunction with one kind of ore, namely, that rich oxidized nickel ore which was discovered in New Caledonia about 1875, and has since been imported into Europe in large and yearly increasing quantities. It occurs in veins within serpentine, and consists of garnierite mixed with more or less of oxide of iron, chrome-iron ore, and a little black oxide of cobalt. It is valuable chiefly through its absolute freedom from arsenic and sulphides. Most of the ore goes to France, where it is worked chiefly by two firms. Christofle at St Denis treats the ore with hydrochloric acid, and from the solution recovers the metal by methods analogous to those customarily employed in connexion with speis and mats. Garnier, at the Septêmes Works near Marseilles, makes straight for the metal. The powdered ore, after mechanical purification (by such methods as are explained in Metallurgy, vol. xvi. p. 59), is mixed with charcoal and fluor-spar (or other flux) and worked into a paste with coal-tar, which is then shaped into bricks or walnut-sized stones. The ore thus prepared is then manipulated pretty much in the same way as an iron ore is for the production of pig-iron. The furnaces used are about 18 feet high, and worked with cold wind. Garnier in this manner produces three kinds of metal:—(1) an almost pure carbide of nickel, which needs only be decarbonized to be converted into pure metal; (2) an alloy of the carbides of nickel and iron: and (3), from mixtures of nickel and iron ore, a nickeliferous pig-iron which, when refined and puddled, yields a very superior kind of wrought iron, harder and less liable to oxidation than the ordinary metal.

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[1] Said to be originally a term of contempt—"goblin copper," meaning a tricky ore, which promises copper but does not yield it.

Extraction of Metal from Mats and Speises.—The first step as a rule is a roasting process, which, in the case of a speis, yields an arseniferous mixture of oxides; a mat, in general, passes into a mixture of oxide, sulphate, and unchanged sulphide. Either roasted material is easily disintegrated by being treated with aqueous muriatic or sulphuric acid, with formation of a solution of nickel-salt, contaminated, in general, with arsenic, antimony, bismuth, copper, iron, cobalt, and zinc, which must be removed by suitable analytical methods. But, as we have no space to consider this problem in its general form, we will assume antimony, bismuth, and zinc to be absent. If, in this case, the iron predominates sufficiently over the arsenic, these two can both be removed at one stroke by evaporating the solution to dryness and calcining the residue at the lowest sufficient temperature; the iron-salt only is reduced to an insoluble basic salt (of Fe_2O_3), which includes all the arsenic, so that by redissolving in water and passing the liquor through a filter press we obtain a solution which, by theory, is free of iron and arsenic. Practically, however, a trace of iron remains, and must be removed by precipitation with carbonate of lime in the cold and filtration. A repetition of the same process at about 60° C. eliminates the copper, so that only the cobalt is left, which, however, is no impurity metallurgically, and consequently may be suffered to remain, but, if present in sufficient quantity, must be recovered for its own sake. This is effected by addition of bleaching powder and gentle heating. If care be taken to let a little of the cobalt escape, the rest goes down as black peroxide, Co_2O_3, sufficiently pure for its ordinary applications. From the filtered nickel solution the metal is precipitated, by addition of milk-of-lime, as a green hydrated oxide, which is collected and washed in a filter press. The precipitate, being inconveniently gelatinous and bulky, is next rendered compact by a gentle calcination, and, if it is, as usual, contaminated with sulphate of lime, is freed from this impurity by judicious washing with highly dilute muriatic acid or otherwise. The purified oxide then, either by mere pressure or with the help of starch or other plastifying material, is shaped into little cubes of about one centimetre's side, embedded in charcoal dust within graphite or fire-clay crucibles and heated in a fire. A dull red heat suffices for the mere reduction of the oxide to metal; but a strong red heat is applied in order to cause the nickel cubes to sinter together and become fast and compact. No degree of red heat will fuse them unless they are contaminated with copper. There is no need to explain how, with cupriferous leys, the process has to be modified to lead ultimately to a fused regulus of copper-nickel available for the preparation of german silver. From a copper-free liquor, provided only it contains its iron all as ferric salt, a pure nickel precipitate can be obtained at once by addition of oxalic acid. The (green) oxalate of nickel precipitate need only be washed, dried, and ignited to be converted into a pure (but partially oxidized) metal. This process has actually been applied, at least experimentally, in the working of the New Caledonian ore, with this modification, however, that the oxalic acid was recovered by boiling the oxalate of nickel with carbonate of potash, and precipitating the acid by milk-of-lime from the alkaline solution.

Ordinary cube-nickel contains from 94 to 99 per cent. of real nickel. The purest commercial metal is that extracted from the New Caledonian ore; it often contains only a fraction of a per cent. of impurities. The present writer has no information regarding the mechanical characters of such highly-refined New Caledonian metal. The best commercial cube-nickel (although it may contain less than 1 per cent. of impurities) is always utterly devoid of plasticity; it breaks under the hammer, although the pure metal, as was shown as early as 1804 by Richter, and confirmed by Deville in 1856, is highly ductile and tenacious. To obtain the pure metal, the best laboratory method is to prepare pure oxalate and heat it intensely in a close crucible made of quicklime, when it is obtained as an almost silver-white regulus, which has all the ductility and malleability of the best wrought iron combined with one and a half times the breaking strain and greater hardness. It is attracted by the magnet. Its specific gravity is 8·279 for ingot, and 8·666 (Richter) for the forged metal. It can be welded at a red heat like wrought iron, which it exceeds in relative infusibility. It does not tarnish even on long exposure to the air. Sulphuretted hydrogen does not blacken it. Liquid water, even in the presence of air, has no action upon it. Aqueous non-oxidizing acids act upon it as they do on iron, but more slowly. Nitric acid and aqua regia dissolve it as nitrate $Ni(NO_3)_2$ and chloride $NiCl_2$ respectively. When heated strongly in air it is gradually oxidized; it decomposes steam, slowly, at a red heat. In brief, it unites in itself all the virtues of iron with some of the characteristics of the noble metals, and yet its application in the mechanical arts was never thought of until Fleitmann in 1879 made a most remarkable observation. Finding that even the purest nickel which he could produce on a manufacturing scale was brittle, he attributed this defect not to the traces of metallic impurities still present in it but to occluded carbonic oxide, and tried to remove this by addition of magnesium to the molten metal. He succeeded beyond expectation: one-eighth of a per cent. of magnesium added to the metal (in an atmosphere of carbonic acid) before pouring imparted to it all the plasticity of the pure metal.[1] Fleitmann also found that the thus purified nickel could be permanently welded on wrought iron, and that a combination plate thus produced could be rolled out into the thinnest sheet without breach of continuity. Since that time his firm (Fleitmann & Witte of Iserlohn) have made a business of the manufacture of cooking utensils and other useful articles out of such nickel-plated iron. Physiological experiments on a dog, instituted at the instance of the firm, showed that the metal is innocuous. Cobalt, as Fleitmann found, behaves in every respect like nickel, and even exceeds it in whiteness and brilliancy.[2] The writer has for more than a year been in the habit of using a nickel basin (supplied by Messrs Johnson & Matthey of London) for operations with caustic-alkali lye, and finds it to work admirably—better, in fact, than a silver one.

Nickel Electroplating.—This art, invented by Böttcher about 1848, has developed into an important industry, especially in the United States. The best kind of solution to use is one of the double sulphate of nickel and ammonia, which should be saturated at 25° and used in conjunction with a plate of nickel as positive electrode.

Alloys.—Nickel alloys were used practically long before Cronsted's discovery of the metal. GERMAN SILVER (*q.v.*), long known to the Chinese as "Pack Tong," *i.e.*, "white copper," consists of nickel, copper, and zinc united in varying proportions,—3 of copper, 1 of zinc, and 1 of nickel is said to give the most silver-like alloy. An alloy of "german" with real silver has lately been introduced as "tiers-argent"; it consists of silver 27·6, copper 59·0, zinc 9·6, nickel 3·4 per cent. In the United States, in Belgium, and in Germany, an alloy of 1 of nickel with 3 of copper serves for the making of minor coins. All these alloys are non-magnetic.

Salts.—For nickel salts see CHEMISTRY and chemical handbooks.

Analysis.—Nickel-salts, as a rule, and their solutions more generally, exhibit a green colour. Sulphuretted hydrogen does not precipitate the metal from solutions containing free mineral acid. Sulphide of ammonium, from neutral or alkaline solutions, precipitates a black sulphide which, like sulphide of cobalt, when once produced is almost insoluble in dilute cold hydrochloric acid, and has the specific property of being very appreciably soluble in a mixture of yellow (*i.e.*, ordinary) sulphide of ammonium and free ammonia, forming a dark coffee-brown solution. Unlike iron-salts, nickel-salts are not oxidized into sesquioxide (analogous to Fe_2O_3) salts by nitric acid or chlorine. Carbonate of baryta, which readily precipitates oxide of iron (Fe_2O_3) and alumina, does not precipitate nickel from its solutions in the cold. By means of these reactions nickel is easily distinguished and separated from all other metals except cobalt. To test a nickel solution for cobalt, add excess of nitrite of potassium and acidify with acetic acid. Cobalt, if present, comes down gradually as "Fischer's salt," a double nitrite of Co_2O_3 and K_2O.

The atomic weight of nickel, according to the latest determinations, is identical with that of cobalt:—$Ni(=Co)=58{\cdot}6$, O being 16.

Karmarsch and Heeren's *Technisches Wörterbuch* gives a very full account of the metallurgy of nickel, quite up to date (1883). (W. D.)

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[1] It is perhaps well to repeat a warning given by Fleitmann, that the introduction of the magnesium, if not very cautiously done in the absence of air, leads to violent explosions.

[2] It is only fair to state that as early as the Universal Exhibition of Vienna in 1873 the American Wharton exhibited vessels of pure forged nickel, prepared from the spongy metal by strong compression under a steam hammer at a red heat.

NICOBARS, a cluster of eight large and twelve small islands in the Bay of Bengal, lying to the south of the Andamans, between 6° 40′ and 9° 20′ N. lat. and between 93° and 94° E. long., with a population in 1881, exclusive of aborigines, of 308. The largest island, the Great Nicobar, is about 30 miles in length and from 12 to 15 in breadth. Many of the islands are hilly, with peaks of considerable height; others are flat and covered with forests of cocoa-nut trees. All are well wooded. Tropical fruits grow in abundance, and yams of fine quality and size. The Nicobar swallow is the builder of the edible bird's nest, which, together with trepang (bêche-de-mer), cocoa-nuts, tortoiseshell, and ambergris, forms the whole export of the islands. Agriculture is quite unknown. Trade is carried on by barter with the crews of English, native, and Malay vessels. The inhabitants, a race of savages with Malay-like features, had an evil reputation for piracy, and murder of the crews of vessels visiting the island or ship-wrecked upon them. An inquiry by the Government of India into a case of this sort in 1869 led to the annexation of the whole archipelago, the administration being placed under the superintendent of the Andaman Islands.

NICOL, William, the inventor of the invaluable polarizing prism (LIGHT, vol. xiv. p. 612), was born about 1768, and died at Edinburgh in September 1851. Nothing is known of his early history, beyond the fact that, after amassing a small competence as an itinerant popular lecturer on various parts of natural philosophy, he settled in Edinburgh to live a very retired life in the society of his apparatus alone. Besides the invention of his prism (of which we are told that he himself did not understand the mode of action), he devoted himself chiefly to the examination of fluid-filled cavities in crystals, and of the microscopic structure of various kinds of fossil wood. In the preparation of the sections of wood he introduced improvements of the utmost value. Before his time only the roughest slices were employed. His skill as a working lapidary was very great; and he executed a number of lenses of garnet and other precious stones, which he preferred to the achromatic microscopes of the time. The majority of the few, though important, papers which he published are to be found in the old and new *Edinburgh Philosophical Journal*.

NICOLAI, Christoph Friedrich (1733–1811), a German author and bookseller, was born on the 18th of March 1733, at Berlin, where his father was a bookseller. He was educated at a real-school in Berlin, and in 1749 went to Frankfort-on-the-Oder to learn his father's business. In 1752 he returned to Berlin, and soon began to take part in current literary controversy. At that time the leaders of critical opinion in Germany were Gottsched and Bodmer. In 1755 Nicolai issued a book, *Briefe über den jetzigen Zustand der schönen Wissenschaften*, in which he tried to show that each of these writers was in his own way narrow and intolerant. This work secured for the author the friendship of Lessing, whose power as a critic was then beginning to be recognized. In 1757 Nicolai devoted himself exclusively to literature; but next year, after the death of his brother, who had continued the elder Nicolai's business, he found it necessary to resume the life of a bookseller. He did not, however, abandon his literary labours. In association with his friend Moses Mendelssohn he had established, in 1757, the periodical called *Bibliothek der schönen Wissenschaften*, and this he conducted until 1760. From 1761 to 1766 he contributed to the *Briefe, die neueste Literatur betreffend*; but it was Lessing's work that made this series famous. For many years (from 1765 to 1791) Nicolai edited the *Allgemeine deutsche Bibliothek*, a periodical which served as the organ of the so-called popular philosophers, who warred against authority in religion and against what they conceived to be extravagance in literature. The new movement of ideas represented by Herder, Goethe, Schiller, Kant, and Fichte he was incapable of understanding, and he made himself ridiculous by foolish misrepresentation of their aims. Of Nicolai's independent writings, perhaps the only one of permanent value is his *Anekdoten von Friedrich II.* His romances are forgotten, although *Leben und Meinungen des Herrn Magisters Sebaldus Nothanker* had a certain reputation in its day. His *Beschreibung einer Reise durch Deutschland und die Schweiz* was attacked by many writers, and it proved that in middle life he had become in a new way not less bigoted than the authors whose bigotry he had spent much of his time in exposing. Nicolai died on the 8th of January 1811. He wrote an *Autobiography*, which was published in 1806. See *Nicolai's Leben und literarischer Nachlass*, by Göckingk (1820).

NICOLAIEFF. See NIKOLAIEFF.

NICOLAS, Sir Nicholas Harris (1799–1848), English antiquary, was born 10th March 1799, the fourth son of John Harris Nicolas of East Looe in Cornwall, whose Breton ancestors had settled there on the revocation of the edict of Nantes. He entered the navy in 1808, and was promoted lieutenant in 1815. At the close of the war he retired from the service and began to study for the bar. He was called at the Inner Temple in 1825, but his business as a barrister was chiefly confined to the claims of peerage before the House of Lords, his special genealogical knowledge rendering his assistance in such cases invaluable. On genealogical questions and those connected with the descent of ancient families his researches have thrown much important light. Of works on these subjects he published a considerable number, the most useful being *Notitia Historica* (1824; expanded in 1835 for "Lardner's Cabinet Cyclopædia" into *Chronology of History*), *Synopsis of the Peerage of England* (2 vols., 1825), and *Testamenta Vetusta* (2 vols., 1826). Nicholas wrote a number of valuable biographical notices for Pickering's Aldine edition of the poets, among others those of Chaucer, Surrey, Wyatt, Collins, Cowper, Thomson, Burns, and Kirke White. His "Lives of Isaak Walton and Charles Cotton," prefixed to Pickering's edition of the *Complete Angler*, are also the fruit of independent and original research. The service of Nicolas in the royal navy seems to have left an impress on his mind which his antiquarian studies tended rather to deepen than obliterate; and it is where his passion for antiquarian research was exercised in illustrating the historic glories of England and the heroic deeds of famous individuals that he found the most congenial scope for his powers. His *magnum opus* is his *History of the Orders of Knighthood of the British Empire* (4 vols., 1841–42). For his previous researches into the history of the orders he was, in 1831, made a knight of the Hanoverian Guelphic order and in 1832 chancellor of the Ionian order of St Michael and St George, and in 1840 he was advanced to the grade of the Grand Cross. In his later years Nicolas was occupied chiefly with works connected with the naval achievements of England. He published *Dispatches and Letters of Admiral Lord Viscount Nelson* (7 vols., 1844–46); and he was engaged until a few days before his death in editing the papers of Sir Hudson Lowe. He died at Cape Curé, near Boulogne, August 3, 1848.

Sir Harris Nicolas left an unfinished *History of the British Navy*, in 2 vols. He became a member of the council of the Society of Antiquaries in 1826, but on account of a controversy with the other members in regard to the management of its affairs he withdrew in 1828. Besides exposing in various pamphlets what he regarded as serious defects in its management, he made frequent reference to them in the *Retrospective Review*, of which he was joint-editor. He also instituted an inquiry into the proceedings of the Record Commission, the publications of which he regarded as not commensurate in value with the money expended on them. But, although, owing to the warmth of his feelings and his keen interest in his subject, Nicolas was apt to involve himself in keen controversy, he never cherished personal animosity, and his motives were otherwise above suspicion. A complete list of the writings of Nicolas will be found in the *Gentleman's Magazine* for October 1848.

NICOLE, PIERRE (1625–1695), one of the most distinguished of the Port-Royalists, a scholar of great excellence, and, according to Bayle (who had no particular reason for praising him), "one of the best writers in Europe," was born at Chartres in 1625. Like his friend Pascal he was a precocious boy, though his precocity showed itself in classics and in miscellaneous reading, not in mathematics, and it was when he was transferred from his native town to Paris to finish his education that the rising school of Port Royal fixed its attention upon him. At an early age he was made a master in the Port Royal school, where his special department was classical instruction, though he is said to have taken no small part in the famous *Art de Penser* or Port Royal logic. He shared in the history of the school, and with the exception of Arnauld and Pascal may be said to have been its most accomplished member. Not a little of the materials of the *Provinciales* is said to be due to him, and at the completion of Pascal's great work he translated it into Latin. One of the most virtuous men in France, he was a favourite of the notorious duchess of Longueville for politico-theological reasons, and he was the immediate master of Racine. This latter circumstance brought about an incident thoroughly discreditable to the dramatist. Nicole was the author of certain *Lettres sur les Visionnaires* or *à un Visionnaire*, as they are most frequently cited. The actual title of the collected work is *Les Imaginaires et les Visionnaires* (1667). In these he had attacked Desmarets de Saint Sorlin, and with the excessive puritanism which characterized his sect had reflected on fiction and the drama generally. Racine, without a shadow of personal provocation, replied in two letters of great asperity, of which the first was actually published, and the second only delayed (it was published after its author's death) owing to the judicious counsel of Boileau. But Nicole made no reply, and indeed public opinion condemned Racine without hesitation. Nicole, who, owing to the theological disputes in which he was concerned, had never fully taken orders, and who had been compelled at one time to leave France, devoted himself in his later years chiefly to moral philosophy. The first volume of his *Essais de Morale* appeared in 1671, and the rest of his life was chiefly occupied on this book, though he wrote many others. He was warmly admired by many of the best judges among his contemporaries, Madame de Sévigné deserving especial mention, and numerous selections of his ethical works have appeared in recent times. Modern opinion hardly recognizes in Nicole the right to hold the place close to Pascal which his own time accorded to him. His style is clear, simple, and correct, but a little flat and monotonous; his thought sensible, just, and charitable, but somewhat destitute of depth, subtlety, and originality. He was certainly one of the best men of his time, but as certainly not one of the greatest; and his reputation was due first to his scholarship, secondly to his moderation. He died of apoplexy, November 16, 1695, and had latterly somewhat separated himself from the Jansenists. Numerous stories are told of his personal timidity and unreadiness in oral argument. It does not appear that his works (by far the most important of which is the already-mentioned *Essais de Morale*, Paris, 1671, *sq.*) were ever collected.

NICOMEDES I., son of Zipœtes, succeeded his father as king of Bithynia in 278 B.C. He enlarged and consolidated the kingdom, which had been founded by his father in 288, and founded the great city of Nicomedia as the capital. He was for some time engaged in war with Antiochus of Syria, and invited the Gauls under Leonnorius and Lutarius to cross into Asia Minor and help him against his foreign and domestic enemies. His reign seems to have been long, prosperous, and uneventful; the year of his death is unknown.

NICOMEDES II., fourth in descent from the preceding, was son of Prusias II. He was so popular with the people that his father became jealous and sent him to Rome. Here he was so much favoured by the senate that Prusias sent an ambassador, Menas, to Rome, giving him secret orders to assassinate Nicomedes. Menas revealed the plot, and persuaded the prince to rebel against his father. Supported by Attalus II., king of Pergamum, he was completely successful, and ordered his father to be slain before the altar of Zeus in Nicomedia. Nicomedes reigned from 149 to 91 B.C., and during his long reign adhered steadily to the Roman alliance. He made himself for a time master of Paphlagonia, and married Laodice, widow of Ariarathes VI., in order to have a claim on her deceased husband's kingdom of Cappadocia.

NICOMEDES III., son and successor of the preceding. His brother Socrates contested the kingdom with him, relying on the alliance of the great Mithradates. Nicomedes was established on the throne by Roman help in 90 B.C., but expelled by Mithradates in 88, after a great defeat in Paphlagonia. In 84 he was restored by the Romans. In 81 Julius Cæsar, sent to him by his commander, became so intimate with him as to give rise to great calumnies at home. He died in 74 B.C., and beqeathed his kingdom to the Romans.

NICOMEDIA, a town at the head of the Sinus Astacenus, which opens on the Propontis, was built in 264 B.C. by Nicomedes I., king of Bithynia, and has ever since been one of the chief towns in this part of Asia Minor. It still retains the ancient name under the form Ismid, and it is the terminus of a short railway. Its situation made it a convenient centre of government. It was the metropolis of Bithynia under the Roman empire (see NICÆA); Diocletian made it the capital of the East, and fixed his court there. It retained its importance even after Constantinople was founded, for the roads from all parts of Asia Minor to the capital converge at Nicomedia.

NICOPOLI. See NIKOPOLI.

NICOPOLIS, or ACTIA NICOPOLIS, an ancient city of Epirus, founded 31 B.C. by Octavian in memory of his victory over Antony and Cleopatra at Actium. The colony, composed of settlers from a great many of the towns of the neighbouring countries (Ambracia, Anactorium, Calydon, Argos Amphilochicum, Leucas, &c.), proved highly successful, and the city was considered the capital of southern Epirus and Acarnania, and obtained the right of sending five representatives to the Amphictyonic council. On the spot where Octavian's own tent had been pitched he erected a sanctuary to Neptune adorned with the beaks of the captured galleys; and in further celebration of his victory he instituted the so-called Actian games in honour of Apollo Actius. The city was restored by the emperor Julian, and again after the Gothic invasion by Justinian; but in the course of the Middle Ages it was supplanted by the town of Prevesa. The ruins of Nicopolis, now known as Paleoprevesa (Old Prevesa), lie about 3 miles north of that city, on a small bay of the Gulf of Arta (Sinus Ambracius) at the narrowest part of the isthmus of the peninsula which separates the gulf from the Ionian Sea. Besides the acropolis, the most conspicuous objects are two theatres (the larger with twenty-seven rows of seats) and an aqueduct which brought water to the town from a distance of 27 miles. See Wolfe in *Jour. Roy. Geog. Soc.*, 1833; Leake, *Northern Greece*; Bursian, *Geog. von Griechenland*.

Nicopolis was also the name of (1) a city in Cappadocia in the valley of the Lycus, founded by Pompey on the spot where he defeated Mithradates; (2) a city in Egypt, founded by Octavian 24 B.C. to commemorate his final victory over Antony; and (3) a city in Thrace at the junction of the Iatrus with the Danube, founded by Trajan in memory of his victory over the Dacians (Nikup).

NICOSIA is the name in common use, though originally a mere corruption of the Greek name Lefkosia, for the capital of Cyprus. It is situated in the midst of the great plain of the Mesaria, which traverses the island from sea to sea, and is nearly equidistant from the Gulf of Morphu at one end and that of Famagosta at the other. Though the name of Lefkosia (*Λευκωσία*) is undoubtedly Greek, it is not found in the ancient geography of the island; and, though the discovery of some ancient tombs in the immediate neighbourhood prove that the site was inhabited in very early times, no mention is found of it before the reign of Constantine, by whom it was fortified with a circuit of walls, which continued to exist down to the time of the Venetians. It became the capital of the island under the kings of the Lusignan dynasty, who were the rulers of Cyprus from 1192 to 1489,—an advantage which it probably owed to its inland, and somewhat central, situation, though in other respects its position affords few advantages. It stands in a barren and treeless plain, on the banks of the river Pedias, which is, however, a mere shingly bed during the greater part of the year, and the town is dependent for its supply of water upon an aqueduct by which it is conveyed from the neighbouring hills. Like many other Oriental towns, Nicosia has rather an imposing effect from a distance, in consequence especially of its lofty walls, built by the Venetians to replace the previously existing circuit, which remain unbroken to the present day. Above these towers the beautiful Gothic cathedral, now converted into a mosque. But the interior of the city is a mere labyrinth of narrow streets, and presents an aspect of great decay. The population, which was previously estimated at 16,000, was found by an actual census, taken in 1879, to amount to only 11,197 souls, of whom 5628 were Mohammedans and 5251 Greeks. Since the occupation of Cyprus by the English, some improvements have been introduced at Nicosia, which still continues to be the capital of the island, and the residence of the British commissioner, as well as of the Greek archbishop. A new carriage road has also been constructed from thence to Larnaca, which is becoming a place of considerable trade. But the natural disadvantages of its situation will probably prevent Nicosia from ever rising again to an important town. At the present day it is worthless as a fortress, on account of its being completely commanded from the neighbouring heights.

NICOSIA, a city of Italy in the province of Catania in Sicily, about 50 miles west of Catania, near the rise of the Seminato. It is a picturesque mediæval-looking place, with a cathedral in the Norman style, a communal library, mineral wells, and a trade in grain, wine, and oil. The population of the commune was 14,731 in 1861 and 15,460 in 1881; that of the town was 14,508 in 1871.

Nicosia probably represents the ancient Herbita, which gallantly maintained its independence against Dionysius of Syracuse. Destroyed by the Saracens, the city was restored by the Normans, and the Lombard colony introduced by Roger is said to have left its trace in the popular speech. The bishopric dates from 1816.

NICOTINE. See TOBACCO.

NIEBUHR, BARTHOLD GEORG (1776–1831), the historian of ancient Rome, was the son of Karsten Niebuhr, noticed below, and was born at Copenhagen on August 27, 1776. His family was of Hanoverian extraction. In his infancy his father removed to Meldorf in South Ditmarsh, where he had received a Government appointment, and devoted his leisure to the instruction of his son. From the earliest age young Niebuhr manifested extraordinary precocity, and especial interest in history and politics. From 1794 to 1796, being already a finished classical scholar and acquainted with several modern languages, he studied at the university of Kiel, applying himself to mathematics, logic, philosophy, and other studies previously neglected. He there formed the most important friendship of his life, that with Madame Hensler, the widowed daughter-in-law of one of the professors, and a woman of unusual strength of character, six years older than himself. He also made the acquaintance of her sister, Amelie Behrens, whom he subsequently married. After quitting the university he became private secretary to Count Schimmelmann, Danish minister of finance, but finding that the post did not allow him sufficient leisure for study, he quitted it for an appointment at the royal library. He shortly afterwards travelled in Great Britain, and spent a year at Edinburgh studying agriculture and physical science. His observations on England and Scotland, conveyed in letters to his betrothed, are exceedingly interesting; but he failed to obtain that confidence in the capacity of an educated community for self-government which residence in a free country might have been expected to bestow, and which would have saved him much sorrow, and most of his errors in practical politics. He says, nevertheless, "my early residence in England gave me one important key to Roman history. It is necessary to know civil life by personal observation in order to understand such states as those of antiquity. I never could have understood a number of things in the history of Rome without having observed England." He also acquired in Scotland a feeling for nature, in which he had previously been remarkably deficient. In 1799 he returned to Denmark, where he was soon appointed assessor in the East India department of the Board of Trade, and secretary for the affairs of the Danish consulates in Barbary. In 1800 he married and settled at Copenhagen. In 1804 he became chief director of the National Bank, but in September 1806, after negotiations which had extended over more than a year, quitted this for a similar appointment in Prussia. The step was a false one as concerned his personal interests, and not highly creditable to his patriotism as a Danish subject; but it is not to be regretted, since, without the release from public life which it ultimately occasioned, we should not have possessed his *Roman History*.

He arrived in Prussia on the eve of the catastrophe of Jena, and shared to the full all the disasters and miseries which overwhelmed the monarchy. He accompanied the fugitive Government to Königsberg, where he rendered considerable service in the commissariat, and was afterwards still more useful as commissioner of the national debt, and by his opposition to ill-considered schemes of taxation. He was also for a short time Prussian minister in Holland, where he endeavoured without success to contract a loan. The extreme sensitiveness of his temperament, however, disqualified him for politics; he proved impracticable in his relations with Hardenberg and other ministers, and in 1810 retired for a time from public life, accepting the more congenial appointment of royal historiographer and professor at the university of Berlin. He commenced his lectures with a course on the history of Rome. The enthusiastic reception these experienced filled him with delight. He recognized that he had found his vocation, and henceforth regarded the history of Rome from the earliest age to Augustus as the task of his life. The first two volumes, based upon his lectures, were published in 1812, but attracted little attention at the time owing to the absorbing interest of political events. In 1813 Niebuhr's own attention was diverted from history by the uprising of the German people against Napoleon; he entered the landwehr, and ineffectually sought admission into the regular army. He edited for a short time a patriotic journal, *The Prussian Correspondent*, joined the headquarters of the allied sovereigns, and witnessed the battle of Bautzen, and was subsequently employed in some minor negotiations. In 1815 he lost his father, whose life he subsequently wrote; and in July his beloved wife, whose health had long been declining, expired, enjoining him to finish his *History*. He next accepted the post of ambassador at Rome, which he probably thought would assist his historical labours, and departed to assume that office in July 1816. On his way he discovered in the cathedral library of Verona the long-lost *Institutes* of Gaius, afterwards edited by Savigny, to whom he communicated the discovery under the impression that he had found a portion of Ulpian. Before his departure for Rome he had married his wife's niece, an amiable young person, but inferior intellectually to his first wife, and almost equally delicate in constitution. Although devoted to him, she could in no way replace her predecessor. Nor was he happy in other respects. He disliked the Italians, and found himself unable to proceed as he wished with his *History*. These causes, acting upon a naturally querulous and despondent temper, produced a general dissatisfaction and discouragement which coloured all his views of human affairs, and deprived the world of the benefit that it might have received from the observations of one endowed with such profound insight and such noble sympathies. While his distrust made him ungenerous to those who were contending for a better order of things, his appreciation of the lessons of history withheld him equally from siding with the reactionary party. His position in his latter years was hence one of great isolation, not uncheered, however, by the sympathy of friends and disciples such as Savigny and Bunsen. During his residence in Rome he discovered and published fragments of Cicero and Livy, aided Cardinal Mai in his edition of Cicero *De Republica*, and shared in framing the plan of Bunsen and Platner's great work on the topography of ancient Rome, to which he contributed several chapters. He also, on a journey home from Italy, deciphered in a palimpsest at St Gall the fragments of Flavius Merobaudes, a Roman poet of the 5th century. In 1823 he resigned the embassy and established himself at Bonn, where the remainder of his life was spent, with the exception of some visits to Berlin as councillor of state. He here rewrote and republished (1827–28) the first two volumes of his *History*, and composed a third volume, bringing the narrative down to the end of the First Punic War, which he did not himself entirely complete, but which, with the help of a fragment written in 1811, was edited after his death by Professor Classen. He also assisted in Bekker's edition of the Byzantine historians, and delivered courses of lectures on ancient history, ethnography, and geography, and on the French Revolution, which were published from notes after his death. In February 1830 his house was burned down, but the greater part of his books and manuscripts were saved. The revolution of July in the same year was a terrible blow to him, and filled him with the most dismal anticipations of the future of Europe. He died on January 2, 1831, from a chill taken in coming home from a news-room where he had been eagerly studying the trial of the ministers of Charles X. His wife survived him only nine days. He left several children by her; his first marriage had been childless.

Niebuhr's great work counts among epoch-making histories both as marking an era in the study of its special subject, and for its momentous influence on the general conception of history. "The main results," says Dr Schmitz, "arrived at by the inquiries of Niebuhr, such as his views of the ancient population of Rome, the origin of the plebs, the relation between the patricians and plebeians, the real nature of the ager publicus, and many other points of interest, have been acknowledged by all his successors." Other alleged discoveries, such as the construction of early Roman history out of still earlier ballads, have not been equally fortunate; but if every positive conclusion of Niebuhr's had been refuted, his claim to be considered the first who dealt with the ancient history of Rome in a scientific spirit would remain unimpaired, and the new principles introduced by him into historical research would lose nothing of their importance. He suggested, though he did not elaborate, the theory of the myth, so potent an instrument for good and ill in modern historical criticism. He brought in inference to supply the place of discredited tradition, and showed the possibility of writing history in the absence of original records. By his theory of the disputes between the patricians and plebeians arising from original differences of race he drew attention to the immense importance of ethnological distinctions, and contributed to the revival of these divergences as factors in modern history. More than all, perhaps, since his conception of ancient Roman story made laws and manners of more account than shadowy lawgivers, he undesignedly influenced history by popularizing that conception of it which lays stress on institutions, tendencies, and social traits to the neglect of individuals. History, so treated, always inclines to degenerate into mere disquisition; and if Niebuhr were weighed in the scales of Livy it might be questioned whether he could even claim to rank among historians. That his rank should be so high is a proof of the extension which the definition of history has received in our day. An historian should before all things tell a story. Niebuhr is often engaged in proving that there is no story to tell. The peculiar character of his work is incidentally expressed by himself. "That," he says, "which would be harmonious in a national and poetical historian would be out of tune in a work written more than eighteen hundred years later by a foreigner and a critic. His task is to restore the ancient tradition." He is not, that is to say, an historian but an historical critic. It would therefore be unjust to try him by the standard of great artists in history like Gibbon, eminent in narrative, in character-painting, in historical grouping and light and shade. His intense admiration for Livy proves how greatly he himself valued such accomplishments, but he makes no attempt to emulate them. Such an endeavour could have had no place in the treatment of early Roman history according to the principle he had prescribed for himself; and it is perhaps fortunate for his fame that the pen dropped from his hand as he was slowly emerging from the regions of historic twilight into a clear day where the actions of statesmen and generals are no longer a matter of uncertainty, and only require to be interpreted by their motives. There are indeed in the latter pages of his history evidences of deep human sympathy, and a capacity for viewing men and things in the concrete, as, for instance, in his treatment of Pyrrhus; but this tendency is continually checked and controlled by his propensity to analytical criticism. Had his work been carried down, as he designed, to the period of Augustus, he would have given a masterly study of such episodes as the legislation of the Gracchi, he would have thrown the clearest light on the constitutional questions between Cæsar and his adversaries, he would now and then have illuminated the character of a great man by a flash of inspiration; but as a whole his history would have lacked life, colour, and movement. It must be added that, if his style is not precisely inelegant, even the refined literary skill of his English translators has failed to render it attractive. Whence, then, is this history not merely valuable, but delightful? The answer must be from its freshness, its elation of real or supposed discovery, the impression it conveys of actual contact with a great body of new and unsuspected truth. We seem to be at once learning and unlearning; we see many new things, and old things as we never saw them before. It is an intellectual emancipation, momentous for the world and the individual, even if particular conclusions should prove to be hasty, and particular details inaccurate. In this sense Niebuhr was justified in his proud assumption that "the discovery of no ancient historian would have taught the world so much as my work." His further prediction "that all that may hereafter come to light from ancient and uncorrupted sources will only tend to confirm or develop the principles I have advanced" has not received equal confirmation. The theory on which he laid so much stress of the derivation of ancient Roman history from popular ballads has been refuted by Sir George Lewis, and now finds little acceptance. The general scepticism as to the credibility of ancient history implied in his method went too far, and has been succeeded by a legitimate reaction fortified by such practical arguments as the recent archæological discoveries at Ilion and Mycenæ, and more lately at Samos, in the deserts of Moab, and even on the confines of Ethiopia. Writing, it is evident, was more ancient and more practised; oral tradition was more disciplined (as might have been inferred from a memorable passage in Plato's *Timæus*); there was more even of a judicial and critical spirit in antiquity than was surmised by Niebuhr. The testimony of Xanthus to the Lydian origin of the Etruscans, so summarily set aside by him, would now be considered strong *prima facie* evidence. Yet, after every deduction, Dr Leonhard Schmitz, prefacing the English translation of the *Roman History* by Mommsen which has for readers of general cultivation superseded Niebuhr, is able to say of the latter, "The main pillars of his grand structure are still unshaken." The endowments which enabled him to achieve so much in the absence of so many of the historian's most essential gifts may be characterized as learning, memory, sagacity, imagination. His erudition is marvellous for a man so much engaged in public affairs, and the perfect ease with which it is wielded is even more rare and admirable. This facility was greatly assisted by the prodigious memory which remembered things not only in themselves but in their relations to other things, and hence would often quite unexpectedly bring one circumstance to bear upon the interpretation of another. Niebuhr's sagacity is considerably overestimated when it is spoken of as "divination"; this dangerous term, however, may be serviceable in expressing his faculty for remote inference, and for detecting how much may be implied in a statement, an allusion, or an omission previously disregarded. It must be confessed that this faculty was sometimes perverted by a tendency to paradox, particularly observable in some of his minor speculations, such as his disquisitions on the dates of Quintus Curtius and Petronius. Imagination, nevertheless, was Niebuhr's most signal endowment,—not the historical imagination that reanimates actors departed from the world's theatre, but the critical imagination that makes past social conditions living and real. In the pourtrayal of men Niebuhr's touch is uncertain, but his treatment of institutions is an actual contact. Everything becomes alive to him, and to the reader's elation at finding himself thus apparently introduced to realities where he had looked only for abstractions must be ascribed much of the overwhelming influence and success of a work so deficient in the ordinary attractions of history.

Niebuhr's other works are interesting, but would not of themselves have made a great reputation. The notes of his Bonn lectures on ancient history and geography disappointed expectation, but expectation had been pitched unreasonably high. They were not finished compositions, and could not be more than useful and suggestive commonplace books. A detailed examination of their *obiter dicta* by the light of recent discovery and more exact research would be highly interesting. His lectures on the French Revolution, delivered in 1825, though well worth hearing, were not worth publishing, especially as the editor cannot vouch for their verbal or even their substantial fidelity. The *Kleine Schriften* include many valuable essays. His letters form one of the most interesting collections of correspondence extant, alike for the multiplicity of important subjects treated in them, and their revelation of the writer in all his strength and weakness. The luminous profundity of his remarks is frequently startling. Like Coleridge he seems to have an intuitive faculty for descending below the apparent surface of things, while he is no more successful than Coleridge in applying this gift to the appreciation of the practical problems of his own age. There is hardly another book from which it would be possible to select more entirely perverse and erroneous views respecting human society in general, and more admirable observations on individual men and things. A selection of remarks and aphorisms, both from his correspondence and his historical writings, would be a compilation of great value.

Niebuhr's personal character was in most respects exceedingly attractive. His heart was kind and his affections were strong; he was magnanimous and disinterested, simple and honest. He had a kindling sympathy with everything lofty and generous, and framed his own conduct upon the highest principles. His chief defect was an over-sensitiveness leading to peevish and unreasonable behaviour in his private and official relations, to hasty and unbalanced judgments of persons and things that had given him annoyance, and to a despondency and discouragement which have frustrated the great good he might have effected as a critic of public affairs from the point of view of a lofty morality. His imagination sometimes usurps the functions of his judgment, and his sagacity is traversed by a vein of paradox. In this, as in many other features of his intellectual character, he strikingly resembles Bentley, but his moral constitution is totally dissimilar.

The principal authority for Niebuhr's life is the *Lebensnachrichten*, prepared by Madame Hensler in 1838, and consisting mainly of correspondence linked by a brief biographical narrative. In the English translation by Miss Winkworth (1852) a great part of the correspondence is omitted, but the narrative is rendered more full, especially as concerns Niebuhr's participation in public affairs. It also contains interesting communications from Bunsen and Professor Loebell, and select translations from the *Kleine Schriften*. The reminiscences of Francis Lieber (London, 1835) convey a pleasing view of Niebuhr's character, and preserve passages of his conversation when ambassador at Rome. The first edition of his *Roman History* was translated into English by F. A. Walter (1827), but was immediately superseded by the translation of the second edition by Julius Hare and Connop Thirlwall, completed by Dr William Smith and Dr Leonhard Schmitz (last edition, London, 1847–51). The *History* has been discussed and criticized in a great number of publications, the most important of which, perhaps, is Sir George Cornwall Lewis's *Essay on the Credibility of the Early Roman History*. The *Lectures on Ancient History* have been translated by Dr Schmitz (London, 1852–53). (R. G.)

NIEBUHR, KARSTEN (1733–1815), Eastern traveller, was born at Lüdingworth, Lauenburg, on the southern border of Holstein, March 17, 1733, the son of a small farmer. He had little elementary education, and for several years of his youth had to do the work of a peasant. His bent was towards mathematics, and he managed to obtain some lessons in surveying. It was while he was working at this subject that one of his teachers, in 1760, proposed to him to join the expedition which was being sent out by Frederick V. of Denmark for the scientific exploration of Egypt, Arabia, and Syria. To qualify himself for the work of surveyor and geographer, he studied hard at mathematics for a year and a half before the expedition set out, and also managed to acquire some knowledge of Arabic. The expedition sailed in January 1761, and, landing at Alexandria, ascended the Nile and devoted some time to an examination of the pyramids and of the hieroglyphic writings of Egypt. Proceeding to Suez, Niebuhr made a visit to Mount Sinai, and in October 1762 the expedition sailed from Suez to Jiddah, journeying thence overland to Mocha. Here in May 1763 the philologist of the expedition, Van Haven, died, and was followed shortly after by the naturalist Forskål. San'a, the capital of Yemen, was visited, but the remaining members of the expedition suffered so much from the climate or from the mode of life that they returned to Mocha. Niebuhr seems to have saved his own life and restored his health by adopting the native habits as to dress and food. From Mocha the ship was taken to Bombay, the artist of the expedition dying on the passage, and the surgeon soon after landing. Niebuhr was now left alone, the only surviving member of the expedition. He stayed fourteen months at Bombay, and then returned home by Muscat, Bushire, Shiraz, and Persepolis, visited the ruins of Babylon, and thence went to Baghdad, Mosul, and Aleppo. After a visit to Cyprus he made a tour through Palestine, crossing Mount Taurus to Brussa, reaching Constantinople in February 1767, and Copenhagen in the following November. On his return Niebuhr at once set himself to the task of preparing the records of the expedition. His first volume, *Beschreibung von Arabien*, was published at Copenhagen in 1772, the Danish Government defraying the expenses of the abundant illustrations. This was followed in 1774–78 by other two volumes, *Reisebeschreibung von Arabien und anderen umliegenden Ländern*. The fourth volume was not published till long after his death, in 1837, under the editorship of Niebuhr's daughter. He also undertook the task of bringing out the work of his friend Forskål, the naturalist of the expedition, under the titles of *Descriptiones Animalium*, *Flora Ægyptiaco-Arabica*, and *Icones Rerum Naturalium* (Copenhagen, 1775–76). To a German periodical, the *Deutsches Museum*, Niebuhr contributed papers on the interior of Africa, the political and military condition of the Turkish empire, and other subjects. He married in 1773, and for some years held a post in the Danish military service which enabled him to reside at Copenhagen. In 1778, however, he accepted a position in the civil service of Holstein, and went to reside at Meldorf, where he died, April 26, 1815.

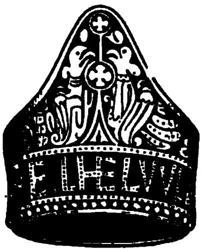
Niebuhr was in no sense a genius nor even a man of many accomplishments, but he was one of the best scientific travellers that ever lived. He was well equipped for the particular service which he had to perform in connexion with the Eastern expedition; above all, he was an accurate and careful observer, had the instincts of the scholar, was animated by a high moral purpose, and was rigorously conscientious and anxiously truthful in recording the results of his observation. His works have long been classical, and even now must be consulted by any one who desires to have the most trustworthy accounts, not only of the geography, but of the people, the antiquities, and the archæology of much of the district of Arabia which he traversed. His narratives are simple, and he himself is kept almost entirely in the background. He was a genuine peasant in many respects to the end of his life, having many of the peasant's virtues as well as failings.

French and Dutch translations of his narratives were published during his lifetime, and a condensed English translation, by Robert Heron, of the first three volumes in Edinburgh, 1792. His distinguished son Barthold published a short *Life* at Kiel in 1817; an English version was issued in 1838 in the *Lives of Eminent Men*, published by the Society for the Diffusion of Useful Knowledge.

NIELLO (Italian form of Latin *nigellum*, diminutive of *niger*, "black"; late Greek, *μελανόν*), a method of producing delicate and minute decoration on a polished metal surface by incised lines filled in with a black metallic amalgam. In some cases it is very difficult to distinguish niello from black enamel; but the black substance differs from true enamel in being metallic, not vitreous. Our knowledge of the process and materials employed in niello-work is derived mainly from four writers,—Eraclius the Roman (a writer probably of the 11th century), Theophilus the monk, who wrote in the 12th or 13th century,[1] and, in the 16th century, Ben. Cellini[2] and Giorgio Vasari.[3] These, with the exception of Eraclius, whose account is slightly different, agree closely in their description of the process. The design was cut with a sharp graving tool on the smooth surface of the metal, which was usually silver, but occasionally gold or even bronze. An alloy was formed of two parts silver, one-third copper, and one-sixth lead; to this mixture, while fluid in the crucible, powdered sulphur in excess was added; and the brittle amalgam, when cold, was finely pounded, and sealed up in large quills for future use. A solution of borax to act as a flux was brushed over the metal plate and thoroughly worked into its incised lines. The powdered amalgam was then shaken out of the quills on to the plate, so as to completely cover all the engraved pattern. The plate was now carefully heated over a charcoal fire, fresh amalgam being added, as the powder fused, upon any defective places. When the powder had become thoroughly liquid, so as to fill all the lines, the plate was allowed to cool, and the whole surface was scraped, so as to remove the superfluous niello, leaving only what had sunk into and filled up the engraved pattern. Last of all the nielloed plate was very highly polished, till it presented the appearance of a smooth metal surface enriched with a delicate design in fine grey-black lines. This process was chiefly used for silver work, on account of the vivid contrast between the whiteness of the silver and the darkness of the niello. As the slightest scratch upon the metal received the niello, and became a distinct black line, ornament of the most minute and refined description could easily be produced.

The earliest specimens of niello now existing belong to the Roman period. Two fine examples are in the British Museum. One is a bronze statuette of a Roman general, nearly 2 feet high, found at Barking Hall in Suffolk. The dress and armour have patterns partly inlaid in silver and partly in niello. The dark tint of the bronze rather prevents the niello from showing out distinctly. This statuette is apparently a work of the 1st century.[4] The other example is not earlier than the 4th century. It is a silver casket or lady's toilet box, in which were found an ampulla and other small objects, enriched with niello-work.[5]

From Roman times till the end of the 16th century the art of working in niello seems to have been constantly practised in some part at least of Europe, while in Russia and India it has survived down to the present day. From the 6th to the 12th century an enormous number of most massive and splendid works in the precious metals were produced at Byzantium or under Byzantine influence, many of which were largely decorated with niello; the silver dome of the baldacchino over the high altar of S. Sophia was probably one of the most important of these. Niello is frequently mentioned in the inventories of the treasures belonging to the great basilicas of Rome and Byzantium. The Pala d'Oro at S. Mark's, Venice, 10th century (see METAL-WORK), owes much of its refined beauty to niello patterns in the borders. This art was also practised by Bernward, artist-bishop of Hildesheim (*ob.* 1023); a fine silver paten, decorated with figures in niello, attributed to his hand, still exists among the many rich treasures in the church of Hanover Palace. Other nielli, probably the work of the same bishop, are preserved in the cathedral of Hildesheim. In France too, judging both from existing specimens of ecclesiastical plate and many records preserved in church inventories, this mode of decoration must have been frequently applied all through the Middle Ages: especially fine examples once existed at Notre Dame, Paris, and at Cluny, where the columns of the sanctuary were covered with plates of silver in the 11th century, each plate being richly ornamented with designs in niello. Among the early Teutonic and Celtic races, especially from the 8th to the 11th centuries, both in Britain and other countries, niello was frequently used to decorate the very beautiful personal ornaments of which so many specimens enrich the museums of Europe. The British Museum possesses a fine fibula of silver decorated with a simple pattern in niello and thin plates of repoussé gold. This, though very similar in design to many fibulæ from Scandinavia and Britain, was found in a tomb at Kertch (Panticapæum).[6] Several interesting gold rings of Saxon workmanship have been found at different times, on which the owner's name and ornamental patterns are formed in gold with a background of niello. One with the name of Ethelwulf, king of Wessex (836–838), is now in the British Museum (see figure). Another in the South Kensington Museum has the name of Alhstan, who was bishop of Sherborne from 823 to 867. The metal-workers of Ireland, whose skill was quite unrivalled, practised largely the art of niello from the 10th to the 12th century, and possibly even earlier. Fine croziers, shrines, fibulæ, and other objects of Irish workmanship, most skilfully enriched with elaborate niello-work, exist in considerable numbers. From the 13th to the 16th century but little niello-work appears to have been produced in England. Two specimens have been found, one at Matlask, Norfolk, and the other at Devizes, which from the character of the design appear to be English. They are both of gold, and seem to be the covering plates of small pendent reliquaries, about an inch long, dating about the end of the 15th century. One has a crucifix between St John the Baptist and a bishop; the other, that found at Devizes, has the two latter figures, but no crucifix.[7] It is, however, in Italy that the art of niello-work was brought to greatest perfection. During the whole mediæval period it was much used to decorate church plate, silver altar-frontals, and the like. The magnificent frontals of Pistoia cathedral and the Florence baptistery are notable instances of this.[8] During the 15th century, especially at Florence, the art of niello-work was practised by almost all the great artist-



Gold and Niello Ring.

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[1] *Div. Art. Sched.*, iii. 27–29 (see Hendrie's edition, 1847).

[2] *Trattato dell' Oreficeria.*

[3] *Tre Arti del Disegno.*

[4] See *Soc. Ant. Vet. Mon.*, iv., pls. 11–15.

[5] See Visconti, *Una Antica Argentaria*, Rome, 1793.

[6] See *Antiquities of Kertch*, pl. v.

[7] See *Proc. Norfolk Archæo. Soc.*, iii. p. 97.

[8] See METAL-WORK; and Gori, *Thesaurus Veterum Diptychorum*, vol. iii. Florence, 1759.

goldsmiths of that period. Apart from the beauty of the works they produced, this art had a special importance and interest from its having led the way to the invention of printing from engravings on metal plates. For the description of how this happened see Engraving, vol. viii. p. 439. Vasari's account of this invention, given in his lives of Pollajuolo and Maso Finiguerra (*Vite dei Pittori e Scultori*), is very interesting, but he is probably wrong in asserting that Maso was the first worker in niello who took proofs or impressions of his plates. The most important work of this sort by Maso Finiguerra, described at length by Vasari, still exists in the Opera del Duomo at Florence. It is a pax with a very rich and delicate niello picture of the coronation of the virgin; the composition is very full, and the work almost microscopic in minuteness; it was made in 1452. Impressions from it are preserved in the British Museum, the Louvre, and other collections. Among the many great Italian artists who were also niellists occur the names of Brunelleschi, Ant. Pollajuolo, Baccio Baldini, Francia, Pellegrino da Cesena, Cellini, Caradosso, and Foppa. Some fine specimens signed by Francia are preserved in the Bargello at Florence. The British Museum, the Louvre, the Berlin Museum, and the royal gallery of Vienna are especially rich both in nielli and in sulphur and paper impressions. The British Museum also possesses the finest existing example of 15th-century German niello. It is a silver beaker, covered with graceful scroll-work, forming medallions, in which are figures of cupids employed in various occupations;[1] it is a very remarkable piece of silver-work, both for design and beauty of execution. The art of niello-work is still practised with considerable skill both in Russia and in various parts of India. The "bidri work," so called from Bedar in Hyderabad, is a variety of niello, in which the pattern shows as silver on a niello ground. The modern revival of the art in Paris has been hitherto very unsuccessful.

Literature.—The Archæological Journal (vol. xix. p. 323) has an excellent monograph on the subject, see also vol. xii. p. 72 and vol. iv. p. 247; *Archæologia*, vol. xxxi. p. 404; Merrifield, *Ancient Practice of Painting*, vol. i., 1849 (gives MSS. of Eraclius and other early writers); Catalogue of Museum of Royal Irish Academy; *Les Nielles à la Cath. d'Aix-la-Chapelle*, Paris, 1859; Alvin, *Nielles de la Bibliothèque roy. de Belgique*, 1857; Duchesne, *Nielles des Orfèvres Florentins*, 1826; Passavant, *Le Peintre-graveur*, 1860–64; Ottley, *History of Engraving* (1816) and *Collection of Fac-similes of Prints* (1826); Cicognara, *Storia della Scultura* (iii. p. 168, Prato, 1823) and *Storia della Calcografia*, (Prato, 1831); Lanzi, *Storia Pittorica*, ep. i. sec. iii., 1809; Baldinucci, *Professori del Disegno* (1681–1728) and *L'Arte di Intagliare in Rame* (1686); Zani, *Origine dell' Incisione in Rame*, 1802; Labarte, *Arts of the Middle Ages*, 1855; Texier, *Dictionnaire de l'Orfèvrerie*, p. 1822, Paris, 1857; Bartsch, *Le Peintre-graveur*, vol. xiii. pp. 1–35; Rumohr, *Untersuchung der Gründe für die Annahme*, &c., Leipsic, 1841; and Lessing, *Collectaneen zur Litteratur* (vol. xii. art. "Niellum"). (J. H. M.)

NIEMCEWICZ, Julian Ursin (1757–1841), was born in 1757 in Lithuania. In the earlier part of his life he acted as adjutant to Kosciusko, was taken prisoner with him at the fatal battle of Maciejowice (1794), and shared his captivity at St Petersburg. On his release he travelled for some time in America, where he married. He died as an emigrant at Paris in 1841.

Niemcewicz tried many styles of composition. He wrote comedies (one of which, *The Return of the Deputy*, enjoyed a great reputation), tragedies, and a novel, *John of Tenczyn*, in the style of Scott, which gives a vigorous picture of old Polish days. He was also the author of a *History of the Reign of Sigismund III.* Perhaps, however, he is now best remembered by his *Historical Songs*, a series of lyrical compositions in which the chief heroes of Polish history are introduced. The poet dwells with delight upon the golden age of Sigismund I., and the reigns of Stephen Bathori and Sobieski. With the last of these, as with the fall of Polish grandeur, the collection closes, one piece only being added by way of supplement, entitled "The Funeral of Prince Joseph Poniatowski," the marshal of Napoleon, drowned in the Elster in 1813 after the battle of Leipsic. Niemcewicz also translated a great deal from the English, among other poems Pope's *Rape of the Lock* and Gray's *Elegy*. His reputation has somewhat waned since his death. He has been eclipsed in modern times by the genius of Mickiewicz, to say nothing of Slowacki and Krasinski, all poets of much greater calibre. Perhaps some of the enthusiasm which his writings once kindled may have been due to his being a patriot and a man of action during the death-struggles of his unfortunate country.

NIEPCE, Joseph Nicéphore (1765–1833), one of the inventors of photography, was born at Châlon-sur-Saône on March 7, 1765. His father, a "conseiller du roi," was in good circumstances, and young Niepce, who was of a meditative and poetical temperament, showed no eagerness to choose a profession. In 1792, however, he entered the army as a sub-lieutenant, and in the following year he saw active service in Italy. Ill-health and failing eyesight compelled him to resign his commission before he had risen above the rank of lieutenant; but in 1795 he was nominated "administrateur" of the district of Nice, and he held the post until 1801. Returning in that year to his birthplace, he gave himself along with his brother to mechanical and chemical researches; and in 1811 he directed his attention to the rising art of lithography. In 1813 the idea of obtaining sun pictures first suggested itself to him in this connexion; the history of the subsequent development of the conception will be found under Daguerre (vol. vi. p. 761) and Photography. Niepce died at Gras, his property near Châlon, on July 3, 1833. A nephew, Claude Félix Abel Niepce de Saint-Victor (1805–1870), served with destinction in the army, and also made important contributions towards the advancement of the art of photography (actinescence); he published *Recherches photographiques* (Paris, 1855) and *Traité pratique de gravure héliographique* (Paris, 1866).

NIÈVRE, a central department of France, formed out of the old province of Nivernais with a small portion of the Orléanais, lies between 46° 40′ and 47° 35′ N. lat. and between 2° 50′ and 4° 12′ E. long., and is bounded N.W. by Loiret, N. by Yonne, N.E. by Côte d'Or, E. and S.E. by Saône-et-Loire, S.W. and W. by Allier, and W. by Cher. It belongs partly to the basin of the Loire, partly to that of the Seine. Towards the west its limits are marked by the Allier-Loire valley,—the Loire striking across the south-west corner of the department by Decize and Nevers and then continuing the line of its great affluent the Allier northwards by Fourchambault, La Charité, Pouilly, and Cosne. Secondary feeders of the Loire are the Nièvre, which gives its name to the department, and the Aron, whose valley is traversed by the Nivernais Canal. The largest Seine tributary in Nièvre is the Yonne, which rises in the south-east, passes by Clamecy, and carries along with it the northern part of the Nivernais Canal. The Cure, the principal affluent of the Yonne (with which, however, it does not unite till after it has left the department), is the outlet of a lake, Lac des Settons, which serves as a reservoir for the practical regulation of the river. The watershed between the two river systems runs, like the general slope of the department, from south-east to north-west,—the highest summits belonging to the Morvan, an uplift of granite, porphyry, and gneiss, which extends into Saône-et-Loire, Côte d'Or, and Yonne. Here stands

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[1] It is well illustrated in Shaw's *Dresses and Decorations of the Middle Ages*, vol. ii., 1858.

Mount Préneley (2790 feet), the highest point in Nièvre, and 7 or 8 miles north-north-west, at an altitude of nearly 2000 feet, is Château-Chinon, the highest town in the department. The lowest level in the department is 443 feet, at the exit of the Loire. Nièvre is divided by the line of the canal into two distinct geological districts: to the east the old crystalline rocks of the Morvan, to the west the Jurassic limestones. Both are partly covered by extensive stretches of woodland. Morvan ("Black Forest") is one of the most picturesque portions of France; and the western district, known as the "Bon Pays," is one of its finest pastoral areas, terminating towards the Loire in hills generally clad with vines. Owing to its greater elevation and the retention of the rain-water on its hard surface in the shape of ponds and streams, Morvan shows a mean temperature 6° Fahr. lower than that of the western district, which, in the valley of the Loire, is almost identical with that of Paris (52° Fahr.). At Nevers the annual rainfall amounts to only 18 inches; but in Morvan it is about three times as great.

The area of the department is 2631 square miles, one-half being arable land, a third woods, and a tenth pasture, while 42 square miles are occupied by vines. The live stock numbers 20,000 horses (mainly of Morvan breed, small but hardy and strong), 500 mules, 7000 asses, 146,100 cattle (generally of Nivernais-Charolais breeds), 210,000 sheep, 70,000 swine, 5700 goats; and there are 18,600 bee-hives. In 1880 the department produced 2,984,000 bushels of wheat, and about the same quantity of oats; barley, 1,122,000 bushels; rye, 521,000; buckwheat, 211,000; potatoes, 4,620,000; besides beetroot (86,108 tons), pulse, maize, hemp, colza, fruits. The vintage of 1881 yielded 5,304,816 gallons of wine,—the best being the white wines of Pouilly, a locality which besides sends a great quantity of its grapes to Paris for table use. The Nièvre forests, consisting of oak, beech, hornbeam, and elm, supply about three-fifths of the firewood required for the Parisian market. The coal-field of Decize, with its seven seams making a total thickness of 40 feet, yielded 200,000 tons in 1882. Fine building stone, a little white marble, sandstone, millstones, granite, and kaolinic sands are all worked in the department. The best-known mineral springs are those of Pougues and St Honoré,—the former chalybeate and the latter sulphurous, as at Eaux Bonnes in the Pyrenees. Of the iron-works for which Nièvre is famous, the most important are those of FOURCHAMBAULT (*q.v.*), employing more than 2000 workmen, and manufacturing into bridges, building frames, rails, wheels, &c., the product of 40,000 tons of ore. At Imphy the staple is rails and Bessemer steel. The Government works of La Chaussade at Guérigny employ 1300 workmen, and make armour-plates and the materials required in iron shipbuilding; wood charcoal is used, which explains the selection for this industry of a department so well supplied with timber. There are besides in the department minor foundries and forges, manufactories of agricultural implements and hardware, potteries, tile-works, chemical works, paper-mills, and wool-mills, as well as numerous tanneries, breweries, and oil works (colza, poppy, and hemp). In the Morvan district a large part of the population is engaged in the timber industry; the logs carried down by the streams to Clamecy are then collected into rafts or put into boats. Besides firewood and charcoal Nièvre exports cattle; but it has to import cereals. A great deal of the traffic is by water: the canal along the left bank of the Loire runs through the department for 38 miles, and the Nivernais Canal (from Decize to Clamecy and so to the Yonne) for 47 miles. The total length of the railways is 145 miles. The population of the department was 347,576 in 1881. Nièvre is divided into 4 arrondissements, 25 cantons, 313 communes. It forms the diocese of Nevers, and part of the districts dependent on the corps d'armée and the court of appeal of Bourges. The chief towns of the arrondissements are Nevers, Château Chinon (2613 inhabitants), Clamecy (5536), and Cosne (7401). Other places of note are La Charité (4826), with an old church of the order of Cluny; Decize (4927), with an old church and interesting ruins; and St Pierre le Moutier (3080), having an old Cluniac monastery.

NIEZHIN, NIEJIN, or NYEZHIN, a district town of Russia, situated in the government of Tchernigoff, 50 miles south-east of that town, on the railway between Kursk and Kieff. The old town is built on the left bank of the (canalized) river Oster, and its suburbs, Novoye Myesto and Magherki, on the right. It has an old cathedral, two Greek churches, one Catholic church, a synagogue, and two monasteries. The high school (lyceum of Bezborodko) formerly had 200 students, but now only from 30 to 40, since its transformation into a philological institute. The 23,000 inhabitants are mostly Little Russians and Jews (about 3000); there are also some 400 Greeks, descendants of those who immigrated in the 17th century, at the invitation of Bogdan Khmelnitski, and have since then constituted a privileged trading corporation. About 7000 of the population of Niezhin are engaged in agriculture, in market gardening, and especially in the cultivation and preparation of tobacco. Cast-iron wares and agricultural implements are manufactured, but not extensively; candle-making and tanning are also carried on. In the district there are several distilleries, producing about 160,000 gallons of wine-spirit. The commerce of Niezhin, which formerly was very prosperous, has fallen off since the opening of the Black Sea ports. Its merchants, however, especially the Greeks, still carry on an active trade in tobacco, which is exported from Niezhin to the amount of nearly 200,000 cwts., in all kinds of manufactured wares, in cattle, in wine-spirit, and also in preserved fruits and vegetables, which are a kind of specialty with the citizens.

The date of the foundation of Niezhin is unknown, but Unyezh, which is supposed to have been its former name, is mentioned as early as 1147. At that time it belonged to the principality of Tchernigoff; afterwards it fell under the rule of Poland. It was ceded to Russia about 1500, but became again a Polish possession after the treaty of Deulin. In 1649, after the revolt of Little Russia and its liberation from the Polish rule, Niezhin was the chief town of one of the most important Cossack regiments. It was annexed to Russia in 1664. In the 18th century it was a flourishing commercial city, owing to its situation on the highways from Kieff to Moscow and from Tchernigoff to Poltava, and to the Greek merchants who kept up commercial relations with Turkey, Italy, and Austria.

NIGER, one of the most famous of African rivers, has its headwaters on the north side of the mountains (known as Kong Mountains and by various other local names) which run parallel with the coast of Upper Guinea and Sierra Leone at a distance of about 200 miles, flows north-eastward as far as 17° 30′ N. lat. and the meridian of Greenwich, and then turning south-eastward reaches the Gulf of Guinea after a total course of about 2600 miles. The main stream bears in different districts a great variety of names—Joliba (Dholiba or Dialiba), Kworra (Quorra), Mayo, Kaki 'n ruwa, &c.; and the same is true of the great eastern confluent the Benue, Shary or Tchadda.[1] (For other synonyms see Baikie, *Narr. of an Expl. Voyage*, p. 426.) It will be convenient to retain the established European name for the whole river system, and to call the main stream the Kworra and the confluent the Benue.

Of the many headwaters which go to form the upper Kworra, the Tamincono, Falico, and Tembi are the most important; and, as the largest of these, the Tembi, rises in the Loma Mountains in 8° 36′ N. lat. and 10° 33′ W. long., this may be considered the true position of the long-sought source of the Niger. The Falico rises in 8° 45′ N. lat. and 10° 25′ W. long.; the Tamincono, of much less significance, about 60 miles farther north. A narrow watershed separates these headstreams from the head-streams of the Rokelle, which flows west through Sierra Leone. At Farannah (now destroyed), in 10° N. lat., the river is about 100 yards wide, and taking its Mandingo name of Joliba (or Great River) bends eastwards. From the source of the Tembi to Kuruassa, where Caillié crossed in June 1825, and found it 9 feet deep, the course of the river (nearly 300 miles) has not been followed by any European; but the general character of the next 60 or 70 miles, down to Bora, is known because Caillié's route skirted the eastern bank. Below that point there is another unexplored stretch. At Bammako, after the junction of the Milo, the Bafing or Bafi (Black River), the Fandube, &c., the depth is 6 feet, with a breadth of 1300 feet. About 7 or 8 miles farther down the Sotuba rocks mark the end of what may be regarded as the upper Kworra. Even in this section the stream is probably navigable in small boats all the way from the union of the headstreams to Sotuba. From Bammako begins a more rapid deflexion towards the east, and it is not till the Mahel Balevel, a very important tributary, joins in that a more directly northward direction is resumed. For several hundred miles below this confluence the Kworra shows a great tendency to split into different channels, often enclosing extensive tracts of country in their meshes, and turning whole provinces into a perfect labyrinth of creeks, backwaters, and lagoons. Kabara, the port of Timbuktu, is situated on one of the secondary branches; but the main channel, at no great distance, is about a mile across. At times the river rises so that boats can approach the walls of the city proper; and in 1640 an exceptional inundation turned the central and lowest quarter into a lake. The swamps and side-creeks continue to the east of Timbuktu, and, though at Bamba (130 miles) the river is shut in by steep banks and narrows to 600 or 700 yards, it again spreads out for some distance farther down. At Tahont 'n eggish (Entrance Rock), however, a great change is observed, the banks beginning to be rocky and the channel definite; and at Tosaye the width is reduced to not more than 150 yards, and the depth is enormously increased. At Burrum the valley again widens out to about 3 miles, and tracts of level ground, swamps, or sandy downs skirt the river on both sides. A ledge of rocks runs right across the stream at Tazori; about 1500 yards below a passage is forced between two masses 30 or 40 feet high; and at Tiborawen there is a very labyrinth of rapids and divided creeks. In the neighbourhood of Birni the hills close in so as to form a kind of defile, but at Say the Kworra is again a noble stream about 700 yards in breadth, with rocky banks 20 to 30 feet high on the one side and a comparatively flat country on the other. Between Say (Barth's southmost point) and Gompa (Flegel's northmost) the distance of 60 or 70 miles is practically unknown, and forms the only complete break in the delineation of the river from Bammako. At Gompa lies the mouth of the Gubbi 'n Gundi, a left hand tributary which brings down the waters of the Mayo (Mao) Kebbi or river of Sokoto, the Mayo Ranco, the Gubbi 'n Rimi, and other streams from the north-east and south. Between Yauri (100 miles farther down) and Bussa or Bussan (60 miles) the Kworra is often interrupted by rocks and islands, and below Bussa, where Park lost his life, these obstructions increase so that a distance of 10 or 12 miles cannot be passed by canoes, at least in November. The islands are occupied by considerable villages. Just where the direction of the course turns eastward, a curious rock, Mount Ketsa (Kesa or Kisey of Lander), rises in mid channel to a height of 300 feet. At Rabba (130 miles below Bussa) the width of the stream is about 2 miles, and opposite the town lies the low and populous island of Zagozhi. About 60 miles farther down is the mouth of the left hand tributary the Kadina, which passes near the important town of Bida (Crowther, 1857).

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[1] These last two names really belong to another river which discharges into Lake Chad, Tchad, or Tsad.

In 7° 50′ N. lat. and 6° 45′ E. long., the Kworra is joined by the Benue or Binue ("Mother of Waters" in the Batta tongue). This magnificent confluent rises in Adamaua a little to the north of Ngaundere (Ngamdere of the Houssas), about 7° 10′ N. lat. and 13° 20′ E. long., at a height of between 3000 and 5000 feet above the sea, and in the early part of its course it is separated by a narrow water-parting from the headstreams of the Logone or Serbewel, which probably flows eastward to Lake Chad. For the first 100 miles of its course it remains a rocky mountain stream, but after the junction (at about 800 feet above the sea) of the Mayo Kebbi (itself probably navigable to Dawa in the Tuburi country, and there possibly forming a bifurcation between the basins of the Niger and Lake Tchad) it takes a western direction and becomes navigable for boats drawing 4 feet of water. For some 40 miles below Ribago (Rebom)—the farthest point reached by exploration upward—the Benue has an average width of 180 to 200 yards, and flows with a strong steady current, although a broad strip of country on each side is swampy or submerged. Below the junction of the Faro the width increases to 1000 or 1500 yards, and, though it narrows at the somewhat dangerous rapids of Rumde Gilla to 150 or 180, it soon expands again. It flows onwards with comparatively unobstructed current through a beautiful country, its valley marked out for the most part by ranges of hills, and its banks diversified with forests, villages, and cultivated tracts. (See Crowther in *Proc. Roy. Geog. Soc.*, 1877; Hutchinson, *Ibid.*, 1880; Flegel in *Petermann's Mitth.*, 1880.)

At their confluence the Kworra is about ¾ mile broad and the Benue rather more than a mile. The united stream is like a lake about 2 miles in width, dotted with islands and sandbanks; and the peninsula at the junction is low, swampy, and intersected by numerous channels. From this point the course of the Niger is well known. As far south as Iddah or Idah, a town on the east bank, it rushes through a deep valley cut between the hills, the sandstone cliffs at some places rising 150 feet high. Between Iddah and Onitsha (destroyed by British gunboats in 1879), 80 miles, the banks are lower and the country flatter, and to the south of Onitsha the whole land is laid under water during the annual floods. From this point, consequently, may be said to begin the great delta of the Niger, which, extending along the coast for about 120 miles, and 140 or 150 miles inland, forms one of the most remarkable of all the swampy regions of Africa. The river soon breaks up into an intricate network of channels, dividing and subdividing, and intercrossing not only with each other but with the branches of other streams that drain the neighbouring coast, so that it is practically impossible to say where the Niger delta ends and another river system begins. Westwards the anastomosis probably extends to the lagoons at Lagos, and eastwards to the Old Calabar or Cross River. Hitherto the channel almost regularly followed is the Rio Nun, a direct continuation of the line of the undivided river. From the sea the only indication of a river mouth is a break in the dark green mangroves which here universally fringe the coast. The crossing of the bar requires considerable care, and at ebb tide the outward current runs 5½ knots per hour. For the first 20 miles (or as far as Sunday Island, the limit of the sea tide in the dry season), dense lines of mangroves 40, 50, or 60 feet in height shut in the channel, so that nothing is visible save a narrow strip of sky overhead; then palm and other trees begin to appear, and the widening river has regular banks; and before long little villages and plantations of plantains and sugar-cane show that even in this region of miasma and mud human beings find means to exist.

As the Kworra and the Benue have quite different gathering grounds they are not in flood at the same time. The upper Kworra rises in June as the result of the tropical rains, and decreases in December, its breadth at Turella expanding from between 2000 and 2500 feet to not less than 1½ miles. The middle Kworra, however, reaches its maximum near Timbuktu only in January; in February and March it sinks slowly above the narrows of Tinsherifen (Tosaye), and more rapidly below them, the level being kept up by supplies from backwaters and lakes; and by April there is a decrease of about 5 feet. In August the channel near Timbuktu is again navigable owing to rain in the Wangara highlands. The Benue reaches its greatest height in August or September, begins to fall in October, falls rapidly in November, and slowly in the next three months, and reaches its lowest in March and April, when it is fordable in many places, has no perceptible flow, and at the confluence begins to be covered with the water-weed *Pistia Stratiotes*. The flood rises with great rapidity, and reaches 50, 60, or even 75 feet above the low-water mark. The two confluents being so unlike, the united Niger differs from each under the influence of the other. Here the river is at its lowest in April and May; in June it is subject to great fluctuations; about the middle of August it usually begins to rise; and its maximum is reached in September. In October it sinks, often rapidly. A slight rise in January, known as the *yangbe*, is occasioned by water from the Kworra. Between high and low water-mark the difference is as much as 35 feet.

As a highway of commerce the Niger has been little used, trading steamers having mainly confined their operations to the river below the confluence. But since 1857 the area of supply has been considerably extended, the quantity of goods (chiefly oil and shea butter) collected has greatly increased, and steamers five or six times the size of the vessels formerly used have been introduced. The delta region has become more populous, and trading posts more frequent. The Church Missionary Society, which, except the British Government, has done more than any other agency for opening up the lower Niger, has stations at four places on the coast, at Osamare (120 miles inland), Onitsha (20 miles farther), Lokoja (90 miles), Kipo Hill, Egan (90 miles), Shonga (94 miles farther, and only 12 or 15 short of Rabba). Lokoja is near the site of the experimental farm maintained by the Government for some years from 1841.

Pliny mentions a river Nigris of the same nature with the Nile separating Africa and Ethiopia, and forming the boundary of Gætulia; and it is not improbable that this is, in fact, the same with the modern Niger. In Ptolemy, too, appears along with Gir a certain Nigir (Νίγειρ) as one of the largest rivers of the interior; but so vague is his description that, while D'Anville and Leake strongly maintain that this, also, is the Niger, Walckenaer and Vivien St Martin insist on the negative view, and Mr Bunbury is almost inclined to follow them. When the Arabian geographers became acquainted with the river near Timbuktu they called it the Nile of the Negroes, and down to the present century European authorities (such as Jackson in his *Empire of Morocco*, 1800) fought zealously for the identity of this Nile with the river of Egypt.

The following dates show the progressive exploration of the river. 1788. Formation of the African Association in England. 1795. Mungo Park (African Association) saw the Niger near Sego "glittering in the morning sun as broad as the Thames at Westminster, and flowing slowly to the eastward." In this first expedition he went down the river as far as Sella and up as far as Bammako; in his second he sailed down to Bussa, where he was drowned. Park adopted the opinion that the Niger and the Congo were one. Major Peddie's expedition to the Niger, and Tuckey's expedition to the Congo, threw no light on the relation of the rivers. 1802. Reichard, a German, suggested that the Rio Formoso was the mouth of the Niger. 1822. Laing learned that the sources of the Niger lay not far from Sulima. 1826. Caillié sailed down the river from Jenne to the port of Timbuktu. Clapperton and Richard Lander visited Bussa. 1830. Richard and John Lander passed down from Yauri to the mouth of the Rio Nun, thus settling the doubt as to the outlet of the river. 1832. Macgregor Laird established the African Steamship Company, and Richard Lander and Oldfield (as members of its first expedition) ascended the Niger to Rabba and the Benue (or, as it was when called, the Shary or Tchadda) as far as Dagbo (80 miles). 1840. Consul Beecroft ascended beyond Rabba in the "Ethiope." 1841. An expedition, consisting of three steamers of the royal navy, under Captain (afterwards Admiral) H. D. Trotter, went up to Egga (Egam), but was forced to return owing to sickness and mortality. 1851. Barth crossed the Benue at the junction of the Fa and conjectured it to be the upper part of the Tchadda. 1854. Barth sailed down from Saraiyamo to Kabara (port of Timbuktu), and then skirted the left bank to Bornu and the right thence to Say. The "Pleiad" expedition (Baikie, Crowther, D. J. May) advanced up the Benue 400 miles to Dulti or Jin. 1857–59. Expedition (Baikie, Glover, &c.) up to Bussa; steamer "Dayspring" wrecked on a rock above Rabba. Mission stations founded at Onitsha, Gbebe, and Rabba. 1864. Crowther made bishop of the Niger. 1877. Rev. Henry Johnson journeyed up the river to Bida. 1879. "Henry Venn," steamer (Ashkroft, Kirk, Flegel), passed up the Benue to Gurua (145 miles beyond Jin), and her boats 8 miles farther to Rebom or Ribago. Zweifel and Moustier, sent out by M. Verminck, a Marseilles merchant, discovered the sources of the Falico, &c. 1880–81. Flegel went up from Rabba to Gompa.

Besides the reports of expeditions published by Laird and Oldfield, Allen, Baikie, Crowther, &c., see Barth's *Travels*, vols. iv. and v., and his paper in *Z. für allg. Erdkunde*, Berlin, 1863; Cole, *Life on the Niger*; Crowther, *The Gospel on the Niger*; *The Church Missionary Intelligencer*; *Mittheilungen der Afrikan. Ges. in Deutschland*, 1862 and 1863; and Hutchinson's paper in *Jour. of Soc of Arts*, 1860. (H. A. W.)

NIGER, C. PESCENNIUS, governor of Syria under the emperor Commodus, and one of the rivals of Septimius Severus for the succession after the murder of Pertinax, belonged to an Aquinum family of equestrian rank, and owed his promotion to the Syrian command not only to the interest of Narcissus, the favourite of Commodus, but also to his known merits as a soldier. He was saluted emperor by the troops at Antioch as soon as the death of Pertinax became known, in the spring of 193 A.D., but he unaccountably delayed marching on Rome until he learned that Severus had assumed the offensive. He now strongly garrisoned Byzantium as well as the principal towns of Asia Minor, but after his legate Æmilianus had been defeated and slain near Cyzicus he himself was driven from Nicæa and decisively routed, with great slaughter, in the neighbourhood of the Cilician Gates. Having failed in an effort to escape towards the Euphrates, he was brought back and put to death in 194.

NIGHTINGALE (Anglo-Saxon, *Nihtegale*, literally "singer of the night"), the bird justly celebrated beyond all others by European writers for the admirable vocal powers which, during some weeks after its return from its winter-quarters in the south, it exercises at all hours of the day and night. The song itself is indescribable, though several attempts, from the time of Aristophanes to the present, have been made to express in syllables the sound of its many notes; and its effects on those that hear it depend so much on their personal disposition as to be as varied as are its tones. To some they suggest melancholy; and many poets have descanted on the bird (which they nearly always make of the feminine gender) leaning its breast against a thorn and pouring forth its melody in anguish. It is accordingly to be observed that the cock alone sings, and that there is no reason to suppose that the cause and intent of his song, unsurpassed though it be, differ in any respect from those of other birds' songs (see BIRDS, vol. iii. p. 770). Sadness, therefore, is certainly the last impelling sentiment that can be properly assigned in this case. In great contrast to the Nightingale's preeminent voice is the inconspicuous coloration of its plumage, which is alike in both sexes, and is of a reddish-brown above and dull greyish-white beneath, the breast being rather darker, and the rufous tail shewing the only bright tint. The range of this bird in Europe has already been so fully described (BIRDS, vol. iii. p. 756, 757) as to render a further account of it needless. The Nightingale reaches its English home about the middle of April,[1] the males (as is usual among migratory birds) arriving some days before the females; and, often stopping on their way, letting their song be heard in places they do not habitually frequent, pass to their proper breeding-quarters. At this time they run very great danger from birdcatchers, for their capture is effected with facility, and it is painful to add that of those then caught nine-tenths are said to die within a month. Fortunately for the species, it receives great protection from the practice of game-preserving, which guards from intrusion so many of the localities it affects, and there is probably no country in which the Nightingale breeds more abundantly and in greater security than in England. On the cocks being joined by their partners, the work for which the long and hazardous journey of both has been undertaken is speedily begun, and before long the nest is completed. This is of a rather uncommon kind, being placed on or near the ground, the outworks consisting chiefly of a great number of dead leaves ingeniously applied together so that the plane of each is mostly vertical. In the midst of the mass is wrought a deep cup-like hollow, neatly lined with fibrous roots, but the whole is so loosely constructed, and depends for lateral support so much on the stems of the plants, among which it is generally built, that a very slight touch disturbs its beautiful arrangement. Herein from four to six eggs of a deep olive colour are duly laid, and the young hatched. If the latter be taken when nearly fit to fly from the nest, they can with proper care be reared by hand, and this is the only justifiable mode of proceeding for those who wish to keep this fine songster in confinement, as, if the birds survive their first moult, they may live for some years in a cage, and the cocks will in due time exercise their full vocal powers. The nestling plumage of the Nightingale differs much from that of the adult, the feathers above being tipped with a buff spot, just as in the young of the Redbreast, Hedge-Sparrow, and Redstart, thereby shewing the natural affinity of all these forms. Towards the end of summer the Nightingale disappears, and but little has been observed of it in its winter-retreats, which are presumably in the interior of Africa. One of the few records of it at that season proves that it visits the Gold Coast (*Ibis*, 1872, p. 291).

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[1] Poets and novelists are apt to command at will the song of this bird, irrespective of season. If the appearance of truth is to be regarded, it is dangerous to introduce a Nightingale as singing in England before the 15th of April or after the 15th of June. The "Early Nightingale" of newspaper paragraphs is generally a Song-Thrush.

The Nightingale is the *Motacilla luscinia* in part of Linnæus, and the *Daulias luscinia* of some modern ornithologists. In the east of Europe a second species occurs which was not discriminated by Linnæus, though long known to German bird-fanciers as the *Sprosser*. This, the *Sylvia philomela* or *Daulias philomela* of many scientific writers, is a somewhat larger bird, which fact, and the presence of some faint spots on its breast, have caused it to receive the English name of Thrush-Nightingale. Its westward range appears to be limited to the valley of the Rhine, and the statement that it has occurred in England is erroneous. Its song is louder than that of the true Nightingale, but not so sweet in tone or so varied in note. The name Nightingale has been vaguely applied to several other birds. The so-called "Virginian Nightingale" is a species of GROSBEAK (vol. xi. p. 205), and the REDWING (*q.v.*), strangely enough, has been often spoken of as the "Swedish Nightingale."

The Nightingale holds a place in classical mythology. Procne and Philomela were the daughters of Pandion, king of Attica, who in return for warlike aid rendered him by Tereus, king of Daulis in Thrace, gave him the first-named in marriage. Tereus, however, being enamoured of her sister, feigned that his wife was dead, and induced Philomela to take her place. On her discovering the truth, he cut out her tongue to hinder her from revealing his deceit; but she depicted her sad story on a robe which she sent to Procne; and the two sisters then contrived a horrible revenge for the infidelity of Tereus, by killing and serving to him at table his son Itys. Thereupon the gods interposed, changing Tereus into a Hoopoe, Procne into a Swallow, and Philomela into a Nightingale, while Itys was restored to life as a Pheasant, and Pandion (who had died of grief at his daughters' dishonour) as a bird-of-prey (see OSPREY). The fable has several variants. Ovid's version may be seen in the 6th Book of his *Metamorphoses* (lines 412-676). (A. N.)

NIGHTSHADE, a general term for the genus of plants known to botanists as *Solanum*. The species to which the name of Nightshade is commonly given in England is the *Solanum Dulcamara*, L., which is also called the Bittersweet or Woody Nightshade. It is a common plant in damp hedgebanks and thickets, scrambling over underwood and hedges. It has slender slightly woody stems, with alternate lanceolate leaves more or less cordate and auriculate at the base. The flowers are arranged in drooping cymes, and resemble those of the potato in shape, although much smaller. The corolla is rotate, of a lilac-blue colour with a green spot at the base of each segment, and is furnished with yellow sessile anthers united at their margins so as to form a cone in the centre of the corolla. The flowers are succeeded by ovate scarlet berries, which in large doses appear to be poisonous or, to say the least, dangerous to children, cases of poisoning by them having occurred. The plant derives its names of bittersweet and *Dulcamara* from the fact that its taste is at first pleasantly sweet and then bitter. The young stems collected in autumn have been used in medicine as an alterative in rheumatism and certain skin diseases, but are little used at the present time except by homœopaths, by whom *Dulcamara* is given as an anticatarrhal remedy in all symptoms produced by cold arising from exposure to damp. It owes its medicinal activity to a bitter principle yielding by decomposition sugar and the alkaloid "solania," $C_{43}H_{69}NO_{16}$. This principle has been found in small quantity in the leaves, stalks, and berries. *Dulcamara* also contains another glucoside "dulcamarin," $C_{22}H_{34}O_{10}$, which when boiled with dilute acid splits up into sugar and "dulcamaretin," $C_{10}H_{26}O_6$. Solania appears to exert a depressant action on the vagus nerve and an excitant action on the medulla oblongata. The term Deadly Nightshade is often erroneously applied to this plant, and the popular usage has even been confirmed by so eminent a botanist as Bentham (*Handbook of the British Flora*, p. 384, 1858). It is generally accepted, however, that the deadly nightshade is *Atropa Belladonna*, L. (see vol. iii. p. 543).

Solanum Dulcamara is subject to the same parasitic fungus (*Peronospora infestans*) as the potato, and may serve as a medium for communicating the spores to the potato if not removed from the hedges of the fields where potatoes are grown.

The Garden Nightshade, *Solanum nigrum*, L., differs from *S. Dulcamara* in having white flowers in small umbels and globose black berries. It is a common weed in gardens and waste places, growing about 12 or 18 inches high, and has ovate, entire or sinuate-dentate leaves. Two varieties of the plant, one with red and the other with yellow berries, are sometimes met with, but are comparatively rare. The berries have been known to produce poisonous effects when eaten by children, and owe their properties to the presence of solania. They are, however, said to be eaten without inconvenience in British Kaffraria, and in Réunion and Mauritius the leaves are eaten like spinach; their innocuousness in these cases may, however, be due to the poisonous principle being removed or decomposed by the process of cooking.

The name of nightshade is applied to plants of different genera in other countries. American Nightshade is a species of *Phytolacca*; the Three-leaved Nightshade is a *Trillium*; the Malabar Nightshade is a *Basella*; the Bastard Nightshade is a *Rivina*; and the Enchanter's Nightshade is *Circæa lutetiana*. The last-named is not known to possess any poisonous property, and the name seems to have been given to it in the first place in mistake for a species of *Mandragora* (see MANDRAKE).

NIGRITIA. See SOUDAN.

NIIGATA, a city of Japan, with a population of about 34,000, the chief town of the province of Echigo, and one of the ports open to foreign trade since 1869, lies in 37° 57′ N. lat. and 139° E. long., on the west coast of the island of Nippon, on a narrow strip of sandy ground between the left bank of the Shinano and the sea, which though quite at hand is shut out from view by a low range of sandhills. It occupies an area of rather more than one square mile, and consists of five long parallel streets intersected by cross-streets, which in most cases have canals running down the middle and communicating with the river, so that the internal traffic of the city is mainly carried on by water. The houses are usually built with gables to the street, and roofs and verandas project so as to keep the windows and footpaths from being blocked up by the heavy winter snows. In August 1880 nearly half of the town was destroyed by fire; but in the following year most of the public buildings were restored. The college, founded in 1870, was handed over to the authorities in 1878 (with an English department, an engineering school, a geological museum, and various laboratories); and the large hospital was rebuilt on a more spacious scale and in European style in 1878. There are large public gardens in the city; many of the canals are bordered with trees; and an air of tidiness and comfort prevails throughout the un-Europeanized quarters. Niigata has a greater junk traffic than any other town on the west coast of Japan, but it has been found quite unsuited in its present state for foreign commerce. The mouth of the river is obstructed by a bar with only 12 feet of water at high tide, and in autumn and winter the squalls are so violent that only very powerful steamers can safely anchor in the bay. Ebisuminato, on the island of Sado, has been opened as a supplementary harbour of refuge but not as a trading port. The shore of the Shinano has already been improved up to the town; and when the Government has constructed the new harbour and breakwater planned in 1880 Niigata will doubtless become a very flourishing commercial centre, as it is the natural outlet of a large and populous province, producing rice, tea, coal, petroleum, copper, silver, and gold. Almost all the foreign trade of the place has passed into the hands of the Japanese since the Mitsubishi Company began to call at the port. In 1879 thirty-six of their vessels entered, with a total burden of 29,361 tons. In 1878 there were only twenty foreigners in the city, and these mostly in Government employment or agents of mission societies. The Edinburgh Medical Mission has maintained a valuable hospital and dispensary since 1875. During winter Niigata suffers from a terribly severe climate, and the people go "about in wadded clothes with only their eyes exposed."

See Bird, *Unbeaten Tracks in Japan*, for many picturesque det

NIJAR, a town of Spain, in the province of Almeria, 14 miles to the east-north-east of that town, occupies an exposed site on the southern slope of the Sierra Alhamilla. It has dye-works, and manufactures woollen stuffs and pottery; trade is carried on in the products of these industries, as well as in corn, cattle, barilla, and fine potter's clay procured in the neighbourhood. The population of the ayuntamiento in 1877 was 13,661.

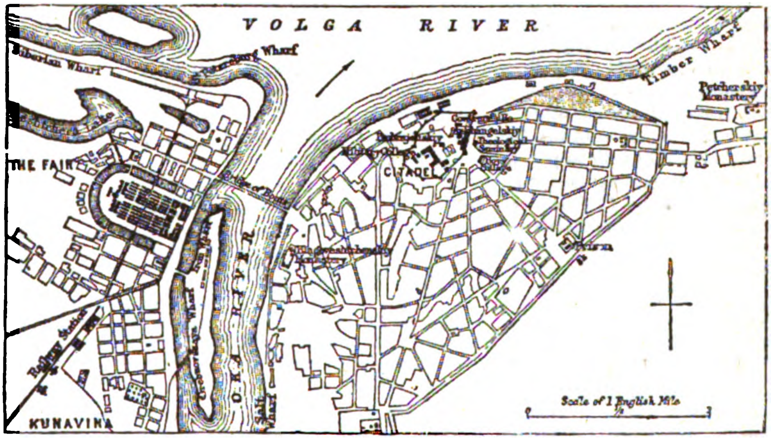
NIJNE-TAGHILSK, currently known as Taghil, a town and iron-work of Russia, situated in the government of Perm and district of Verkhoturie, 100 miles to the south-east of the district town. It occupies an advantageous position in a longitudinal valley on the eastern slope of the Ural Mountains, within a few miles of the place where the Taghil, cutting through the eastern wall of the valley, escapes to the lowlands to join the Tura, a tributary of the Tobol. The southern part of this valley is occupied by the upper Taghil, and its continuation towards the north by the upper Tura, from which it is separated by a low watershed; it is dotted with numerous iron-works, and is now connected by railway (the first in Siberia) with Perm and Ekaterinburg (88 miles distant). The town was founded in 1725 by the well-known Russian miner Demidoff, and is still the property of his family. The river, which above the iron-work expands into a small lake, supplies the iron-work with motive power, driving no less than twenty-seven water-wheels, while there are several steam-engines. Nijne-Taghilsk is a central foundry for a number of iron-mines and eleven other works scattered in the valley of the Taghil and its tributary, the Salda, the aggregate production of which in 1879 amounted to 749,000 cwts. of cast iron and 280,000 cwts. of wrought iron (547,500 cwts. of iron and iron-ware, worth 6,000,000 roubles, in 1881). About 360 ℔ of gold, 2500 ℔ of platinum, and 11,600 cwts. of copper are also annually mined at Nijne-Taghilsk. The town has several educational institutions both primary and secondary, the latter including a technical school and a school for girls. It has a very animated appearance during its weekly fairs, and, being the chief corn-market for the supply of nearly all the iron-works of the district of Verkhoturie, carries on a brisk corn trade, which the railway has further developed. The inhabitants also make wooden boxes and trays which are sent to the fairs of Irbit and Nijni-Novgorod. The population, including that of the Vyiski iron-work, situated close at hand, exceeds 30,000, all Great-Russians, and chiefly Nonconformists.

NIJNE-TCHIRSKAYA, a Cossack village, or stanitsa, of Russia, chief town of the Second Don district of the Don Cossack government, is situated on the right bank of the Don, at its junction with the Tchir, 25 miles below the Kalatch station of the Volga and Don Railway, and is the chief point for corn and linseed from the basin of the middle Don. Its 14,000 inhabitants (with the 11,000 of Verkne-Tchirskaya, 2 miles distant) are mostly engaged in agriculture and cattle-raising, favoured by the extensive landholdings (about 700,000 acres) belonging to the Cossacks of both stanitsas. The hills above the village are covered for several miles with rich gardens and vineyards. Besides the trade in grain and linseed, a considerable business is done in cattle, wool, and salt. Manufactures, as among the Don Cossacks generally, are very limited, being confined to tanning, brick-making, and candle-making. The place is in regular steamboat communication with Novotcherkassk and Taganrog.

NIJNI-LOMOFF, a district town of Russia, in the government of Penza, 69 miles west-north-west from the capital of the government, on the Lomoff; the railway from Penza to Tula passes within 17 miles. It was founded as a south-eastern frontier fort in 1636, in a country of moderate fertility, and has but slowly developed. It has now 19,000 inhabitants, who support themselves chiefly by agriculture and gardening. The merchants carry on trade in grain, wine-spirit, hempseed oil, leather, woollen goods, and a variety of wooden wares (cars, sledges, wheels, and so on), largely manufactured in the southern and wooded part of the district. The yearly fair is of some importance as regards corn and cattle. The town and the district have also a few distilleries, manufactures of woollen cloth and potash, oil-works, and potteries.

NIJNI-NOVGOROD, or Nijniy-Novgorod, a government of Central Russia, bounded by Vladimir on the W., by Yaroslaff and Vyatka on the N. and N.E., by Kazan and Simbirsk on the E., and by Penza and Tamboff on the S., with an area of 19,800 square miles, two-thirds being on the right and the rest on the left bank of the Volga. The smaller portion, with the exception of the better-drained lands close to the river, is a low flat marshy district, covered with thick forests and sandy hills, and is but thinly peopled. The space between the Oka and Volga is also flat and covered with forests, but offers somewhat greater advantages to the settler. The best part of the government is that to the east of the Oka; it is hilly, traversed by deep ravines and better drained, and has patches of fertile black earth in the south. Geologically, Nijni-Novgorod belongs chiefly to the Permian system; the Carboniferous appears only in the lowest formations, and the Permian limestones are covered with a stratum 450 feet in thickness, of variegated marls, formerly considered as Permian, but now supposed to be Triassic. It is watered by the Volga with its tributaries, the Kerjenetz and Vetluga on the left, and the Sura (with the Piana) and Oka on the right. These and their numerous tributaries offer great facilities both for navigation and for the transit of timber. Very numerous lakes dot the government, especially in the north; and one-third of its entire surface is still covered with forests, which occupy nearly the whole of the Zavoljie (to the north of the Volga), and extend without a break for 50 and 80 miles to the west and south-west. The climate is severe, especially in the Zavoljie, where the average yearly temperature is 5°·6 Fahr. lower than at Nijni. The population in 1880 reached 1,376,000; they are mostly Great-Russians, Mordvinians (50,600), and Tartars (42,650); the Tcheremisses numbered 5630, and the Jews about 1500. Of the total, 1,266,550 belong to the Greek Church, 63,850 (probably much understated) are registered as Old Believers and Raskolniks, 42,650 are Mohammedans, 750 Protestants, and 740 Catholics. The urban population is only 101,000. The yearly increase of the population is estimated at 0·43 per cent., and the mortality at 47 per 1000.

The chief occupation of the inhabitants is agriculture, but only 38 per cent. of the area is under crops. Cattle breeding is falling off rapidly, and in 1880 there were only 229,000 horses (as against 326,000 in 1848 and 264,000 in 1865), 232,000 horned cattle, 444,000 sheep (585,000 in 1865), and 74,000 pigs. Kitchen-gardens are a source of income in several districts. Agriculture, on the whole, has to contend with great difficulties on account of the climate, the soil, and the small allotments of land. A variety of petty trades carried on by the peasantry have accordingly developed in the villages; of these cutlery is the chief, no less than 6000 families being engaged in that industry at Pavlovo and Vorsma. In other parts of the government the peasants make felt and woollen wares, leather wares and harness, iron-wire and sieves, &c.; each village has its own specialty, being renowned for its felt shoes, or for its gloves, its fine scales, and so on. The chief occupation, however, is the manufacture of wooden wares,—sledges, wheels, dishes and spoons, window frames, boxes, &c., —which are exported in large quantities to the governments of the lower Volga, and even to Bokhara and Persia. The manufactures are rapidly developing. In 1880 there were 465 factories (principally machine-works, steam flour-mills, iron and steel works, naphtha distilleries, cutlery and copper works, tanneries, and rope-works), employing about 20,000 work-people, and producing goods to the value of more than 15,000,000 roubles (8,840,000 in 1876); the production of the distilleries amounted to 4,540,000. The building of boats and steamers is also a considerable source of income. A very large proportion of the population fails to find the means of self-support within the province, and every year no fewer than 100,000 to 117,000 persons leave their villages and go in search of labour as far as St Petersburg and Astrakhan. Trade in corn, salt, timber, leather, iron, and all kinds of manufactured ware is well developed in all towns of the government, and there are important fairs at several places. The educational institutions are few, and, on the whole, except among the Raskolniks, education stands at a very low level. The government is divided into eleven districts, having as their chief towns Nijni-Novgorod (50,000 inhabitants), Ardatoff (3500), Arzamas (10,500), Balakhna (4000), Gorbatoff (3000), Knyaghinin (2500), Lukoyanoff (10,000), Makarieff (2000), Semenoff (3000), Sergach (4000), and Vasilsursk (3000). The other towns are Perevoz (1000) and Pochinki (7500); the two villages Pavlovo (about 10,000) and Vorsma (4000) are important manufacturing centres.



Plan of Nijni-Novgorod.

Nijni-Novgorod, or simply **Nijni** or **Nijniy**, capital of the above government, is situated at the confluence of the Oka and Volga, 276 miles by rail to the east of Moscow. It occupies a most advantageous position on the great artery of Russian trade, at a place where the manufactured and agricultural products of the basin of the Oka meet with the metal wares from that of the Kama, the corn and salt brought from the south-eastern provinces, the produce of the Caspian fisheries, and the various wares imported from Siberia, Central Asia, Caucasus, and Persia. It has thus become the seat of the great Makarievskaya fair, and one of the chief commercial centres of Russia. Its importance has still further increased during the last twenty years in consequence of the growth of manufactures in the Oka basin, the rapid development of steamboat traffic on the Volga and its tributaries, the extension of the Russian railway system, and the opening of Central Asia for trade. Nijni-Novgorod consists of three parts:—the upper city, including the Kremlin; the lower town, or Nijni Bazaar; and "the Fair," with the suburb Kunavina. The upper city covers three hills, which rise as steep crags to a height of 400 feet (490 feet above sea-level) on the right banks of both the Oka and the Volga. The Kremlin, or old fort, occupies one of these hills facing the Volga. It was erected in the beginning of the 16th century, on the site of the old palisaded fort, and has a wall 2300 yards long, with eleven towers; it contains the law-courts, the governor's residence, the arsenal, barracks, the military gymnasium of Count Arakchéeff, transferred from Novgorod, and two cathedrals, Preobrajenski and Arkhangelski. These were erected in 1225 and 1222 respectively, and have been rebuilt more than once; the present structures, in somewhat poor taste, date from 1834 and 1732. The Preobrajenski cathedral, however, retains several relics of the past, such as a holy picture of 1380, and a Bible of 1404; Minin, the hero of Nijni, lies buried there. The Kremlin is adorned with a square, containing a monument to Minin and Pojarsky erected in 1826, and pretty boulevards have been laid out along its lower wall. The view from the Kremlin of the broad Volga, with its low-lying and far-spreading left bank, is very charming. The Pechorsky monastery, close by, is archæologically interesting; it was built in the first half of the 16th century,—instead of the old monastery founded in 1330 and destroyed by a land-slip,—and has several antiquities and a library with very valuable MSS. Another monastery, contemporary with the foundation of Nijni, that of Blagovyeschensk, is situated on the right bank of the Oka. Its old churches have been destroyed by fire, but it has a very ancient holy picture—probably the oldest in Russia—dating from 933, which attracts many pilgrims. Besides the Kremlin, the upper town contains the best streets and public buildings. Five descents lead from it to the lower town, which covers the alluvial terrace, 30 to 35 feet in height, on the banks of the Oka and Volga, and is the centre of a very lively traffic. Its embankments are covered with storehouses, and during the fair great quantities of merchandise are unloaded there: hills of salt surround the salt-harbour on the Oka; farther down are seen the extensive storehouses and heaps of grain of the corn-harbour; then comes the steamboat quay on the Volga, opposite the Kremlin, and still farther to the east the timber-harbour. The fair is held on the flat sandy tongue of land between the Oka and the Volga, connected with the town only by a bridge of boats, 1500 yards long, which is dismounted in winter. The shops of the fair, more than 3000 in number, built of stone in regular rows, are surrounded by a canal, and cover half a square mile. A complete town has sprung up around them, whilst the sandy banks are occupied by storehouses. The Siberian harbour during the fair has a special interest on account of its accumulations of tea boxes and temporary shelters where the different kinds of tea are tried and valued by tasters. The point of the peninsula is occupied by the storehouses of the steamboat companies, while metal wares and corn are discharged on a long island of the Oka, at the iron-harbour and Grebnovskaya harbour. An island in the Volga is the place where various kinds of rough wares are landed. An immense cathedral has been recently erected to the north of the fair, on a site which is often flooded. The railway from Moscow has its terminus close to the fair buildings, to the south of which is the suburb Kunavina, widely known throughout the East as a place for amusements of the lowest kind during the fair.

Nijni-Novgorod is well supplied with drinking-water by springs which flow from beneath the Triassic marls of which its hills are constituted. The water is collected in a basin on the banks of the Volga and pumped to the upper town (114,000 gallons per day). The climate of Nijni is harsh and continental, the yearly average temperature being 39° Fahr. (10°·6 in January and 64° in July), and the extreme thermometric readings – 40° and 104° Fahr.

The town has a settled population of 50,000 inhabitants, rising to 250,000 or perhaps to 300,000 during the fair. The inhabitants are nearly all Great-Russians, and many of them are Nonconformists. The mortality exceeds the birth-rate. The educational institutions, which are few, include, besides the military school, one college (gymnasium) for boys and one for girls, a technical school, a theological seminary, two schools for sons and daughters of the clergy, and a dozen primary schools. The aggregate number of scholars being 3000, nearly 8000 children receive no public instruction. There is a small public library, and a single periodical—*The Exchange News*; the five printing offices are employed almost exclusively by the public institutions. Of late the statistical committee has issued a most valuable publication, the *Nijegorodskiy Sbornik*, containing all kinds of statistical, ethnographical, and archæological information about the government.

The manufactures are unimportant, but on the increase. The steam flour-mills, iron and machine works, manufactories of ropes and candles, distilleries, and potteries have an aggregate production of nearly £250,000 per year. Shipbuilding, especially for the transport of naphtha on the Caspian Sea, and also steamboat building, have recently advanced considerably. Nijni is the chief station of the Volga steamboat traffic. The first steamer on the Volga made its appearance in 1821, but it was not till 1845 that steam navigation began to assume large proportions. In 1846 the whole traffic, carried on by nearly 1000 boats and 200 larger boats moved by horse-power, did not exceed 1,000,000 tons; it is now estimated at 2,500,000 tons, worth £3,000,000, and the number of steamers on the Volga alone is about 500. The head offices of the chief companies are at Nijni. The merchants also carry on a brisk trade, valued (apart from that of the fair) at more than £2,000,000 (20,000,000 roubles) of purchases and £1,800,000 of sales; the chief items are corn (from £200,000 to £500,000), salt, iron, tea, fish, groceries, and manufactured goods. The annual budget of Nijni is under £20,000.

The chief importance of Nijni is due to its fair, which is held from August 5th to September 15th. From remote antiquity Russian merchants were wont to meet in summer with those from the East at different places on the Volga, between the mouths of the Oka and Kama,—the fair changing its site with the increasing or decreasing power of the nationalities which struggled for the possession of the middle Volga. Bulgary, or Bakhrimovo, Nijni-Novgorod, Kazan, and Vasilsursk have successively been its seat since the 10th century. From 1624 its seat was long at the Jeltovodski monastery, 55 miles below Nijni, close to Makarieff, whence its present name. The situation, however, being in many ways inconvenient, and a conflagration having destroyed the shops at Makarieff, the fair was transferred in 1817 to its present seat at Nijni. The first fair held here showed a large increase of arrivals, which reached the value of 27,000,000 roubles, and this figure has steadily increased, reaching an average of 168,628,600 roubles in 1871–75, and 200,446,000 roubles in 1880. The value of the merchandise unsold usually varies from 15 to 25 millions (31 millions in 1880). The goods chiefly dealt in are cotton, woollen, linen, and silk stuffs (35 to 38 per cent. of the whole), iron and iron wares, furs and skins, pottery, salt, corn, fish, wine, and all kinds of manufactured goods. The Russian goods constitute four-fifths of the whole trade; those brought from Asia—tea (imported *via* Kiachta, Canton, and Suez), raw cotton and silk, leather wares, madder, and various manufactured wares—do not exceed 10 or 11 per cent. Manufactured wares, groceries, and wines are the goods principally imported from western Europe.

The above figures, however, convey but a very imperfect idea of the total business transacted at the fair, which has been estimated at 371,018,911 roubles in 1880 (320,532,700 in 1876), and in reality stands at a much higher figure. Twenty-five years ago, the Russian manufacturers depending chiefly on the barter-trade in tea at Kiachta, their production was regulated principally by the prices of tea established at the fair; but now cotton takes the lead, and the extension to be given each year to the mills of central Russia is determined at the fair by the price of raw cotton imported from Asia, by that of madder, and by the results of the year's crop which become known during the fair. The same holds good with regard to all other stuffs, the prices of wool (provisionally established at the earlier fairs of south-western Russia) being ultimately settled at Nijni, as well as those of raw silk. The whole of the iron production of the Ural depends also on the same fair. The "caravans" of boats laden with iron-ware, starting from the Ural works in the spring, reach Nijni in August, after a stay at the fair of Laisheff, which supplies the lower Volga; and the purchases of iron made at Nijni for Asia and middle Russia determine the amount of credit that will be granted for the next year's business to the owners of the iron-works, on which credit most of them entirely depend. The fair thus influences directly all the leading branches of Russian manufacture. It exercises a yet greater influence on the corn and salt trades throughout Russia, and still more on the whole of the trade in Siberia and Turkestan, both depending entirely on the conditions of credit that the Siberian and Turkestan merchants obtain at the fair.

The Makarievskaya fair attracts therefore no fewer than 200,000 people from all parts of Russia, and partly from Asia. The 3000 shops of the Gostinoy Dvor being insufficient for all the merchandise, other 3000 shops are erected on a field close by, whilst the quays are covered for 10 miles with heaps of ware and temporary shelters. The Oka and Volga are literally covered with thousands of boats of all descriptions; thousands of bargemen swarm in the dirtiest holes, spreading epidemics; whilst the lowest amusements are carried on in the houses of Kunavina. The fair is under the control of a special committee, who raise more than 400,000 roubles for shop rents.

Two other fairs of some importance are held at Nijni,—one for the trade in wooden wares is held on the ice of the Oka, and another, in June, for the trade in horses.

History.—The confluence of the Oka and the Volga, inhabited in the 10th century by numerous Mordvinian tribes, began to be coveted by the Russians as soon as they had occupied the upper Volga, and as early as the 11th century they had established a fort, Gorodetz, 20 miles above the mouth of the Oka. In 1221 the people of Suzdal, under Yuri Vsevolodovich, erected a fort on the hill now occupied by the Kremlin of Nijni, and gave it the name of *Novgrad Nizovskiya Zemli* (new town of the lowland). Until the beginning of the 14th century Nijni-Novgorod, which grew rapidly as the Russians colonized the banks of the Oka, remained a sub-town of Suzdal; it enjoyed, however, almost complete independence, being ruled by its popular assembly. In the 14th century, until 1390, it elected its own princes. Ill protected by its palisaded walls, it was plundered in 1377 and 1378 by the Tartars, supported by the Mordvinians. In 1390 Prince Vasili of Moscow, in alliance with the khan Toktamish, took Nijni and established his own governors there; in 1412 it was definitely annexed to Moscow, becoming a stronghold for the further advance of that principality towards the east. It was fortified in 1508–11, and was able to repel the Tartars in 1513, 1520, and 1536. The second half of the 16th century was for Nijni a period of peaceful and rapid development. It became a depôt for all merchandise brought from the south-east, and even English merchants established warehouses there. With the fall of Kazan, and the opening of the free navigation on the Volga, it became also the starting place for the "caravan" of boats yearly sent to the lower Volga under the protection of a military force; whilst the thick forests of the neighbourhood favoured the development of shipbuilding. In 1606–11 the trading classes of Nijni took an active part in the expeditions against the revolted serfs, and it was a Nijni dealer in cattle, Kozma Minin Sukhoruki, who took the initiative in sending an army for the delivery of Moscow from the Poles. During the 17th century the country around Nijni became the seat of a vigorous religious agitation, and in its forests the Raskolniks spread hundreds of their monasteries and communities, those of the Kerjenets playing an important part in the history of Russian Nonconformity even to our own day.

Nijni-Novgorod had at one time two academies, Greek and Slavonic, and took some part in the literary movement of the end of the last century; its theatre also had some importance in the history of the Russian stage. It is the birthplace of Kulibin and Dobroluboff. (P. A. K.)

NIKKO, one of the chief religious centres of Japan, is beautifully situated on the Nikko Zan (Mountains of the Sun's Brightness) in Tochigi *ken* (province of Shimotsuke), about 92 miles north-north-west of Tokio (Yedo) by the ordinary route *via* Utsunomiya. The town is properly called Hachi-ishi, but this name is very little used in comparison with that of the shrines. A Shintô temple seems to have existed at Nikko from time immemorial, and in 767 its first Buddhist temple was founded by Shô-dô Shô-nin (the subject of many strange legendary adventures); but the main celebrity of the place is due to the sepulchres and sanctuaries of Iyeyasu and Iyemitsu, the first and third shôguns of the Tokugawa dynasty. Iyeyasu was buried with amazing pomp in 1617, and Iyemitsu, his grandson, was slain in 1650 while visiting his tomb. From 1644 to 1868 the "abbots" of Nikko were always princes of the imperial blood; thirteen of them are buried within the sacred grounds. Though the magnificent abbots' residence was destroyed by fire in 1871, and the temples have lost most of their ritual and much of their material splendour, enough remains to astonish by excellence and bewilder by variety of decorative detail. Of the numerous structures which cluster round the shrine of Iyeyasu, it is sufficient to mention the cylindrical copper column, 42 feet high, adorned at the top with a series of six lotus flowers, from the petals of which hang small bells; a five-storied pagoda, 104 feet high, with the animals of the duodenary cycle running round the base; the gate of the Two Kings, with its figures of unicorns, tapirs, elephants, and tree-pæonies; the vermilion-coloured timber enclosure to which this gate gives entrance, with three great storehouses, a sumptuous stable for the sacred horses, and a finely fashioned granite cistern for holy water; and the Yo-mei gate, which with the contiguous cloister is covered with the most elaborate carving, and gives access to the court in the midst of which stands the last and most sacred enclosure. This, known as the *Tamagaki*, is a quadrangle of gilt trellis-work 50 yards square; within it stands the "chapel" or oratory (or rather a series of chapels, though the inmost is kept closed), in the decoration of which gilding and black lacquer have been lavishly employed. The tomb of Iyeyasu lies apart from all this magnificence two hundred and forty steps higher up the hills, in the shadow of tall cryptomerias—a single light-coloured bronze urn or casket standing on a circular base of three steps with a stone table in front on which rest a censer, a lotus-cluster, and a stork with a candlestick in its mouth,—the whole enclosed by a high stone wall. Somewhat similar are the tomb of Iyemitsu and its surroundings; and though the art displayed is of an inferior character, the profusion of buildings and embellishments is even more perplexing. Hotoké Iwa, the hill on which the tomb stands, is completely covered to the summit with trees of various tints.

See Satow and Hawes, *Guide-book to Japan*, 1881; Bird, *Unbeaten Tracks in Japan*, 1880.

NIKOLAIEFF, the chief naval station of Russia on the Black Sea, is situated in the government of Kherson, 41 miles north-west of the government capital. It stands most advantageously a little above the junction of the Ingul with the Bug, at the head of the *liman*, or estuary, of the Bug, and is the natural outlet for the basin of that river. The estuary, which is 23 miles long, enters that of the Dnieper; and Nikolaieff, 42 miles distant from the Black Sea, thus combines the advantages of a good seaport with those of an inland town. The entrance to the double estuary of the Bug and Dnieper is protected by the fortress of Otchakoff and by the fort of Kinburn, erected on a narrow headland opposite, while several forts surround Nikolaieff on both sides of the Bug and protect it from an attack by land. The town, which occupies two flat peninsulas between the Bug and the Ingul, extends up the banks of the latter, while its suburbs spread still farther into the steppe, the whole covering an area of 6 square miles. Immense unoccupied spaces separate the houses, which are mostly one-storied, and border on spacious streets. The bank of the Ingul is taken up with shipbuilding yards, docks, slips, and various workshops of the admiralty for the construction of armour-plates, guns, boilers, &c. On the river there is a floating dock for armoured ships, but Nikolaieff has this drawback that fully armoured ships are unable to pass the bar, which is only 18 to 21 feet deep. Before the Crimean War the activity of the dockyards was very great, ships of 130 guns being built in them; the suburbs—which belong to the admiralty—were bound to supply the necessary hands to the number of 3000 every day, and all the inhabitants had to perform compulsory service. Special bodies of militarily organized workmen were trained in shipbuilding, and thus Nikolaieff became a great school for all branches of navigation and naval architecture. The population, numbering 35,000, was mainly dependent on these sources; but when the activity of the admiralty was brought to a stop for fourteen years by the treaty of Paris the inhabitants had to seek other means of support. By a branch of the Balta-Krementchug Railway, starting from Znamenka (147 miles), Nikolaieff has been brought into connexion with the Russian railway system, and its grain exports now equal those of Riga, while it is the chief market for a region comprising the governments of Kherson, Poltava, Kharkoff, Ekaterinoslaff, and parts of Kieff and Podolia. In 1878 it reached the maximum of 2,665,000 quarters (9,660,000 cwts. in 1881). Large storehouses, capable of holding 2,000,000 quarters, stand close to the commercial port, two miles distant from the town, at Popova Balka on the Bug. The export of timber, skins, tallow, and cattle is steadily increasing. The population, which is growing rapidly, now amounts, including the suburbs, to upwards of 70,000 (45 per cent. of them military, and 7000 Jews). The sanitary conditions are bad, and the mortality reaches 40 per thousand. The educational institutions of Nikolaieff are more numerous and better than in many capitals of Russian governments. They include a gymnasium, an artillery school, and a dozen schools for boys and girls, an astronomical and meteorological observatory (46° 58′ N. lat. and 31° 38′ E. long.), four museums and libraries, and a hydrographical institute. Among the public buildings, the cathedral, which contains some good Italian pictures, the theatre, the admiralty and several other state buildings are worthy of mention. The manufactures in the hands of private individuals include a shipbuilding yard and several tallow-melting houses and tobacco works. Since 1870 the Nikolaieff admiralty has resumed activity, especially in the construction of armoured ships and torpedo boats, though not to such an extent as before the Crimean War. Though a district town of the government of Kherson, Nikolaieff is under an independent military governor.

The remains of the well-known Greek colony Olbia have been discovered close to the confluence of the Ingul with the Bug at the Sto-Moghily (Hundred Graves). In mediæval times the country was under the Lithuanians, and subsequently under the Zaporogian Cossacks. Russian colonists settled in the locality about the end of the last century, and after the fall of Otchakoff Prince Potemkin established a wharf on the Ingul which received the name of Nikolaieff. The further development of the town is due almost entirely to the efforts of the Russian Government to make it an important naval station.

NIKOLAIEVSK, a district town of Russia, in the government of Samara, on the right bank of the Irghiz, lies 48 miles from the Volga and 109 miles to the south-west of Samara. Its 10,000 inhabitants are mostly Raskolniks, or of the "United Church," and about 2000 Tartars occupy a separate part of the town. The chief occupation of the Russian and Tartar inhabitants is agriculture and cattle-breeding, in the products of which the merchants carry on a lively trade. The industries (tallow-melting and tanning) are unimportant. The fertility of the soil in the district favours commerce, as well as the development of large villages, many of which—Poganovka (6000 inhabitants), Ekaterinstadt (5000), Porubejka (5000), and several others—are more important and wealthier than many district towns of Russia. The famous Irghiz monasteries of the Raskolniks occur along the Irghiz in the same district, whilst the left bank of the Volga is studded with rich German colonies.

Under the name of Metchetnoye, Nikolaievsk was founded in 1762, by Raskolniks who had fled to Poland and returned when Catherine II. undertook to grant them religious freedom. The monasteries which were founded at the same time became the refuge of numerous runaway serfs, and so the focus of the disturbances which broke out in 1773. In 1828 serious prosecutions began, with the result that the monasteries were closed with the exception of three, which were handed over in 1829 and 1836 to the United Church by order of Government. In 1835 the name of Metchetnoye was changed to Nikolaievsk.

For Nikolaievsk-on-the-Amur, a town of Eastern Siberia, on the left bank of the estuary of the Amur, 23 miles from the Gulf of Amur, see MARITIME PROVINCE, vol. xv. p. 548.

NIKOLAIEVSKAYA SLOBODA, a village of Russia, in the government of Astrakhan and district of Tsareff, 3 miles from the Volga, on its left bank, opposite Kamuishin. It dates from about the end of the last century, when a number of Little-Russians settled here for the transport of salt from Lake Elton. Although still but a village, it has about 30,000 inhabitants, and is one of the chief centres on the lower Volga for the trade in corn and salt.

NIKOPOL, a town of Russia, in the government and district of Ekaterinoslaff, on the right bank of the Dnieper, 76 miles to the south-south-west of Ekaterinoslaff. The town, formerly called Nikitin Rog, occupies an elongated peninsula between two branches of the Dnieper, at a point where its banks are covered on both sides and to a considerable distance with marshes, and has been for many centuries one of the places where the middle Dnieper could most conveniently be crossed. The old "setcha," or fortified camp, of the Zaporogian Cossacks had its seat a little above. Numbers of graves around it recall the battles which were fought for the possession of this important strategic point. One of them, close to the town, "the Great Grave" (*Tolstaya Moghila*), contained, along with other Scythian antiquities, the well-known precious vase representing the capture of wild horses. Even now Nikopol, which is situated on the highway from Ekaterinoslaff to Kherson, is also the point where the "salt-highway" of the Chumaks (Little-Russian carriers of salt) to the Crimea crosses the Dnieper. A wharf for the building of trading ships navigating the estuary of the Dnieper has been established at Nikopol, and it is still one of the chief places on the lower Dnieper for the export of corn, linseed, tallow, and wool. Its 10,000 inhabitants are Little-Russians, Jews, and Mennonites, who prosecute agriculture extensively. The trade in wheat, hemp, tallow, and wool is important in connexion with the export trade of Nikolaieff and Odessa.

NIKOPOLI, or NICOPOLI (Turkish, *Nighebolu* or *Nebul*), a city of Bulgaria, the chief town of a circle in the district of Plevna (Plyeven), is picturesquely situated on the south bank of the Danube, at the confluence of the Osma. According to the census of 1881 it had only 4652 inhabitants, but previous to its destruction by the Russians in 1877 they numbered about 10,000, and as a military post the town has for centuries been of considerable importance. A ruined castle still dominates the place, and fortifications stretch down to the river.

Nikopoli occupies the site of the ancient Asamus, but by some mediæval confusion bears the name of Nicopolis ad Istrum, which was founded by Trajan several miles down the river, at the inflow of the Iatrus or Yantra, at the spot still called Nikup. The following are the chief points in the modern history of the place:—capture of the fortress by Sigismund of Hungary in 1392 and 1395; defeat of Sigismund and his hosts in 1396 by Bajazet; siege of the town by Uladislaus of Hungary in 1444; defeat of the Turks by Bathori in 1595 and by Michael of Wallachia in 1598; occupation of the fortress by the Russians in 1810; destruction of the Turkish flotilla and storming of the Turkish camp by Govaroff in 1829; and the capture and burning of the town by the Russians under Krüdener on 15th June 1877.

NILE. This mighty river, which after a course of 3370 miles pours into the Mediterranean a low-water current of 61,500 cubic feet per second, has its cradle in the Victoria Nyanza, an enormous lake in Central Africa where the line of the equator is crossed by 32°, 33°, and 34° of E. long., somewhere about 4000 feet above the sea. The Victoria Nyanza[2] measures 230 miles from north to south and 220 from east to west. Its coast-line, which is very irregular, cannot be less than 2000 miles; its water area is estimated at 27,000 miles, and its very islands have an aggregate area of 1400 square miles. The physical features of the shores vary greatly from district to district.[3] At the south-east corner is Speke Gulf, about 60 miles long, formed partly by a deep indentation of the mainland and partly by the peninsular island of Ukerewe, which is separated from the mainland by Rugisi or Rugeshi Strait, a narrow and shallow channel about ¾ mile long, overgrown with rushes, papyrus, and a fine network of grass which undulates beneath the foot. Bukindo is the chief village on the island, which forms the territory of a separate ruler. Its inhabitants murdered Lieutenant G. Shergold Smith, R.N., and Mr O'Neill, members of the 1876-77 expedition of the Church Missionary Society. To the north of Ukerewe lies Ukara, for the most part barren, and with two rugged hills rising 200 or 300 feet. The natives average less than 5 feet in height (Wilson and Felkin, i. pp. 99-101). Along the south and south-west coasts is a whole series of islands—notably Komeh, Mysomeh, Bumbireh, and Bukerebe or Alice Island; but of much more importance is the great Sesse Archipelago off the coasts of western Uganda. At first entered on our maps as a single great island, it has turned out to be (according to King Mtesa's possibly somewhat exaggerated statement) a cluster of four hundred mostly inhabited islands, some of the largest being 10 to 15 miles in length and 3 to 4 miles in breadth. Clothed as they generally are with forest, and fringed along the shore with papyrus or low jungle, they often present scenes of the richest tropical luxuriance. Along the east half of the northern coast are a number of

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[1] Plate XV. shows the river system south of the Tropic of Cancer. For the Egyptian portion see Plate VI., vol. vii.

[2] Nyanza means water or lake. Other names are—Nyanza Kerewe (Linant), Nerua Bali (Baker), Luero lo Luta Nzige, *i.e.*, "white with dead locusts" (Speke), Bahari ya Pila or "Second Lake" and Bahari ya Ukara (of the Sawahili), and Sea of Ukerewe (of the Arabs).

[3] A description will be found in Wilson and Felkin, *Uganda and the Egyptian Soudan*, vol. i. p. 250-54.

considerable islands such as Usuguru, and, at the head of Napoleon Channel, Uvuma, famous for the canoe contest waged between its inhabitants and King Mtesa of Uganda, of which Mr Stanley was spectator. Ugingo, on the east coast, is a large island separated like Ukerewe by a narrow channel from the mainland. Though when its extent is taken into account Victoria Nyanza may be described as shallow in contrast to such basins as those of Tanganyika, the depth, especially on the eastern side, appears to be very considerable, Stanley giving 275 and even 580 feet not far from the shore. Of the affluents of the lake a few only require to be mentioned. The Shimiyu, which falls into the south side of Speke Gulf, was described by Stanley (March 1875) as a magnificent flood a mile wide receiving the waters of the Monangah, the Luwamberri, and the Duma, and having a course of 300 miles. If this were the case it would take the southmost point of the Nile system as far at least as between 4° and 5° S. lat. But when Lieutenant Shergold Smith saw the Shimiyu in 1876 he found it a comparatively insignificant stream, and if the altitudes observed by Smith and Pearson be correct it cannot be the recipient of the Luwamberri and the Monangah. Instead of the Shimiyu, either the Wami (or Kiye) or the Muinguira (Isanga or Isanda), both of which flow into Jordans Creek,[1] may be the southmost feeder of the Nile. Of much more importance as a tributary than any of these is the Kagera (of the Waganda), otherwise known as the Kitangule, Kitangure (Burton), Tengure (Grant), or Alexandra Nile (Stanley), a river 450 feet wide and 85 feet deep at its mouth, with a strong current, apparently pouring into the lake more water than is carried off by the Nile. It may be navigated for about 50 miles, and is believed to have its sources between 200 and 300 miles to the south-west. There are several lakes along its course—Lake Windermere, Lake Thema, and the larger Lake Alexandra not yet reached by Europeans.

The leading fact in regard to the position of Victoria Nyanza in the general hydrography of Central Africa is that by none of its affluents is it connected with any of the other great "equatorial" lakes. Tanganyika[2] lies in a trough about 1400 feet lower. Between the Victoria and Lake Nyassa (Zambesi system) there is a stretch of 500 miles; and, though a large lake, part of which Stanley saw in 1876, and named Gulf Beatrice, lies to the west, it forms in all probability a distinct basin.

In 1875 Stanley proved that the only outflow from Victoria Nyanza was by the Ripon Falls on the north side of the lake. These falls (named after Earl de Grey and Ripon, president of the Royal Geographical Society in 1859) were discovered July 28, 1862, by Captain Speke, but from native accounts he was led to believe that other streams (such as the Luajerri) issued from the lake. The Nile, as it drops about 12 feet over the rocks, has a breadth of 400 to 500 feet, divided into several sections by a number of wooded isles. For the next 300 miles the Victoria Nile or Somerset River, as this section is called, has all the character of a mountain stream racing swiftly along a rocky channel often walled in by cliffs (at times 180 feet high) and broken by picturesque islands and countless rapids. At first for 117 miles its course is north-north-west, but reaching the Khor Kafu (on which Mruli stands), about 1° 38′ N. lat. and 32° 20′ E. long., it takes the north-east direction of this channel, and it is not till 2° N. lat. that it again turns north-west towards the Albert Nyanza. About 52 miles below the Ripon Falls, Long, who in 1874 boated from Urondogani to Foweira, describes himself as having passed through a lake 20 to 25 miles broad; but this expanse, which appears in text-books and maps (sometimes as two lakes, Kaja and Ibrahim Lakes), may have been the result of a mere temporary overflow. At Karuma, below Foweira, the river falls over a wall-like ledge of rock 5 feet high which extends right across its bed. But the great feature of the Victoria Nile is the Murchison Fall, about 2° 18′ N. lat. and 31° 50′ E. long., where the river rages furiously through a rock-bound pass, and plunges at one leap of about 120 feet into a gloomy abyss. Below this point, continuing between steep forest-covered hills, it gradually calms down into a stream so slow and steady that at certain seasons it is only from the scarcely perceptible drifting of the little green water-plants, called *Pistia Stratiotes*,[3] that the flow can be observed. About 20 or 25 miles below the fall it enters the north end of the Albert Nyanza.

This lake[4] was first reached by Baker on March 14, 1864, near Vacovia on the east coast, a small village of fishermen and salt-makers. From a granitic cliff 1500 feet above the water he looked out over a boundless horizon on the south and south-west, and towards the west descried at a distance of 50 or 60 miles, blue mountains about 7000 feet high.[5] The Albert Nyanza was consequently entered on his map as a vast lake extending from 2° S. lat. to 2° 50′ N. lat., or a distance of about 380 miles. But the circumnavigation of the lake by Gessi Pasha (1876), Mason Bey, and Dr Emin Bey leaves no doubt that its real dimensions are—length 97 miles, average breadth 22 miles, and area about 2000 square miles. The western shore is in its northern half overhung by lofty and precipitous mountains, but farther south is formed by a wide forest-clad plain. At the south end the water is very shallow and encumbered by a vast stretch of ambatch forest. Instead of the lake being, as Baker contended, one of the great sources of the Nile, its functions are those of a large backwater. Of course a considerable amount of drainage must reach it from the surrounding high grounds, though the lakeward slopes are not very extensive; but none of its tributaries appear to be of much importance as feeders of the main stream. Along the western shore the depth is from 15 to 20 feet.

Escaping by an island-studded channel from the north-west corner of the Albert Nyanza, the Nile, which now takes the name of Baḥr al-Jebel, or River of the Mountains, continues to flow in a general northward direction. From Magungo to Dufile (Dufli), 128 miles, its course is wonderfully smooth, and forms a series of lake-like reaches. Below Dufile the high lands close in upon the river, which, from a width of a mile at Dufile, narrows to 400 or 500 yards, and rushes through a gorge. Near Mugi (50 miles below Dufile) are the formidable Yarborah rapids. From Kiri (Kerrie)—an Egyptian fort on an eminence 1500 feet high on the left bank—the river is again navigable, but flows with so strong a current that Mr Felkin's boat took only three and a half hours to reach Bedden, a distance of some 30 miles. At Bedden a line of hills runs right athwart the channel, which is divided by an island of great beauty. An iron rope ferry was established by Gordon at this point, and without it the river could not be crossed. Between Bedden and Rejaf (12 miles) the hills give place to park-like plains dotted with large trees. About 15 miles below Rejaf, Gondokoro is passed on the right hand, and there the traveller may still see the ruins of the old mission church, the earthworks of Baker's camp, and the lemon grove from which the fruit has been distributed throughout the equatorial provinces. At this point the river, about 656 feet wide, is divided by a large island. Eight miles farther down lies Lado (often spelled Lardo) on the left bank, a well-built Egyptian town with houses of burnt brick and a considerable area of cultivated land watered by shadûfs. With the hill to the west of Lado, variously called Nyerkani and Luyola, the mountainous region ends, and the river enters on a vast plain. The affluents which it has hitherto received are for the most part short and individually insignificant *khórs* (temporary streams), but two at least deserve a few words of description. The Unyama, joining the river opposite J. Kuku or Neri, 10 miles below Dufile, is a perennial stream rising in the prairies between Fatiko and Unyoro, and winding through a lovely country for about 80 miles. The Asua (Atza of the Madi), whose mouth is 20 miles farther down on the same side, is about 120 paces broad, and flows through a rocky bed 15 feet deep. As it receives nearly the whole drainage of the Madi and Shua countries and various districts farther east, it becomes in the rainy season a deep and furious torrent. The Atabbi or Atappi (the main drain of the western face of the Shuli mountains) reaches the Asua a short distance above the mouth.

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[1] Named not after the Jordan, but after Speke's country-house, Jordans, in Somersetshire.

[2] Tanganyika level is 2610 feet according to Joseph Thomson.

[3] *Pistia Stratiotes* is characteristic of the Baḥr al-Jebel. It is found drifting far down the White Nile, but, according to Steudner, does not occur in the Baḥr al-Ghazál.

[4] Otherwise known as the Mwutan Nzige (Locust Lake) and the Luta Nzige (Dead Locust).

[5] The descriptive phrase "blue mountains" has since been converted into a geographical name, "Blue Mountains."

The great plain which the Nile enters below Lado, about 5° N. lat., slopes so gradually towards the north that the river falls only 300 feet in a stretch of more than 650 miles between Gondokoro and Khartoum. As the river has gradually raised the level of both bed and banks, an overflow takes place, and lagoons or side channels (*mayás*) are formed wherever the bank breaks down; and as these, from their position, naturally act as settling-ponds they get rapidly silted up.

Up to about 7° 25′ N. lat., in spite of this condition of things, the Nile maintains a fairly definite course, with a considerable depth of water in its main current, but at this point it splits up into two branches as if to form a delta. The left branch, which retains the name Baḥr al-Jebel, but which may be conveniently distinguished by the Denka name of Kir, continues in the line of the river, and the right branch, or Baḥr al-Zeráf (Giraffe River), tends rather more towards the east. After flowing respectively about 160 and 140 miles, they reach the Baḥr al-Ghazál, slowly gliding east with a slight deflexion to the south. The whole region is a vast expanse of low swampy lands crossed by secondary channels, and flooded for many miles in the rainy season. At the junction of the Baḥr al-Ghazál and the Kir the permanently submerged area is usually named Lake No on our maps, but the Arabs simply call it the confluence—Moḳren al-Boḥúr. The scenes presented by this portion of the Nile are of the most peculiar description. The dark and ill-smelling water shows no sign of motion. On all sides stretch monotonous reaches of omm súf (*i.e.*, woolly) grass (*Vossia procera*) and papyrus, rising 20 or 30 feet above the water so as often to close the view like a stone wall; the level of the plain is broken only at intervals by little mounds of earth, tenanted for the most part by white ants, and covered with a clump of brushwood or trees;[1] the moisture in the air is so excessive that gunpowder left in the guns overnight is reduced to a paste; mosquitoes and other swamp flies swarm in myriads. And yet touches of beauty are not wanting. Water-lilies (*Nymphæa stellata* and *Nymphæa Lotus*)—white, blue, and crimson—often adorn the surface of the stream; multitudes of water-fowl, from the familiar Egyptian duck and the pelican to the rare and odd-looking *Balæniceps rex* (abú markúb), breed among the reeds, and at night the scene is lit up by a very firmament of fire-flies.

Previous to 1863 both the Kir and the Baḥr al-Zeráf had been navigable within the memory of man. But when the Tinné expedition passed down the river in March of that year, the White Nile, the united current of the Baḥr al-Jebel and the Baḥr al-Ghazál, was found to be blocked by an accumulation of vegetable flotsam, and it cost the crew two days' hard labour to take their vessel through a channel partially cleared by their predecessors. The obstruction rapidly increased, and thirty vessels had to be employed for five weeks to open a permanent passage. In 1865 Baker found a dam about ¾ of a mile wide already overgrown with reeds and grass so as to form a continuation of the surrounding country. Matters went from bad to worse, and the White Nile, the Kir, and the Baḥr al-Zeráf were all rendered impassable till, in 1874, Ismael Ayub Pasha cleared the main route by the White Nile and the Kir. But in 1878 again the whole Nile rose to an unusual height (the banks at Lado, 15 to 20 feet above the mean level, were overflowed), and enormous quantities of vegetable debris were carried off by the current. A formation of bars on an unprecedented scale was the result, and communication between the upper and lower Nile was not restored till 1880.

If the Kir and the White Nile, with their comparatively strong current, were thus obstructed, it was natural that the more sluggish Baḥr al-Ghazál should contain more extensive though less compact accumulations. In 1881 Gessi Pasha spent three and a half months on a part of the voyage usually performed in five hours, and lost half of his men by starvation. Between the mouths of the Kir and Baḥr al-'Arab there were twenty distinct dams.[2]

Sir Samuel Baker asserted in 1874 that from the equator to the Mediterranean not a drop of water reached the Nile from the west,—the Baḥr al-Ghazál being only a channel of stagnant pools and marshes (*Proc. Roy. Geog. Soc.*, 1873–74, p. 148). But if their total contribution be of little moment in comparison with that of their eastern rivals, the western affluents are exceedingly numerous, and drain a wide extent of country. Their relative importance has been shown by Schweinfurth, Junker, Emin Bey, &c. One or two—the Rodi (Lau) and the Rohl—join the Baḥr al-Jebel in its passage through the plain, but by far the greater number converge to the Baḥr al-Ghazál. At its lowest state, just before the commencement of the rains, this river had in 1881 a depth varying from 20 to 25 feet, though in many places no perceptible current. It is generally navigable to Meshrat-el-Rek, about 200 or 220 miles above the mouth of the Kir, and in the rainy season even small steamers may ascend its tributary, the Dyur or Jur, as far as Wau. In exceptionally dry seasons the channel at Meshrat-el-Rek is so utterly desiccated that drinking-water can be obtained only by digging. One of the main feeders of the Baḥr al-Ghazál is the Baḥr al-'Arab, which is formed by the drainage of southern Darfúr, has a breadth—about 10° 20′ N. lat. and 25° 20′ E. long. (before it receives any of its right hand affluents)—of 360 feet and a depth (in December) of 4 feet, and never quite dries up even in the heat of summer (Felkin, *Uganda*, ii. 239). This is the only considerable accession from the north: the rest of the affluents, an almost countless host if all the small headstreams be included, have their rise in the range of mountainous country which stretches, from the Blue Mountains of the Albert Nyanza and their southern continuation, in a general north-east direction as far as 25° or 26° E. long., and forms the watershed between the Nile basin and those probably of Lake Chad and the Congo. Flowing in many cases for 400 or 500 miles, these streams in the upper part of their course are of considerable volume and of much importance in the economy of the countries which they traverse.

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[1] The ordinary theory is that these mounds are hills constructed by the white ants; but Marno considers them as more probably portions which have resisted the general process of degradation.

[2] See E. Marno, "Die Sumpfregion des äquat. Nilsystems," in *Pet. Mitth.*, 1881, and another paper in 1882.

About 95 miles below the junction of the Kir, and 30 below that of the Bahr al-Zeráf, the White Nile receives its first great affluent from the east. The Sobát, as it is called, has its headwaters (largely unexplored) distributed over a wide area—the southmost rising possibly as far south as 4° N. lat. in the hilly country of Atuka, the eastmost in Kaffa, and the northmost about 9° in the Berta mountains.[1] On one of them there is probably a considerable lake: first inserted as Baro Lake on our maps by Petermann on the report of a slave dealer, it was expunged by Matteucci; but Schuver claims to have seen it from the mountains to the north, and proposes to call it Haarlem Lake. The Sobát proper is navigable from June to November as far as Nasser (180 miles), an Egyptian port established by Gordon in 1874, and even, it is said, for three days farther, though it divides into four branches a short distance above this point. Junker, who visited Nasser[2] in 1876, found the river 15 to 20 feet deep, flowing at the rate of 80 paces per minute between banks high enough to prevent any general inundation. At the mouth of the Sobát there is an Egyptian post of the same name (see *Zeitschr. der Ges. f. Erdk.*, Berlin, 1877).

The northward progress of the White Nile for the next 300 miles is through a great plain stretching from the spurs of the Abyssinian highlands in the east to the hilly districts of Takalla and Kordofan in the west, and consisting almost exclusively of red and other sandstone, often flat as a pavement. Escaping from the swampy region, the river again forms a well-marked channel, with regular and sometimes high banks. Throughout the whole distance indicated a striking confirmation of Baer's law is afforded,—the fairway or deeper side of the stream generally keeping to the eastern shore. About 60 miles below the Sobát mouth lies (on the right bank) Fashoda, an Egyptain town founded in 1867 on the site of Denab, the old "capital" of the Shilluks. In the neighbourhood of Mahadat Abu Zaid (about 13° 5′ N. lat.) begin the Sunt Islands, so called from the Arab name for the *Acacia nilotica*, a tree characteristic of the White Nile.

At Khartoum (Khartúm), in 15° 37′ N. lat., the White Nile is joined by its greatest eastern confluent the Blue Nile[3] (Bahr el-Azrak). This river has its head reservoir in Lake Tana (Tsana), which is so situated that the lines of 12° N. lat. and 37° 2′ E. long. cut it into four nearly equal portions.[4] The height of the lake is 5658 feet (Rohlfs). From east to west the breadth is about 40 miles, and the area is estimated at 2980 square miles. Between Dega and Zegi a depth of 236 feet has been found, and between Korata and Zegi 219. The Blue Nile, or Abai as it is called in Abyssinia, rises on the northward slopes of a cluster of mountains (Mount Geeh, &c.) about 11° N. lat., and flowing northwards enters Lake Tana near the south-west corner, to issue again at no great distance. Of the multitudinous ramifications by which the Abai and its tributaries drain a large part of the Abyssinian plateau, a better idea will be obtained from the map than from any description. From east and south and north the mountain streams pour down into the river,—its eastmost tributary probably rising east of Magdala, and its southmost between 8° and 9° N. lat. At Fazokl or Famaka, 11° 17′ N. lat., it begins to escape from the mountains; about 130 miles farther down, after passing Rosaires and Karkoj on the right and Sennaar on the left, it is joined by the Dinder; and 35 miles more bring it to the confluence of the Rahad (Ra'ad) and the town of Abú Haraz. Beyond this point it flows through the most fertile portion of the Egyptian Soudan, the plain on the left hand more especially being a great grain-growing district. The total length of the Abai or Blue Nile may be estimated at 960 miles.

On the north-west side of the mountains which enclose Lake Tana are some of the headwaters of the Atbara, another important tributary of the Nile; but it does not reach the main stream till about 17° 41′ N. lat., or 200 miles below Khartoum. Its principal branch, the Settit or Takazze, has a course of about 420 miles through the Abyssinian plateau before it joins or (more strictly) is joined by the river which gives its name to the united stream. The Khor-el-Gash, or Mareb, though a considerable river in its upper regions, reaches the Atbara (and thus the Nile, of which it is the northmost affluent) only during a heavy rainy season (see James, *Wild Tribes of the Soudan*, 1883). A large number of these eastern tributaries are mountain torrents, of enormous volume and impetuosity during the rains, and for a short time afterwards, but rapidly dwindling again into mere threads of water or chains of pools, and leaving the rocks and sand of their deep-cut channels as dry and parched as the surrounding desert. No one who has read it will easily forget Sir Samuel Baker's graphic account of the deep pool in the bed of the Atbara into which the fishes, tortoises, crocodiles, and hippopotami from a long reach of the river had gradually been crowded as the water disappeared, and of the sudden release effected by the return of the rainy season.[5] A more recent traveller, Herr Schuver, had a similar experience on the Tumat, the southern tributary of the Blue Nile.[6]

After receiving the Atbara the Nile continues for 650 miles through the Nubian desert, where the volume of the river suffers continual diminution from the extreme dryness of the air, without being recruited by a single drop of water. Between Berber (an important town on the right bank 30 miles below the Atbara) and Wády Halfa (about 600 miles) rapids and cataracts follow at intervals. The highest of these, the fifth cataract of the Nile, is situated about 40 miles below Berber, the fourth, 170 miles farther down, below Shitab, the third, 230 miles farther, at Hannek, and the second just above Wády Halfa. At Assuan (200 miles lower) are the first cataracts. Beyond that point the river flows through the wonderful valley which has already been described in the article EGYPT.

Reduced to its simplest expression, the Nile system may be said to consist of a great steady flowing river fed by the rains of the tropics, controlled by the existence of a vast head reservoir and several areas of repose, and annually flooded by the accession of a great body of water with which its eastern tributaries are flushed. The following details will enable the reader to estimate the hydrographic value of the different portions:[7]—

Victoria Nyanza lies in a zone where rain falls all the year round. At Kagei (south shore) the lake was seen by Mr Wilson in 1877 to be slowly rising in the middle of February, and it had attained its maximum (2 feet) about the middle of May, ten days after the rain had ceased. The total rainfall of this zone is not excessive. Speke's estimate of 49 inches is confirmed by Mr Wilson's much longer experience. In Uganda there are two maximum periods—March to May, and September to November.

The *Asua* is important from 15th April to 15th November.

The *Bahr al-Jebel*, at Gondokoro, begins to rise in April, and gradually attains a maximum of 4½ feet, the river being then 6 to 10 feet deep.

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[1] The connexion of the Godjeb or Omo with the Sobát, first suggested by Beke in 1841, and strongly opposed by Von Klöden, is still matter of doubt.

[2] Naser, *locus ubi torrentes fluunt in alveum.*

[3] At Khartoum the water of the one river has a milky-limy appearance, that of the other is clear and blue, except when in flood, when it gains a reddish-yellow from its alluvial burden.

[4] Lake Tana has been explored by Bruce, Blanc, De Cosson, Piaggia, Stecker, &c.

[5] Baker, *Abyssinian Tributaries of the Nile.*

[6] See *Petermann's Mittheilungen*, 1883; *Erg.-Heft*, No. 72.

[7] *Cf.* Keith Johnston, *Africa*, Appendix.

On the *Kir* the rainy season lasts from the first week of March to the close of October; but the 100 inches of rainfall goes largely to flood the swamps.

The *Baḥr al-Ghazál* is at its lowest in March, and begins to rise soon after.

The *Sobát* is full from June to December.

The *White Nile*, at Khartoum, begins to rise in May, but only gains 2 or 3 feet till July or August. Its maximum (6 feet) is reached in September. Linant Bey estimated its volume at low level as 10,488 cubic feet, and in flood as 213,450.

The *Blue Nile*, at Khartoum, begins to rise in July, and reaches its maximum (17½ feet) by August 20. Its rise is much more rapid than its decline; it takes eighty days to lose the gain achieved in fifty-one. Linant Bey estimated its volume at low level as 5615 cubic feet, and in flood as 220,620. At Famaka it grows turbid about 20th May.

The *Atbara*, for 150 miles above its junction with the Nile, is perfectly dry from March to June.

As a waterway leading into the heart of Africa, the Nile at first sight might appear to be of more importance than it is. Steamers, it is true, as well as sailing craft, can pass up from Egypt as far as Bedden, a distance of 2900 miles; but even at the period of high water (June to August) the ascent of the cataracts between Wády Halfa and Berber is so dangerous for vessels of any size that the river-route is seldom followed throughout. From Wády Halfa the traveller may proceed by camel to El Ordeh (New Dongola), thence take boat to El Dabbeh or to Old Dongola, and again proceed by land either to Berber, Shendy, or Khartoum. Or, instead, he may leave the river at Korosko, and strike through the Nubian desert direct to Berber. From Berber, which is also the terminus of a route often used from Souakim (Suakin) on the Red Sea, steamers ply up the river, but it sometimes takes nineteen days to reach Khartoum. The difficulties of navigating the Kir have already been described. Above Bedden the steamer again finds a free course from Dufile to the neighbourhood of the Murchison Fall; but the route to Victoria Nyanza is again overland from Magungo. It is found more expeditious to come to the equatorial regions from the east coast than up the Nile valley.

For the botanical aspects of the Nile valley the reader is referred to Schweinfurth's papers (*Petermann's Mittheilungen*, 1868); for the general zoology to Heuglin's sketch (*Ibid.*, 1869); and for an account of the fish fauna to Dr Günther's appendix to Mr and Mrs Petherick's *Travels in Central Africa* (1869).

The ancients knew little of the course of the Nile above Meroe (*q.v.*). Juba, in his *Libyca*, quoted by Pliny, makes the Nile rise in western Mauretania, not far from the ocean, in a lake presenting characteristic Nile fauna, then pass underground for several days' journey to a similar lake in Mauretania Cæsariensis, again continue underground for twenty days' journey to the source called Nigris on the borders of Africa and Ethiopia, and thence flow through Ethiopia as the Astapus. This tissue of invention received strange favour in the eyes of many subsequent geographers, and actually left its traces in some of our maps down to a comparatively modern time. Strabo, who ascended the river as far as Syene, states that very early investigators had connected the inundation of the lower Nile with summer rains on the far southern mountains, and that their theory had been confirmed by the observations of travellers under the Ptolemies. Nero despatched two centurions on an expedition for the express purpose of exploring the Nile, and Seneca informs us that they reached a marshy impassable region, which may be easily identified with the country of the White Nile above the mouth of the Sobát. To what they referred when they reported a great mass of water falling from between two rocks is not so readily determined. By the time of Ptolemy information had somewhat accumulated. Two streams, he says, issuing from two lakes[1] (one in 6° and the other in 7° S. lat.), unite in 2° N. lat. to make the Nile which in 12° N. lat. receives the Astapus, a river flowing from Lake Coloe (on the equator). Thus it would appear that he had heard vaguely about the lakes which we know as Victoria Nyanza, Albert Nyanza, and Tana. His two southern lakes, he conceived, were fed by the melting of snows on a range of mountains running east and west for upwards of 500 miles—the Mountains of the Moon, τὸ τῆς σελήνης ὄρος, *Lunæ Montes*. To this opinion he was probably led by hearsay about the snow-clad summits of Kilimanjaro and Kenia. On all the subsequent history of the geography of the Nile Ptolemy's theory had an enormous influence. Mediæval maps and descriptions, both European and Arabian, reproduce the Mountains of the Moon and the equatorial lakes with a variety of probable or impossible modifications. Even Speke congratulated himself on identifying the old Ptolemean range with the high lands to the north of Tanganyika, and connected the name with that of Unyamwezi, the "country of the moon." Attacking the lake region from the east coast, the Portuguese explorers gained a good deal of information which found its way into such maps as those of Pigafetta (1580); but it was not till the present century that the geography of those parts was placed on the basis of fully accepted observations. On November 14, 1770, Bruce reached Lake Tana, and considering, as he did, that the Blue Nile was the main branch, very fairly claimed for himself the honour of being the discoverer of the long-sought *caput Nili*.

The following are a few of the chief dates in the progress of knowledge since 1800 in regard to the river system:—

1807. Completion of Jacotin's *Atlas de l'Égypte* (surveys from the Mediterranean to Assuan). 1814. Burckhardt goes up the Nile, partly by land, as far as Shendi, crosses to the Atbara, and skirts the east side to Gos Rajeb. 1819. Cailliaud is the first to visit Meroe. 1820. Steamers first ascend the cataracts to Korosko. 1822. Cailliaud and Letorzec ascend the Blue Nile with Ibrahim Pasha's military expedition as far as Fazokl. 1827. Linant Bey ascends White Nile 132 geographical miles to Al Ais, in 13° 43′ N. lat. Prokesch von Osten surveys the Nile between Assuan and Wády Halfa. 1839. Mehemet Ali sends up White Nile an expedition, usually known as the First Egyptian Expedition, under Selim Bimbashi, which (28th January 1840) reaches an island Badelik, in 6° 30′ N. lat., but adds little information. Thibaut (Ibrahim Effendi) was a member of this expedition. 1840–41. A second Egyptian expedition (D'Arnaud, Sabatier, Werne) reaches island of Janker near Gondokoro, about 4° 42′ N. lat. 1841–42. Third Egyptian expedition (Selim Bimbashi, D'Arnaud, Sabatier, Thibaut). 1845. Brun-Rollet founds trading post not far from subsequent site of Heiligenkreuz. 1846. First steamboat on White Nile. 1849. Baron Von Müller surveys the Nile from Handak to Ambakol in province of Dongola. 1850. Knoblecher (of Austrian mission) reached Logwek. 1855. Rebmann (missionary at Kisulutini, north-west of Mombasa) sends home map showing Lake Ukerewe, extending from 0° 30′ N. lat. to 13° 30′ S. lat. 1858. Speke, twenty marches north of Kazeh, where he had left Burton, reaches shore of Victoria Nyanza. 1859. Miani reaches mouth of Unyama. 1860. Pruyssenaere starts from Khartoum up the White Nile. 1862. Speke reaches Ripon Falls. Steudner passes down the Ra'ad and Blue Nile to Khartoum. The Tinné expedition goes five hours' journey beyond Gondokoro on the White Nile. 1864. Sir Samuel Baker reaches Albert Nyanza. Petherick closes a long series of wanderings in the White Nile and Bahr al-Ghazál districts. 1868–71. Schweinfurth explores the western affluents of White Nile. 1871–73. Baker in the White Nile region. 1874. Watson and Chippendall survey the river from Khartoum to Rejaf, and J. Kemp from Rejaf to Dufile. 1875. Stanley circumnavigates Victoria Nyanza. 1877. First voyage across Victoria Nyanza by Rev. C. T. Wilson and Lieutenant Shergold Smith. 1881–82. Schuver in the source-district of the Tumat. (H. A. W.)

NÍLGIRI, a petty state in Orissa, Bengal, India, bounded on the N. and W. by Morbhanj state and on the S. and E. by Balasor district, with an area 278 square miles, of which only one-third is under cultivation. Valuable quarries of black stone are worked, from which cups, bowls, platters, &c., are made. The population in 1881 was 50,972.

NÍLGIRI HILLS, or Neilgherry Hills, a district and range of mountains in the Madras presidency, India, lying between 11° 12′ and 11° 37′ N. lat. and between 76° 18′ and 77° 5′ E. long., and bounded on the N. by Mysore, E. by Coimbatore, S. by Coimbatore and Malabar, and W. by Malabar. The district until recently consisted exclusively of a mountain plateau lying at an average elevation of 6500 feet, with an area of about 725 square miles. In 1873 this was increased by the addition of the Ochterlony valley in the south-east Wainád, and again, in 1877, by other portions of the Wainád, making a total area of 957 square miles. The administrative headquarters is at Utakamand, which is also the summer capital of the Government of Madras. The summit of the Nílgiri Hills is an undulating plateau, frequently breaking into lofty ridges and steep rocky eminences. The descent to the plains is sudden and abrupt, the average fall from the crest to the general level below being about 6000 feet, save on the north, where the base of the mountains rests upon the elevated land of Wainád and Mysore, standing between 2000 and 3000 feet above sea-level. The Ochterlony valley and Wainád country consist of a series of broken valleys, once forest-clad throughout, but now studded with coffee-gardens.

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[1] The two lakes afterwards received the names Lake of Crocodiles and Lake of Cataracts.

The highest mountain peaks are—Dodabetta, 8760 feet; Kudiakad, 8502; Bevoibetta, 8488; Makurti, 8402; Dávarsolabetta, 8380; Kúnda, 8353; Kúndamoge, 7816; Utakamand, 7361; Támbrabetta, 7292; Hokabetta, 7267. There are six well-known passes or *ghâts* by which the district communicates with the neighbouring provinces, viz., the Kúnúr, Segúr, Gúdalúr, Sispára, Kotágiri, and Sundapatti, the first three of which are practicable to wheeled traffic. The chief rivers are the Moyár, Paikára, and Calicut, none of which are navigable within the district. The only lake of note is an artificial one, Utakamand (7220 feet above sea-level), which is nearly 2 miles long. The forests consist of fine timber trees, such as *sál* (*Shorea robusta*), *kino* (*Pterocarpus Marsupium*), jack (*Artocarpus integrifolia*), blackwood (*Dalbergia latifolia*), and teak. Eucalyptus and Australian wattle have been extensively planted in the higher grounds of the Wainád. The hills were first explored by British officers in 1814, and in 1821 the first English house was built on the plateau.

The population of the district in 1881 was 91,034. The only town with more than 5000 inhabitants is Utakamand, with a population of 12,335. The most interesting of the hill tribes are the Todas, who regard themselves as autochthonous. They are a tall, well-proportioned, and athletic race, but indolent and dirty. Their sole occupation is cattle herding and dairy work. They practise polyandry, a woman marrying all the brothers of a family. In religion they follow a species of Hinduism, and also worship their dairy buffaloes. The race seems to be gradually dying out, and in 1881 only numbered 675. The most numerous as well as the most wealthy and civilized of the hill tribes are the Badagas. They are occupied in agriculture, dress after the fashion of the natives of the plains, and are fond of ornaments. They profess Hinduism, and in 1881 numbered 24,130 The Kotas, another hill tribe (1065 in 1881), follow agriculture and various handicrafts. They perform menial offices for the Todas and Badagas, and, like the latter, pay a gudu to the Todas. They worship "ideal" gods, which are not represented by any image. The Kurumbas, or shepherds (3185 in 1881), are the most uncivilized of the hill tribes, and officiate as priests to the Badagas. Besides cultivating on a small scale, they collect various sorts of jungle produce, which they barter on the plains for grain and cloth. The Irulas (946 in 1881) live on the lowest slopes and forests, extending from the base of the Nílgiris to the plains. They are an idle and dissolute tribe, although in physique adapted to hard manual labour.

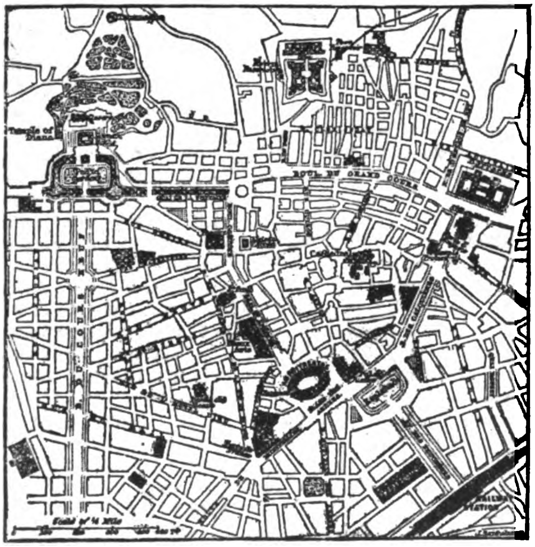
The ordinary crops grown on the Nílgiri Hills include wheat, barley, and other cereals, oilseeds, and nearly every variety of English vegetables and fruits. The commercially important products are coffee, tea, and cinchona. Coffee cultivation was introduced about 1844. One of its chief seats is the beautiful Ochterlony valley. The Madras Government commenced the experimental cultivation of cinchona on the Nílgiris in 1860, and in 1882 the receipts therefrom amounted to over £50,000. Several private cinchona gardens have been laid out, owing to the success of the Government experiment. There are 190 miles of road, bridged and available for wheeled traffic. The climate of the Nílgiri Hills is almost unrivalled for equability of temperature. The average is 58° F.

NIMÁR, a district in the Central Provinces, India, lying between 21° 4′ and 22° 26′ N. lat. and between 75° 50′ and 77° 1′ E. long., and bounded on the N. and W. by Dhar and Indore states, S. by Khandesh and West Berar, and E. by Hoshangábád. The area is 3340 square miles, of which only 659 are under cultivation. The population in 1881 was 231,341 (embracing 199,454 Hindus, 24,426 Mohammedans, 5282 aborigines,—the most numerous tribe of these being the Bhíls). Khandwa town is the administrative headquarters. The district consists of two portions of the Nerbudda and Tapti valleys, separated by a range of hills, a section of the Sátpurá range, about 15 miles in breadth. On the highest peak, about 850 feet above the plain and 1800 above sea-level, stands the fortress of Asírgarh, commanding a pass which has for centuries been the chief highway between Upper India and the Deccan. The district contains extensive forests, but the only tract reserved by Government is the Punása forest, which extends for about 120 miles along the south bank of the Nerbudda, and contains very fine young teak, besides *sáj* (*Terminalia tomentosa*) and *anjan* (*Hardwickia binata*) of great size. The only towns with a population exceeding 5000, in 1881, were Khandwa, the district capital (15,142), and Burhanpur (30,017). The principal line of road is that from Khandwa to Indore. The Great Indian Peninsular Railway traverses the district.

NIMEGUEN, NIMWEGEN, or NYMEGEN (Dutch, *Nijmegen*), probably the oldest of all the cities of the Netherlands, is situated in the province of Guelderland, on the south bank of the Waal, 80 miles from the sea and 17 miles north-west of Cleves. Built partly on a row of five hills—Hessenberg or Hezelberg, Marienberg, Gruitberg, Klokkenberg, and Hunnenberg or Hoenderberg—so that stairs are necessary to lead to the higher portions, Nimeguen stands out with a boldness quite unusual in a Dutch town. Till past the middle of the present century it was strongly fortified, its old walls, erected in 1447, having been strengthened from time to time with extensive bastions and outworks. The beautiful park—the Valkhof—at the east end of the town is the site of Charlemagne's palace, which was still habitable in 1787, but, being greatly damaged during the French bombardment of 1794, was in 1796 sold for what it would bring. Two portions were fortunately preserved,—the vault of a chapel ("Pagan's Chapel"), with two white marble Corinthian pillars, and an octagonal baptistery ("Roman Chapel"). Near the Valkhof stands a lofty tower, the Belvidere, erected by the duke of Alva. The great church (St Stephen's), which forms one of the most striking features in the general view of the town, was originally built between 1254 and 1273, but in its present condition dates mainly from the 15th and 16th centuries. The immense nave is roofed with circular vaulting and supported by thirty-five slender pillars. In the choir is the monument of Catherine of Bourbon (1469), wife of Adolphus, duke of Guelderland. The town-house, built in 1554, is adorned with medallions representing the kings and emperors who had been benefactors of Nimeguen, and contains the great hall in which the treaty of 1678 was concluded. On the ground-floor is a cumbrous and strong safe in which the town's charters from that of Henry IV. in 1230 were preserved with the most jealous care, the garrison being called out and the gates closed when it was necessary to consult any of them. Other buildings of note are the theatre (1838–39), the old burghers' almshouse, the Protestant hospital (1849), and the Roman Catholic or Canisius hospital (1866). Between 1656 and 1679 Nimeguen was the seat of a university; it has now nothing higher than a gymnasium. Tools, gold and silver work, leather, furniture, tobacco, &c., are the chief products of the local industry; and a good deal of traffic is carried on both by means of the river and (since 1865) the railway. The population of the town in 1870 was 19,196; that of the commune increased from 22,929 (15,984 Roman Catholics, 5806 Dutch Reformed, 408 Jews) in 1875 to 24,984 in 1879.

The name Nimeguen appears for the first time as Noviomagum in the Tabula Peutingeriana, but several antiquaries seek to identify the town with the Oppidum Batavorum of Tacitus. Charlemagne's palace continued to be the temporary residence of kings and emperors for many generations. Prince Henry, son of Conrad II. (1026), and the emperor Henry IV. (1164) were both born within its walls. In 1247–48 William, king of the Romans, pawned the town to Reinald of Guelders, but in 1316 the people refused to remain under his authority. The Burgundians, who entered after a four weeks' siege in 1473, were expelled in 1477. In 1494 the archduke Maximilian was successfully repulsed. The duke of Alva, with ten companies of Spanish soldiers, took possession in 1568; but in 1579 Nimeguen joined the Union. In 1584 the duke of Parma's attempt to recover the town proved a failure; next year, the people having expelled the states garrison, he was successful; and, Martin Schenk having lost his life in a rash *coup de main* in 1589, the Spaniards were left in possession till 1591. Between 1672 and 1674 the town was held by the French; they attacked it again in 1703 without success, got easy possession of it in 1794, and remained till 1814.

NÎMES, or Nismes, a city of France, chief town of the department of Gard, a bishop's see and seat of a court of appeal, lies 450 miles south-south-east of Paris by the Clermont-Ferrand Railway, and 80 miles north-west of Marseilles. The importance of the place is due to its central position between the Rhone, the Cevennes, and the sea, to the richness of the surrounding district, which before the ravages of the *Phylloxera* was clothed with vines, to its commerce and industry, and lastly to its archæological treasures. No town in France can show so many remains of the Roman period. The amphitheatre is still in a good state of preservation. Occupied during the Middle Ages by a special quarter, with even a church of its own, it was cleared in 1809, and since then has been well kept in repair. It is built of large stones without mortar. In form it is elliptical, measuring 437½ by 332½ feet externally; the arena is 327 by 222 feet. The elevation (70 feet in all) consists of a ground story of 60 arches, an upper story of 60 arches, and an attic with consoles pierced with holes for supporting the *velarium* or awning. There are four main gates, one at each of the cardinal points; and no fewer than one hundred and twenty-four doorways gave exit from the tiers of the amphitheatre to the inner galleries. Originally designed for gladiatorial shows, or stag or boar hunts, the area has in recent times been sometimes used for bull-fights. The celebrated Maison Carrée, a temple in the style of the Parthenon, but on a smaller scale, 82 feet long by 40 wide, is one of the finest monuments of the Roman period, and probably dates from the time of the Antonines. It contains a collection of antique sculptures and inscriptions. The temple of Diana,—possibly a building connected with the neighbouring baths,—is now overgrown with fig trees and climbing plants, but preserves a few fragments of statues and some rustic columns. The Tour Magne (Turris Magna), situated on the highest point in the city, 375 feet above sea-level, is still 92 feet in height, and was formerly a third higher. Admittedly the oldest monument of Nîmes, it has been variously regarded as an old signal tower, a treasure-house, or the tomb of a Greek family settled in Gaul along with the earliest Phœnician colonists. Attached to the ramparts erected by Augustus, and turned into a fortress in the Middle Ages by the counts of Toulouse, the Tour Magne was restored about 1840. From the top there is a magnificent view extending from Canigou at the east end of the Pyrenees to Mont Ventoux, an outpost of the Alps; northward it takes in the vine- and olive-clad Garrigues and the Cevennes, eastward the valley of the Rhone and the Vaucluse and Alpine ranges, and southward the Mediterranean and the Aigues Mortes ramparts. Near the Tour Magne has been discovered the reservoir from which the water conveyed by the Pont du Gard was distributed throughout the city. Two gates, that of Augustus dating from 16 B.C., and the Porte de France, both semicircular arches, are preserved as historical monuments. Many of the finest buildings known to have existed have disappeared. When it still possessed its capitol, the temple of Augustus, the basilica of Plotina erected under Hadrian, the temple of Apollo, the hot baths, the theatre, the circus, constructed in the reign of Nero, the Campus Martius, and the fortifications built by Augustus, Nîmes must have been one of the richest of the Roman cities of Gaul. The cathedral (St Castor), occupying, it is believed, the site of the temple of Augustus, is partly Roman and partly Gothic in style. It contains the tombs of Flèchier and Cardinal de Bernis. The church of St Paul, a modern Romanesque building, is adorned with frescos by Flandrin; St Baudile (modern Gothic) is of note for the two stone spires which adorn its façade; and the court-house has a fine Corinthian colonnade and a pediment. Other buildings and institutions of note are the hospitals, the barracks, the old citadel (dating from 1687, and now used as a central house of detention), the picture gallery in the old lycée, the public library (50,000 volumes), and the museum of natural history.



Plan of Nîmes.

The esplanade in front of the court-house has in the centre a handsome fountain with five marble statues by Pradier. The Fountain Gardens, in the north-west of the town, owe their peculiar character as well as their name to a spring of water which after heavy rains is copious enough not only to fill the ornamental basins (constructed in the 18th century with balustrades and statues on ancient foundations) but also to form a considerable stream. Neither the spring, however, nor the Vistre into which it discharges, is sufficient for the wants of the city, and water has consequently been brought from the Rhone, a distance of 17 miles. A beautiful avenue, the Cours Neuf, runs south for nearly a mile from the middle walk of the garden.

At the close of the Middle Ages the industries of Nîmes were raised to a state of great prosperity by a colony from Lombardy and Tuscany; and, though the plague, the wars of religion, and the revocation of the edict of Nantes were all sufficiently disastrous in their effects, before the Revolution about half of the whole community, or from 10,000 to 12,000 persons, had come to be engaged in manufactures. Since then, however, the numbers of this class have hardly increased, while the population of the city has been doubled. The silk manufacture (reeling, spinning, weaving) no longer occupies all hands. Upholstery materials (which have almost displaced shawls), carpets, handkerchiefs, tapes, braidings, hosiery, leather, clothes, and boots and shoes are also produced; and, coal being worked in the neighbourhood, a number of foundries have been established. Nîmes is, besides, one of the great southern markets for wine and brandy, silks and cocoons; and there is a good trade in grain, groceries, and colonial wares. The population of the city in 1881 was 61,210; that of the commune was 62,394 in 1871, and 63,552 in 1881.

Nemausus, the ancient Nîmes, derived its name from the sacred wood in which the Volcæ Arecomici (who of their own accord surrendered to the Romans in 121 B.C.) were wont to hold their assemblies. Constituted a colony of veterans by Augustus, and endowed with numerous privileges, it built a temple and struck a medal in honour of its founder. The medal, which afterwards furnished the type for the coat of arms granted to the town by Francis I., bears on one side the heads of Cæsar Augustus and Vipsanius Agrippa (the former crowned with laurel), while on the other there is a crocodile chained to a palm-tree, with the legend COL. NEM. It was Agrippa who built the public baths at Nîmes, the temple of Diana, and the aqueduct of the Pont du Gard. The city-walls, erected by Augustus, were nearly 4 miles in circuit, 30 feet high, and 10 feet broad, flanked by ninety towers, and pierced by ten gates. Hadrian on his way back from Britain erected at Nîmes two memorials of his benefactress Plotina. In the very height of its prosperity the city was ravaged by the Vandals; the Visigoths followed, and turned the amphitheatre into a stronghold, which at a later date was set on fire along with the gates of the city when Charles Martel drove out the Saracens. Nîmes became a republic under the protection of Pippin the Short; and in 1185 it passed to the counts of Toulouse, who restored its prosperity and enclosed it with ramparts whose enceinte, less extensive than that of Augustus, may still be traced in the boulevards of the present day. The city took part in the crusade against the Albigenses in 1207. Under Louis VIII. it received a royal garrison into its amphitheatre; under Louis XI. it was captured by the duke of Burgundy, and in 1420 was recovered by the dauphin (Charles VII.). On a visit to Nîmes Francis I. enriched it with a university and a school of arts. By 1558 about three-fourths of the inhabitants had become Protestant, and the city suffered greatly during the religious wars. From the accession of Henry IV. till the revocation of the edict of Nantes (1685) the Protestant community devoted itself to active industry; but after that disastrous event great numbers went into exile or joined the Camisards. Louis XIV. built a fortress (1687) to keep in check the disturbances caused by the rival religious parties. Nîmes passed unhurt through the storms of the Revolution; but in 1815 Trestaillon and his bandit followers pillaged and burned and plundered and massacred the Bonapartists and Protestants. Since then the city has remained divided into two strongly-marked factions—Catholics and Protestants; happily, however, there has been no repetition of such scenes. Domitius Afer (Quintilian's master), Jacques Saurin the Protestant divine, Nicot the introducer of tobacco into France, Séguier the archæologist, Guizot, and Reboul (the Provencal poet whose statue adorns the Promenade de la Fontaine) are among the celebrated natives of Nîmes.

NIMROD (Νεβρώδ, LXX.), apart from the mere mention of his name in Micah v. 5 (A.V., v. 6), occurs only once in Scripture, namely, in Gen. x. 8–12 (1 Chron. i. 10), where, in a Jehovistic portion of the genealogy of the nations there given, we are told that "Cush begat Nimrod, who was the first mighty one in the earth (he was a mighty hunter before Jehovah, wherefore it is said—A mighty hunter before Jehovah even as Nimrod), and the beginning of his kingdom was Babel, and Erech and Accad, and Calneh in the land of Shinar. Out of that land he went forth into Asshur[1] and builded Nineveh," &c. Just as Enos was the first to call upon the name of Jehovah, and Noah the first to plant vines, so is Nimrod the first mighty ruler in the earth, and as such at the same time a mighty hunter before Jehovah, after the manner of the Oriental sovereigns of old. By the Hebrews the Assyrio-Babylonian empire was at all periods regarded as the prototype of the worldly power; and it is of this kingdom that Nimrod here figures as the founder—not in its prehistorical, but in its historical form as actually subsisting at the time of the writer. This is apparent, not only from the general character of the genealogical table, but also from the enumeration of the cities in the land of Shinar and Asshur. As founder of the kingdom, Nimrod represents both kingdom and people; the genealogy knows no distinction between the hero and the nation,—the latter is the family of the former. When, therefore, Nimrod is said to be descended from Cush, the mighty nation of Asshur and Babel (which in Gen. x. 22 is regarded as belonging to Shem) is also by the Jehovist assigned to Cush. Shem for him seems to have a very narrow meaning, expressing merely the contrast between the Hebrew lords and their Canaanite subjects; Cush, on the other hand (like Ἰνδοὶ with the Greeks), is a very comprehensive and vague word, which does not readily admit of clear geographical or ethnological definition, and therefore also cannot be brought into contrast with Shem if Shem be used in its modern application as indicating race. A god spoken of as "Marri with his hounds" was still worshipped in Harran after the introduction of Christianity (Assem., *Bibl. Or.*, i. 327); that this Marri is akin to Nimrod is suggested on the one hand by his hounds and on the other by the etymology of the two names derived from the synonymous roots *mry* and *mrd*. Nimrod looks like a Syriac imperfect of the root *mrd*, in which case it would seem to follow that the legend arose among the Syrians, the next neighbours of the Babylonians and Assyrians, and from them had passed over to the Hebrews. Then, further, Nimrod may be a modification of the name Merodach, the Babylonian chief god, the final syllable *-ach* being dropped.[2] To the later Jews Babylon was the complete embodiment of the enmity of the heathen world against the kingdom of God, and the idea they formed of Nimrod was influenced by this view. The arrogance of his character, which seemed to be implied in his very name, was conceived of as defiance of God, and he became a heaven-storming Titan. As such he built the tower of Babel, and as such was he identified with the giant in bonds in the constellation of Orion. Jewish legend made choice of Abraham to be his antithesis, the representative of God's kingdom over against the heathen autocrat. Nimrod cast the bold confessor of the true God into the fire of the Chaldæans (Ur Kasdim), whence, according to Gen. xv. 7, Isa. xxix. 22, Jehovah delivered him.[3] The Jewish material was afterwards treated by Mohammed and the Arabian theologians, who mixed it up with other elements.

Compare Philo, *De Gigantibus*, sec. 15 (Mang., p. 272); Jos., *Ant.*, i. 4, 2; 6, 2; *Chron. Pasch.*, p. 36 (Cedren., p. 14); Jerome and Jonathan on Gen. xi. 28; Tabari, i. pp. 319–325. (J. WE.)

NINEVEH (Hebrew נִינְוֵה, in classical authors Νίνος, Ninus; LXX., Νινευη; Jerome, Ninive), the famous capital of the Assyrian empire, called Ninua or Ninâ on the monuments. Though the city appears to have been entirely destroyed in the fall of the empire[4] the name of Nineveh (Syriac, *Nînwê*; Arabic, *Nînawá*, *Núnawá*) continued, even in the Middle Ages, to be applied to a site opposite Mosul on the east bank of the Tigris, where gigantic *tells* or artificial mounds, and the traces of an ancient city wall, bore evident witness of fallen greatness.[5] The walls enclose an irregular trapezium, stretching in length about 2½ miles along the Tigris, which protected the city on the west.[6] The greatest breadth is over a mile. The most elaborate defences, consisting of outworks and moats that can still be traced, were on the southern half of the east side, for the deep sluggish Khausar, which protects the northern half of this face, then bends round towards the Tigris and flows through the middle of the town, so as to leave the south-east of the city more open to attack than any other part. The principal ruin mounds within the walls are that of Ḳuyúnjiḳ, north of the Khausar, and that of the prophet Jonah (Nebí Yúnus) south of that stream. The latter is the traditional site of Jonah's preaching, and is crowned by an ancient and famous Mohammedan shrine. The systematic exploration of these ruins is mainly due to Layard (1845–46), whose work has been continued by subsequent diggers. These researches leave no doubt as to the correctness of the local tradition. Not only have magnificent remains of Assyrian architecture and sculpture been laid bare, but the accompanying cuneiform inscriptions throw much light on the history of the city and its buildings. The mound of Ḳuyúnjiḳ covers palaces of Sennacherib and Assurbanipal,[1] that of Jonah a second palace of Sennacherib and one of Esarhaddon. Of other remains, the most striking is the gateway near the centre of the north wall, consisting of two halls, 70 feet by 23, the entrance to which towards the town was flanked by colossal man-headed bulls and winged human figures. For the structure and art of the palaces see vol. ii. p. 397 and vol. iii. p. 189.

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[1] Not "out of that land went forth Asshur"; for the "beginning" of his kingdom demands a continuation, and Asshur is called Nimrod's land in Micah v. 5.

[2] Compare the converse φαλωχ, LXX., in 1 Chron. v. 26 for פל.

[3] Beer, *Leben Abrahams* (1859), p. 1 *sq.* Compare Dan. iii., whence the confusion of Nimrod with Nebuchadnezzar by the Arabs.

[4] It is generally agreed, and the description hardly leaves a doubt, that the ruins of Mespila and Larissa described by Xenophon, *Anab.*, iii. 4, 7 *sq.*, are Kuyúnjik and Nimrúd respectively. In this case we can be certain that there was no inhabited city on the spot at the time of the march of the Greeks with Cyrus. Comp. Strabo xvi. p. 245.

[5] The references collected by Tuch, *De Nino Urbe*, Leipsic, 1845, are copious, but might easily be added to. Ibn Jubair, p. 237 *sq.*, who as usual is pillaged by Ibn Baṭuṭa, ii. 137, gives a good description of the ruins and of the great shrine of Jonah as they were in the 12th century. The name Nínawá was not appropriated to the ruins, but was applied to the Rustak (fields and hamlets) that stood on the site (Beládhorí, p. 331; Ibn Ḥaukal, p. 145; Yákút, ii. 694).

[6] A change in the bed of the stream has left a space between the wall and the present channel of the Tigris.

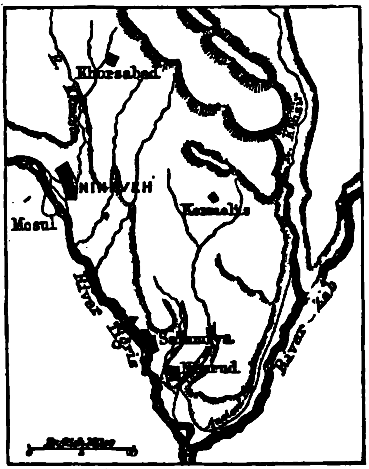

FIG. 1.—Country round Nineveh.

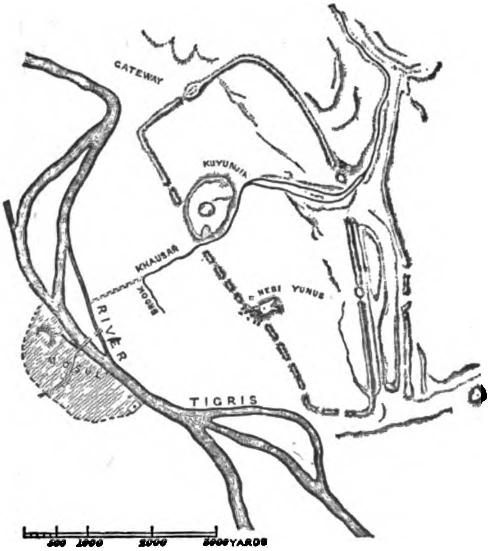

FIG. 2.—Ruins of Nineveh.

Nineveh proper was only one of a group of cities and royal residences whose ruins still mark the plain between the Tigris, the Great Záb, and the Kházir. The chief of these are at Khorsábád or Khurustábád, five hours by caravan north-east of Mosul, on a tributary of the Khausar, and at Nimrúd, on the left bank of the Tigris, eight caravan hours (18 miles) south-east from Ḳuyúnjiḳ. The former site was mainly explored by the Frenchmen Botta and Place. The city was almost square, each face of the wall a little more than a mile in length. The vast T-shaped palace of Sargon (722–705 B.C.), whose name the town bore (Dur-Sarrukin), stood near the northern angle. Its main frontage was nearly a quarter of a mile long; it had thirty-one courts and more than two hundred apartments.[2]

The ruins of Nimrúd, identical with the ruin Athúr of Arabic geographers (Yáḳút, *s.vv.* "Athúr," "Salámíya"), and first excavated by Layard, represent the ancient city of Kalḥu, the Biblical Calah. The enclosure, protected on the west by the old bed of the Tigris, is, according to Layard's measurements, a quadrangle of 2331 yards by 2095 at the widest part, and was surrounded by walls with towers and moats. The chief architectural remains belong to a group of palaces and temples which occupied the south-west quarter of the city. The principal palace (north-west palace) was built by Assur-naṣir-pal (885–860 B.C.), and beside it he raised a temple with a great tower (falsely called the tomb of Sardanapalus) built in narrowing stages. The so-called central palace is that of his son Shalmaneser II.; the unfinished south-west palace was the work of Esarhaddon. Of the so-called south-east palace the chief part is really a temple of Nebo; a statue of the god from this temple is in the British Museum.

The main points in the history of these three great cities which are held to be established by monumental evidence are these. The ancient capital of Assyria was Assur (Ḳal'a Sherḳát) on the Tigris, 50 miles south of Mosul. Assur-naṣir-pal transferred the residence to Calah, a city which he tells us upon an inscription had been originally founded by Shalmaneser I. (*c.* 1300 B.C.), but had subsequently fallen into decay. Calah seems to have been the chief seat of the kings till Sargon the captor of Samaria founded his residence at Khorsábád; the glory of Nineveh proper begins with Sennacherib, but the city existed earlier, for his inscribed bricks represent him only as rebuilder of the walls. It is even averred that kings of the 19th and 15th centuries B.C. built temples at Nineveh, but the remoter dates of Assyrian history must be received with caution.[3] From the time of Sennacherib down to the fall of the capital and empire—an event the date of which is still uncertain, the ancient accounts varying between 626 and 608 B.C.—Nineveh proper, that is, the city on the Tigris and Khausar, appears to have been the chief seat of empire. But when the book of Jonah speaks of Nineveh as a city of three days' journey, or when Ctesias in Diodorus ii. 3 describes its circuit as 480 stadia, it is plain that these conceptions imply an extension of the name to the whole group of cities between the Tigris and the Záb. In this connexion the words of Gen. x. 11 *sq.* are remarkable; for, on the most natural view, the clause "this is the great city" applies not to Resen alone but to the four cities of Nineveh, Rehoboth Ir, Calah, and Resen. Rehoboth Ir and Resen are still untraced; the Syriac tradition which connects the latter with Rēsh 'Ainā, that is, with Khorsábád, does not agree with the text, which says expressly that Resen was between Nineveh and Calah, and indeed the verses in Genesis appear to be older than the foundation of the city of Sargon. The description would suit the mound of Salámíya a little above Nimrúd, but in fact the whole district is studded with ruins.

See the works of Layard, Botta and Flandin, V. Place, Oppert (*Expédition en Mésopotamie*), and G. Smith (*Assyrian Discoveries*). For the ruins and their exploration, Tuch's *Commentatio*, above cited, gives all that was known before the explorations; Schrader, *Keilinsch. u. A. T.* gives the bearing of recent discoveries on the Biblical records. See also, in general, the article BABYLONIA, vol. iii. p. 183 *sq.* (W. R. S.)

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[1] In this palace is the famous library chamber from which Layard and George Smith brought the tablets now in the British Museum, containing the account of the deluge.

[2] There is some evidence that Syriac tradition connected these ruins with the name of Sargon; though our authority Yáḳút, in giving the alleged old name of Khurustábád, has corrupted Ṣarghún into Ṣar'ún, by writing ع for غ – ا. Another Syriac tradition connects Khurustábád with Resen, finding the name Resen in the neighbouring Rás al-'Ain (Rēsh 'Ainā). See Hoffmann, *Syrische Acten*, p. 183.

[3] The legend of Ninus and Semiramis in classical authors appears to be of late origin and quite unhistorical. Ninus is merely the eponym hero of Nineveh.

NING-PO, or **NING-PO-FOO** (*i.e.*, City of the Hospitable Waves), a great city of China, one of the five seaports thrown open to foreign trade in 1842 by the treaty of Nanking, and the principal emporium of the province of Chekeang, stands in a fine plain bounded by mountains towards the west, on the left bank of the Takia or Ning-po river, about 16 miles from its mouth, in 29° 51′ N. lat. and 121° 32′ E. long. It is surrounded by a fine old wall, 25 feet high and 16 feet broad, pierced by six gates and two passages for ships in its circuit of 4 to 5 miles. Just within the walls there is a considerable belt of open ground, and in many places the ramparts are thickly covered with jasmine and honeysuckle. In ascending the river a stranger's eye is first caught by the numerous huge ice-houses with high thatched roofs and by a tall white tower—the Tien-fung-tah or Ning-po pagoda or obelisk—which rises to a height of 160 feet, and has fourteen stories and seven tiers of windows, but has unfortunately been stripped of its galleries and otherwise damaged. Another striking structure in the heart of the city is the Drum Tower, dating from before the 15th century. As is natural in a place long celebrated for its religious and educational pre-eminence, there is no lack of temples, monasteries, and colleges, but few of these are of any architectural significance. Brick is the ordinary building material, and the dwelling-houses are mostly of one story. Silks, cottons, carpets, furniture, white-wood carvings, and straw hats are the chief products of the local industry. Large salt-works are carried on in the vicinity, and thousands of fishermen are engaged, mainly between April and July, in catching the cuttle-fish. In spite of the powerful competition of Shanghai, Ning-po has a valuable foreign trade It is regularly visited by the vessels of the China Navigation Company and the Chinese Merchants Steam Navigation Company. From 216,191 register tons in 1873 the tonnage of the port had increased to 303,109 in 1880,—British shipping having advanced from 18,592 tons to 86,175, and Chinese shipping from 17,972 to 209,487, though on the other hand the American total had sunk from 170,351 to 2100. The principal import is opium, £982,507 being the average value of the annual quantity between 1876 and 1880. Lead for packing tea was formerly a leading item, but it now enters mainly by other ports. Straw or grass hats, straw mats, samshu (from the Shaou-hing district), Chinese drugs, vegetable tallow, and fish are among the chief exports; in 1877 (the maximum year) the hats numbered 13,724,822, though in 1863 they had only amounted to 40,000, and the mats, mainly despatched to South China, average from 500,000 to 1,000,000. After the storming of Chinhai—the fortified town at the mouth of the river—on October 10, 1841, the British forces quietly took possession of Ning-po on the 12th. In 1864 the Taipings held the town for six months. Missions are maintained in Ning-po by the Romish Church, by the Church Missionary Society (1848), the American Presbyterians, the Reformed Wesleyans, the China Inland Mission (1857), &c. A mission hospital was instituted in 1843. The population of the city and suburbs is estimated at from 400,000 to 500,000.

NINIAN (**NINIANUS** or **NYNIAS**), **ST**, was, according to the earliest account of him we possess,—that of Bede (*H. E.*, iii. 4),—a bishop of the nation of the Britons who had been trained at Rome in the doctrine and discipline of the Western Church, and who built at Leukopibia (a town of Ptolemy's Novantæ, on the west side of Wigtown Bay, the modern Whithorn) a stone church, called Candida Casa, dedicated to St Martin of Tours. He is said to have converted the Picts to the south of the Grampians. An old Irish account mentions that he spent his last years in Ireland, where he founded a church in Leinster called Cluain Conaire; he was afterwards commemorated there under the name of Monenn ("Nenn" being simply "Ninian" with the Irish *mo*, or "my," prefixed). There is some evidence that the founding of Candida Casa took place in the year of the death of Martin of Tours (397). The date of Ninian's own death is unknown; he is commemorated in the Roman martyrology on September 16. See Skene, *Celtic Scotland*, vol. ii. A *Life of St Ninian*, compiled in the 12th century by St Ailred of Rievaux, and edited by the late Bishop Forbes, is given in the fifth volume of *The Historians of Scotland*, Edinburgh, 1874.

NIOBE is a figure who appears in the legends of many parts of Greece, especially Thebes, Argos, and the Hermus valley. Proud of her numerous family, she scoffed at Leto as the mother of only two children. Apollo and Artemis, the children of Leto, slew all her children with their arrows; and Niobe, after vainly trying to defend them, wept over them till she became a rock which still weeps incessantly. It is probable that this tale was in its simplest form a myth of the annual destruction of the bloom of earth by the shafts of the cruel sun-god, and that Niobe was a form of the mother-goddess, the goddess of all earthly life, whose progeny is thus slain every summer. The tragedians read in this tale a moralized myth of the instability of human bliss: Niobe became a representative of human nature, ever liable to become proud in prosperity and to forget the submission and respect due to the gods. In this form the legend has found permanent acceptance in literature and art. The metamorphosis of Niobe was adopted from the local legends of the Smyrna district; here it is probable that Niobe was originally a title of the Meter Sipylene, the deity worshipped all round the sacred mountain of Sipylus. An archaic figure of the goddess, carved in the northern side of the mountain near Magnesia, gave rise to the tales current in this district, that Niobe had thrown herself down from the rock, or that she had been turned into stone. It seems necessary to distinguish from this archaic figure, which is still visible, the "Niobe" described by Pausanias and Quintus Smyrnæus, both natives of the district. This was an appearance assumed by a cliff in Sipylus when seen from a distance and from the proper point of view. In these later writers the genuine old local legend had been replaced by a new form, founded on the myth as developed by the tragedians; the archaic figure carved in the cliff was known by the natives to be an image of the mother-goddess, whom they worshipped there year by year. But, as with every other point in the legend in its most developed form, the natives had a local representative of the Niobe, the weeping rock, which they saw in the heart of Sipylus.

On the myth of Niobe and its artistic representation, especially on the famous group thought to be the work of Praxiteles or Scopas, copies of most of the figures in which are preserved at Florence, see Stark, *Niobe und die Niobiden*. On the "Niobe" in Mount Sipylus, see Hirschfeld in Curtius, *Beiträge zur Gesch. u. Topogr. Kleinasiens*; Stark, *Nach dem griechischen Orient*; Ramsay, "Sipylos and Cybele," in *Journal of Hellenic Studies*, 1882.

NIOBIUM, a very rare chemical element which was discovered by H. Rose in 1846 as a component of the columbite of Bodenmais. In it, as also in tantalite, pyrochlore, yttro-tantalite, and a few other rare minerals, it is constantly associated with tantalum, which was discovered by Ekkeberg in 1802. Both metals, with vanadium, form a kind of appendage to the nitrogen group of elements. Like these they are capable of forming acid pentoxides and corresponding chlorides and oxychlorides. The oxychlorides and oxyfluorides, $NbOCl_3$ and $NbOF_3$, were originally thought by Rose to be peculiar (unmixed) chlorides and fluorides of niobium, until Blomstrand ascertained their true nature. The atomic weights of the two elements are $Ta = 182$ and $Nb = 94$.

NIORT, a city of France, chief town of the department of Deux Sèvres, distant 255 miles south-west of Paris by the railway to Poitiers and La Rochelle (here crossed by the line from Angers to Angoulême), is situated at the head of navigation of the Sèvre Niortaise, partly in the valley and partly on the slopes of the enclosing hills. The tower of the church of Notre Dame (16th century) has a spire 246 feet high, with bell-turrets adorned with statues of the evangelists, and at the base a richly-decorated dais in the Renaissance style; and the north doorway shows a balustrade, whose balusters form the inscription, *O Mater Dei, memento mei*. There is a fine window in the apse of St André, and St Hilaire contains some beautiful frescos. Of the old castle, whose site is partly occupied by the prefecture, there still remains the donjon—two large square towers, flanked by several of smaller dimensions. Built, it is said, by Henry II. of England or Richard Cœur de Lion, the south tower contains four vaulted chambers one above the other, and the platform on the top affords a fine view of the public garden (one of the most picturesque in France) and the valley of the Sèvre. The old town-house (now used as "justice de paix") is known as the Aliénor or Éléonore palace, after Éléonore of Guienne; near it is a Renaissance belfry. The convent of the Oratorians is occupied by a public library (30,000 volumes), a picture gallery, and museums of geology and antiquities—the last containing plaster copies of all objects of interest in the ancient monuments of the surrounding country. Niort further possesses extensive barracks, several hospitals, and a lycée named after Fontanes, grandmaster of the imperial university, who was born in the town. The house is still shown in which Madame de Maintenon was born while her father was imprisoned in the donjon. Tanning, currying, shammy-dressing, glove-making, and hair-working are the staple industries of Noirt,—gloves alone giving employment to about one thousand workmen, and brush-making, hair-working, and allied industries to nearly as many. A large cotton-mill, oil-works, foundries, distilleries, and a glass-work also exist in the town. Owing to the mildness of its climate, Niort has admirable nurseries, and its market-gardens export onions and artichokes. The population of the city in 1881 was 18,823, and that of the commune 22,254.

Up to the 7th century the Niort plain formed part of the Gulf of Poitou; and the mouth of the Sèvre lay at the foot of the hills now occupied by the town which grew up round the castle erected by Henry Plantagenet in 1155. The place was captured by Louis VIII. in 1224. By the peace of Brétigny it was ceded to the English; but its inhabitants revolted against the Black Prince, and most of them were massacred when his troops recovered the town by assault. In 1369 Duguesclin obtained possession by a stratagem. Protestantism made numerous proselytes at Niort, and Coligni made himself master of the town, which successfully resisted the Catholic forces after the battle of Jarnac, but surrendered without striking a blow after that of Moncontour. Henry IV. rescued it from the League. It suffered severely by the revocation of the edict of Nantes.

NIPPON. See JAPAN, vol. xiii. p. 569.

NISH, NISCH, or NISSA, the ancient Naissus, a city of the Balkan peninsula, which at one time was the capital of Servia, and after being the chief town of a Turkish eyalet in the vilayet of the Danube, and (1877) of the new vilayet of Kossovo, was again in 1878 restored to Servia, where it is now the administrative centre of a circle containing a population of 117,000. The town is a thriving place of 12,800 inhabitants, the see of a Greek bishop, the headquarters of a militia corps, and an important centre in the Servian railway system. It is situated at the east end of a plain, and is traversed by the Nishava, a tributary of the Morava and sub-tributary of the Danube. Fortifications on the heights, buildings well massed together, numerous minarets, and abundant foliage in the suburbs render the outward appearance of the town both pleasant and imposing; but the interior, with its narrow and ill-kept streets, is utterly disappointing. About a quarter of an hour to the north of the citadel is the Voinik (war) hill, where the Turkish army encamped in 1689.

Naissus, best known as the birthplace of Constantine the Great, was destroyed by Attila, but restored by Justinian. The chief facts in the history of the modern town are its capture by the Turks in 1375 and by John Hunyady in 1443; the victory of Louis of Baden over the Turks in 1689; the recovery by the Turks in 1690; the capture by the Austrians and the subsequent surrender by General Dochat in 1737; and finally the siege by the Servians in 1809. On this last occasion Stephen Singelitch blew up his redoubt, to the destruction at once of his Turkish assailants and himself.

NÍSHÁPÚR, or NÉSHÁPÚR (Arabic, *Naisábúr*), the most important city of Khorásán in the Middle Ages, but now much decayed. The second element of the name is that of the traditional founder Shahpuhr or Sapor. Some accounts name the first, others the second Sapor.[1] The older name of the town or district was Abrashahr. The importance of the place under the Sasanians was in part religious; one of the three holiest fire-temples was in its neighbourhood.[2] Níshápúr under the Moslems contained a large Arab element; it became the capital of Khorásán, and greatly increased in prosperity, under the almost independent princes of the house of Ṭáhir (820–873 A.D.). Iṣṭakhrí describes it as a well-fortified town, a league square, with a great export of cotton goods and raw silk. In the decline of the empire the city had much to suffer from the Turkomans, whose raids have in modern times destroyed the prosperity of this whole region. In 1153 it was utterly ruined by the Ghuzz Turkomans, but soon rose again, because, as Yáḳút remarks, its position gave it command of the entire caravan trade with the East. It was again taken and razed to the ground by the Mongols in 1221, but a century later Ibn Baṭúṭa found the city again flourishing, with four colleges, numerous students, and an export of silk-stuffs to India. Níshápúr was famous for its fruits and gardens, which gave it the epithet of "little Damascus."

The surname of Naisábúrí connects with the city a number of learned men, including 'OMAR KHAYYAM (*q.v.*), the Ḥáfiẓ Abú 'Alí (*ob.* 960), the Korán commentator Aḥmed al-Tha'labí (*ob.* 1035), his disciple Wáhidí, author of the famous *Asbáb nozúl al-Ḳorán* (*ob.* 1076), and the disciple of the latter, Maidání, the author of the well-known collection of Arabic proverbs. See further Kazwíní, ii. 317 *sq.*

NISIBIS, a once famous city and fortress, situated in 37° N. lat. and 41° 20′ 10″ E. long., in the north of Mesopotamia, near the point where the Jaghjagha leaves the mountains by a narrow defile. The modern Naṣíbín consists of some two hundred wretched huts, mainly inhabited by Jews, who pay tribute to the Shammar Bedouins. The neighbourhood, we are informed by Arab writers, was at one time richly wooded. The locality is at present somewhat marshy and unhealthy. The number of dangerous scorpions is specially noticeable. According to Yáḳút the legend is that Persian scorpions were thrown into the place when it was besieged by Anushirwan. The church of St James, belonging to a small community of Jacobite Christians, and a few pillars and blocks of masonry are the only remains of the former greatness of the town.

The site of Nisibis, on the great military and commercial route between the Tigris and the Mediterranean, and commanding alike the mountain country to the north and the then fertile plain to the south, gave it an importance which began during the Assyrian period and continued under the Seleucidæ (see MESOPOTAMIA, vol. xvi. p. 48). From 149 B.C. to 14 A.D. Nisibis was the residence of the kings of Armenia, and it was there that Tigranes had his treasure-house. The place afterwards figured frequently as a strong frontier fortress in the wars of the Romans and the Parthians, its brick walls being unusually thick and its citadel very strong. Ceded to the Parthians by Hadrian, it became a Roman colony (Septimia Colonia Nisibis) under Septimius Severus. It was heroically defended against Sapor II., who unsuccessfully besieged it thrice. In the peace made by Jovian, however, it passed into the hands of the Persians, who established a strong colony there. Nisibis early became the seat of a Jacobite bishop and of a Nestorian metropolitan, and under the Arabs (when it continued to flourish and became the centre of the district of Diyár Rebí'a) the population of the town and neighbourhood was still mostly Christian, and included numerous monasteries. According to Ibn Haukal the taxes and dues derived from the town and district of Nisibin in 358 A.H. (969 A.D.) amounted to five million dirhems and 32,000 dinars. Arab geographers and travellers of the Middle Ages speak in high terms of the gardens of Nisibis, and the magnificent returns obtained by the agriculturist. According to Mukaddasi (*ob.* 1024), acorns, preserved fruits, and manufactured articles such as carriages, inkstands, &c., were exported. A change for the worse soon afterwards set in. The town was so heavily burdened with taxes by the Hamdanid princes living at Mosul that the Arab tribe of the Banu Habíb, although blood relations of the Hamdanids, migrated in a body into Byzantine territory, where they were well received, accepted Christianity, attracted other emigrants from Nisibis, and at last began to avenge themselves by yearly raids upon their old home. Ibn Haukal goes on to say that finally the Hamdanid Náṣir ad-Daule took possession of the town, confiscated the estates of those who had emigrated, and compelled those who remained to substitute corn for their profitable fruit crops. This made a final end of the prosperity of Nisibis; the surrounding district, no longer protected against the incursions of nomad tribes, ceased to be cultivated and became the wilderness which it continues to be to this day.

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[1] Spiegel, *Eranische Alterthumskunde*, iii. 254; Nöldeke, *Gesch. der Perser . . . aus Tabari*, p. 59. The first syllable of the name appears to be *Nēo*, "good" (Noldeke, *l.c.*).

[2] Hoffmann, *Syr. Akten pers. Märtyrer*, p. 290 *sq.*

NÍSI PRIUS. For the history and meaning of this term in English law see ASSIZE. As a rule actions only are tried at *nisi prius*, and a judge is said to sit at *nisi prius* when he sits alone, usually in the Queen's Bench Division, for the trial of actions. The trial at *nisi prius* was formerly by jury, unless with consent of the parties, but since the rules of the Supreme Court of 1883 the ordinary trial at *nisi prius* is without a jury in all but some specially excepted cases, chiefly of torts where the damages are unliquidated. Besides actions, indictments or informations may be tried at *nisi prius*, but only before a jury, the change in the law above-mentioned not extending to such cases. The indictment or information is generally removed from the ordinary forum by *certiorari*, and the trial takes place in the Queen's Bench Division or at assizes before a special or a common jury (see JURY). The removal may be at the instance of the crown, the prosecutor, or the accused. Misdemeanours are removed more often than felonies. The most usual grounds of removal are that difficult questions of law are likely to arise, that local prejudice has been excited, or that the case is quasi-civil, as non-repair of a bridge or obstruction of a highway. It is noticeable that criminal cases tried at *nisi prius* take their place in the *nisi prius* list and not with other criminal cases. Where the proceedings are by indictment at assizes, sentence may be passed either at the assizes or in the Queen's Bench Division; where by information, only the latter course is available.

Nisi Prius Record was before the Judicature Acts the name of the formal copy of proceedings showing the history of the case up to the time of trial. After the trial it was endorsed with the *postea*, showing the result of the trial, and delivered by the officer of the court to the successful party, whose possession of the *postea* was his title to judgment. Since the Judicature Acts there is no *nisi prius* record in civil actions, the nearest approach to it being the deposit of copies of the pleadings for the use of the judge, and there is no *postea*, the certificate of the associate or master as to the result of the trial superseding it. In crown practice, the class of practice under which criminal proceedings at *nisi prius* fall, the *nisi prius* record still exists, crown practice being specially excepted from the operation of the Judicature Acts.

NISSA. See NISH.

NITRATES, NITRE, NITRIC ACID. See NITROGEN.

NITROGEN is a chemical element which, on account of its abundance in nature and its relations to life, is of great importance. About three-fourths of the mass of the atmosphere consists of elementary nitrogen; and, as an essential component of all albumenoids, the element pervades the whole of the animal and vegetable kingdom. Nitrogen minerals are scarce (almost the only ones are Chili saltpetre and native nitre), but traces of the two nitrogen compounds, ammonia and nitric acid, are diffused throughout all soils, besides existing in the atmosphere.

Elementary nitrogen exists only in the one form of nitrogen gas (N_2 = 1 molecule), which is easily extracted from the atmosphere. Though resembling air in its general properties, it is easily distinguished from it by its not supporting combustion. According to Regnault, its specific gravity is 0·9703 times that of pure, dry air; and one litre, measured at t° C. and P millimetres pressure (strictly speaking the pressure exerted by a column of mercury of 0° C. and the height P, at latitude 45° and sea-level) is W grammes, where

$$W = 0{\cdot}45043 \frac{P}{272{\cdot}6 + t}.$$

For sea-level and lat. 55° 54′ (Edinburgh or Glasgow) the constant is 0·45090; for lat. 51° 32′ (London), 0·45072.

According to Dittmar (*Reports on the Challenger Expedition*) 1000 volumes of pure water, when shaken with excess of gas at t° C. and "one atmosphere's pressure," absorb β volumes of the gas measured at 0° and the same pressure,—β having for the temperatures given the following values:—

t =	0°	15°	25°	30°
β =	24·40	17·65	14·95	13·90

Nitrogen is a permanent gas in this sense that no amount of pressure will liquefy it at any temperature lying above the "critical point" of −123°·8 C. At or a little below this temperature 42 atmospheres reduce it to a liquid (Sarrau).

Chemically, nitrogen gas is characterized by perfect inertness towards all ordinary reagents under ordinary conditions. But at certain higher temperatures boron, magnesium, vanadium, and titanium combine with it directly into nitrides. Nitrogen is capable even of uniting with ordinary oxygen. A mixture of the two gases, it is true, remains unchanged when exposed *en masse* to any temperature, but when it is subjected to a succession of electric sparks a small proportion of the two gases, no doubt through local dissociation into isolated atoms N and O, does unite into nitric oxide, NO, which then combines with more oxygen into red fumes of peroxide, N_2O_4.

The part which the nitrogen gas in the atmosphere plays in the economy of nature is as yet a mystery. It certainly is not susceptible of being taken up directly by the plants and utilized in their synthesis of nitrogenous compounds. It plays no active part in the processes of combustion and of animal respiration; in either it appears to act only as an inert diluent of the oxygen.

In the case of respiration, however, this particular diluent seems to be essential; no animal could live healthily for any considerable period of time in pure oxygen, and we know of no other diluent which could be substituted for the nitrogen without producing poisonous effects. Besides, there can be no doubt that atmospheric nitrogen, in an indirect way, contributes towards the building up of nitrogenous organic matter. Every process of ordinary combustion probably, and every electric discharge in the atmosphere certainly, induces the formation of some nitric acid, which by combining with the atmospheric ammonia becomes nitrate of ammonia, and from certain experiments of Schönbein's it would appear that nitrogen gas and water are capable of uniting directly into nitrite of ammonia ($N_2 + 2H_2O = NO_2 . NH_4$), which, supposing it to be produced in the atmosphere, would promptly be oxidized into nitrate. The nitrate produced by either process is carried down by the rain and conveyed to the roots of the plants, which assimilate it as part of their nitrogenous organic matter. However small the scale may appear on which these processes of atmospheric nitrification go on when measured by the mass of nitrogen which remains unchanged, as this mass is immense, their absolute effect must be very considerable, and may form an important item in the economy of nature.

The compounds of nitrogen may be arranged under the heads of ammonia, nitrates, nitro-compounds, organic nitrogen compounds, and cyanides. As all the several classes and their most important members are treated of under **Chemistry** (vol. v. p. 509–514), we confine ourselves here, in the main, to supplementing that article by such details as are of practical or general scientific interest.

Ammonia.

This, the only known compound of hydrogen with nitrogen, is a gas of the molecular formula NH_3. The most convenient process for the preparation of the pure gas is to mix powdered sal-ammoniac with powdered quicklime in a flask and to heat the mixture in a sand-bath. Torrents of ammonia come off, which must be dried by passing it through a closely packed column of solid caustic potash or soda (chloride of calcium absorbs the gas chemically) and collected over mercury, as the gas dissolves most abundantly in water. In addition to what has been said under **Chemistry** of the properties of ammonia, it may here be mentioned that, though uninflammable in air, it burns brilliantly in oxygen, and that it is liable to the following peculiar kind of oxidation. Pour some strong liquor ammoniæ into a large flask, so as to produce a moist mixture of the gas and of air, and suspend in this atmosphere a recently ignited spiral of thin platinum wire. The wire continues glowing and the flask soon fills with dense white fumes of nitrite and nitrate of ammonia, formed according to equation: $2NH_3 + (4O \text{ or } 3O) = H_2O + NO_3H . NH_3 \text{ or } NO_2H . NH_3$. The platinum suffers no permanent change; its mode of action probably consists in this that it alternately absorbs (*i.e.*, combines with) oxygen and hands it over to the ammonia. In any case the reaction is interesting as throwing some light upon the process of nitrification (*vide infra*).

Aqueous ammonia (liquor ammoniæ), being in constant requisition as a reagent, and also used in medicine and in the arts, is being manufactured industrially. Fresenius recommends the following process. A cast-iron pot, fitted up as a retort, is charged with alternate layers of slaked lime (10 kilos of quicklime plus 4 kilos of water) and a powdered and sifted mixture of 6·5 kilos of chloride and 3·5 kilos of sulphate of ammonium. Eight litres of water are then added and well incorporated with the solids. The retort is now closed, and the outlet-tube joined on to the lower end of an inverted condenser, the upper end of which communicates with a set of Woulfe's bottles charged with water. The ammonia is driven off by judicious application of heat, the inverted condenser serving to make the gas relatively dry before being absorbed. In this operation the tubes conveying the gas to the water must go to the bottom of the bottles, as the solution produced is lighter than pure water; and, of course, the bottles must be kept cool by immersion in a cold water-bath. The strength of aqueous ammonia, for commercial purposes, is readily ascertained by means of an hydrometer ranging from 0·85 to 1·0 specific gravity. The relation between specific gravity S at 14° C. (water of 14° = 1) and percentage of ammonia NH_3 (p), according to experiments by Carius, is as follows:—

p	S	p	S	p	S
36	·8844	25	·9106	10	·9593
35	·8856	20	·9251	9	·9631
34	·8868	15	·9414	8	·9670
33	·8907	14	·9449	7	·9709
32	·8929	13	9484	6	·9749
31	·8953	12	·9520	5	·9790
30	·8976	11	·9556		

Aqueous ammonia is generally sent out as "liquor fortissimus" of 30 to 35 per cent. For ordinary laboratory purposes it is usually diluted down to 9 to 10 per cent. This explains the discontinuities in the table.

Two natural sources of ammonia are at present in industrial use. (1) The gaseous exhalations of volcanoes always include ammonia, hydrochloric acid, and sulphurous acid, of which the first two are formed no doubt by the action of steam on deposits of nitrides and chlorides in the interior of the earth. This explains the existence in the fumaroles (smoke-holes), and in the clefts of the lava of Vesuvius, Hecla, and other volcanoes, of deposits of (chiefly) sal-ammoniac. This volcanic ammonia salt is highly valued as a material for the preparation of pure liquor ammoniæ; but its supply hardly comes up to the demands of even this small industry. (2) More important are the masses of ammonia formed in the processes of putrefaction which are going on constantly in nature, and of which a mere fraction would satisfy all the demands of industry, if the recovery of such ammonia were not, as a rule, beset with insuperable difficulties. Thus, for instance, all the immense mass of the ammonia of the sewage of our large cities must be allowed to go to waste because we have no economical method for its extraction. Urine, when undiluted, is an easily handled raw material, and in former times actually formed the principal source of ammonia. Human urine contains from 2 to 3 per cent. of urea, or carbamide as it is called in systematic chemistry, because it is the anhydride of carbonate of ammonia. When urine putrefies, this carbamide takes up the elements of water and becomes carbonate of ammonia, $CO . (N_2H_4) + 2H_2O = CO_3(NH_4)_2$. A prompter mode of conversion is to evaporate the urine with a small proportion of vitriol, and heat the residue to near the boiling-point of the acid, when the nitrogen of the urea passes at once into the form of sulphate of ammonia. This latter process would apply also to the urine of horses and cattle, which, instead of urea, contains hippuric acid, a compound which, when taken conjointly with water, contains the elements of ammonia and benzoic and acetic acids. At the present time urine plays hardly any part in the ammonia industry; but it may be mentioned that the produce of the urinals of Glasgow is, or lately was, wrought for carbonate of ammonia.

Preparation of Ammonia from Nitrogenous Organic Matter.—All such matter when subjected to dry distillation gives up part of its nitrogen as ammonia, of which the greater part condenses with the vapour of water produced, and is thus obtained as part of the aqueous portion of the "tar." Large quantities of such tar-water are being produced incidentally in the manufacture of coal-gas, and it is this material which at present forms the principal source for the industrial production of ammonia and ammonia salts.

It may also be mentioned that the tar-water obtained as a bye-product in the distillation of shale for the production of paraffin oil is rich in ammonia, and has long come to be worked up for sulphate like gas-liquors.

Crude tar-water contains about 1 per cent. of ammonia (more or less according to the quality of coal used, and the way it has been manipulated), mostly in the form of carbonate, part as cyanide, sulphocyanate, and sulphide of ammonium; and this ammonia, of course, is associated with traces of hydrocarbons and other organic matter dissolved, or suspended, in the liquor. In some establishments the ammonia is extracted directly in the form of liquor ammoniæ. The liquor is run into a large iron boiler, and after addition of some ferrous and ferric salt (for fixing the sulphur of the sulphide as FeS, and the cyanogen of the cyanide as prussiate, $(NC)_6Fe \cdot (NH_4)_4$), mixed with slaked lime and distilled. The vapours if condensed as they come off, would yield a very dilute liquor contaminated largely with volatile carbon compounds. To obtain a relatively pure gas, the vapour is subjected to a succession of partial condensations by making it pass through the several compartments of an iron apparatus, similar in its action to the "Coffey's still" which is used for the strengthening and refining of alcoholic liquors (see DISTILLATION, vol. vii. p. 265). The almost pure gas which leaves the last condenser is passed into a mass of water contained in a refrigerated close lead vessel, and thus converted into liquor ammoniæ of the requisite strength. In the majority of large establishments, however, the ammonia is converted into sulphate, for which purpose it need not be so elaborately purified. The ammoniacal vapour obtained from the crude liquor by simple distillation, or by distillation with lime from out of a steam-boiler, is passed into a quantity of chamber-acid contained in a leaden tank, until the acid is almost but not quite neutralized. An excess of alkali would induce the formation of sulphide of iron from the sulphide of ammonium in the vapour and the traces of iron-salt adventitiously present, and lead to a discoloration of the salt. Matters are generally arranged so that the bulk of the sulphate formed crystallizes out, on cooling, in the form of a granular magma, which is allowed to drain and to dry, and either sold as it is, or first purified by recrystallization. The pure salt, $(NH_4)_2SO_4$, forms anhydrous, colourless, transparent crystals, isomorphous with those of the corresponding potash salt, and, like it, belonging to the rhombic system; even when produced on a large scale they are generally of small dimensions; when allowed to grow, they assume forms which strikingly remind one of sugar-candy, although the latter is clino-rhombic. The salt is insoluble in alcohol, like most sulphates,—100 parts of water at 0°, 20°, 100° C. dissolve 71·0, 76·3, 97·5 parts of salt. The solution is neutral to litmus. The salt readily unites with another equivalent of sulphuric acid into crystallizable acid sulphate, $SO_4 \cdot (NH_4) \cdot H$, soluble in alcohol. The neutral salt melts at 140° C. Above 280° it emits ammonia and leaves acid salt, which latter then breaks up with formation of acid sulphite $SO_3(NH_4)H_1$, nitrogen, and water. At a red heat it breaks up into sulphur, nitrogen, and water: $(NH_4)_2SO_4 = S + N_2 + 4H_2O$.

Of other ammonia salts only the hydrochloride and the carbonates are industrially important.

The hydrochloride, $HCl \cdot NH_3 = NH_4Cl$, better known as *sal-ammoniac* (see vol. i. p. 741–2), is made sometimes by sublimation of a mixture of the sulphate with common salt, but it is more conveniently produced direct from gas-liquor ammonia by passing it into muriatic acid until the latter is almost neutralized. The liquor, when sufficiently concentrated by evaporation, deposits, on cooling, part of its salt in feathery crystals, which are customarily purified by sublimation. The subliming apparatus consists of two parts,—(1) a hemispherical stoneware basin placed within a close fitting iron one, or an enamelled iron basin, and (2) a hemispherical lead or stoneware lid, or dome, placed on the top of the basin and cemented on to prevent leakage. The dome has a small aperture in the top which remains open to preclude accumulation of pressure. The carefully dried crystallized salt is pressed into the basin, and, after the lid has been fitted on, is exposed to a long-lasting moderate heat. The salt volatilizes (mostly in the form of a mixed vapour of the two components, which reunite on cooling), and condenses in the dome in the form of a characteristically fibrous and tough crust. The salt readily dissolves in water, with considerable absorption of heat; 30 parts of salt with 100 parts of water at 13°·3 give a mixture of the temperature of −5°·1 C. One hundred parts of water at 0°, 10°, 110° dissolve 28·4, 32·8, 77·2 parts of the salt. From its hot saturated solution it crystallizes on cooling in feathery groups of colourless needles. By slow evaporation of the solution it is possible to produce well-developed crystals which belong to the regular system, but look irregular on account of the predominance of the (hemihedric) faces of the trapezohedron.

Of the *carbonates* of ammonia there are a large number, and their chemistry still lacks definiteness. The normal salt $CO_3(NH_4)_2$ is so unstable that it can hardly be said to exist. The acid salt $CO_3(NH_4)H$ is easily produced by passing carbonic acid into a saturated solution of the commercial salt, when it comes down as a crystalline precipitate. The commercial salt (important as a medicinal agent and as a chemical reagent) is obtained by subliming a mixture of sal-ammoniac and chalk from an iron retort provided with a lead dome and receiver. It forms hard fibrous crusts or cakes, smelling strongly of ammonia. The salt has a variable composition. The greater part, as a rule, consists of "sesquicarbonate," $2(NH_4)_2O \cdot 3CO_2 + H_2O = (NH_4)_2CO_3 + 2(NH_4) \cdot HCO_3$. But it also contains carbamate of ammonia,

$$CO\left\{\begin{matrix}NH_2\\O-(NH_4)\end{matrix}\right. = CO_2 + 2NH_3,$$

as obtainable by the direct union of carbonic anhydride and ammonia.

Of the several ammonia compounds which we have referred to, the sulphate is by far the most important in an industrial sense. Immense quantities of the crude salt are being used as a manure—the German sugar-beet growers alone consume a considerable fraction of the British produce—while to the technical chemist generally it serves as the most convenient starting-point for the manufacture of ammonia, or of other ammonia salts.[1]

In the mode of distilling coal customarily carried on in gas works, only about one-third of the nitrogen is obtained as ammonia in the tar-water, the remaining two-thirds being lost by evaporation into the air, or remaining in the coke in the carbide form. What used to go into the gas is now mostly recovered by efficient scrubbers. But the more efficient condensation of the ammonia actually formed is a matter of chemical engineering which cannot be more than touched on here. According to Bilbey the nitrogen of the coke can be recovered, partly at least, by distilling it at a very high temperature in a current of steam. Bilbey's process, however, has hitherto failed practically to give satisfaction, because the intense heat required means a great expense for fuel, and destroys the retorts at an alarming rate. The analytical chemist has no difficulty in extracting the whole of the nitrogen in a given sample of coal as ammonia by mixing it with soda-lime and heating the mixture in a combustion-tube to redness, and possibly the technical chemist will one day bring this process into a remunerative form. What, however, is meanwhile more easy of attainment is the recovery of the large quantities of ammonia which are being produced in the manufacture of coke and in iron smelting (as far as carried out with coal), and which hitherto have been allowed to go to waste. Quite a number of chemists and engineers have tried their hands at this problem. The apparatus proposed, generally speaking, all come to this, that the coal-smoke produced in the furnace, instead of being allowed to have its own way, is sucked out by exhausters, made to pass through refrigerators to deposit at least part of its tar and ammonia water, and the uncondensed combustible gases are led away to be used as fuel for steam-boilers, or, what in the case of coking is far better, led back to the coke oven and consumed there to increase the temperature, and thus improve the qualities of both coke and tar. The very high temperature of the oven or furnace smoke throws great difficulties in the way of a perfect condensation of the ammonia. These, in a Scottish iron-work, have been turned most ingeniously by mixing the smoke with the sulphureous vapour formed by the roasting of pyritic shale or coal, whereby the ammonia is converted into sulphite and sulphate, which can easily be condensed in even hot water.

Should it not be possible to produce ammonia synthetically from atmospheric nitrogen? This question is still waiting for an industrial solution; scientifically it may be answered in more than one way. Magnesium, boron, and a number of other solid and non-volatile elementary substances, when kept in nitrogen gas at the proper temperature, unite with the nitrogen into solid non-volatile nitrides; and these, when heated in steam, yield ammonia and the corresponding oxide. Thus we have $3Mg + N_2 = N_2Mg_3$ and $N_2Mg_3 + 3H_2O = 2NH_3 + 3MgO$. Unfortunately the reagents are all expensive, and there is no economical method for their regeneration. The following method is not subject to this one objection. A mixture of baryta or carbonate of baryta with charcoal, when heated intensely in nitrogen gas, yields cyanide of barium, $Ba(NC)_2$, and this salt when heated in steam gives off ammonia while carbonate of baryta is left, which latter can be used for starting *de novo*, $BaN_2C_2 + 4H_2O = 2NH_3 + BaCO_3 + CO + H_2$. Where this process fails we are unable to say; what we do know is that nobody has as yet succeeded in working it profitably even as a means for obtaining cyanides, whose value, per unit of nitrogen, is higher than that of ammonia.

Nitrates.

Nitrates (the generic term for nitric acid, HNO_3, and its salts) are produced naturally by the electric discharges in the atmosphere, and in the processes of "nitrification," a fermentative oxidation which always sets in when moist nitrogenous animal or vegetable matter is left to itself in the presence of air and some basic substance (see FERMENTATION, vol. ix. p. 98). This process in former times used to be carried out for the production of saltpetre, but as an industrial operation is now obsolete. The deposits of native nitre in India and elsewhere which nature has produced for us by the same method are, of course, still being utilized as far as they go. But they amount to very little compared with the immense masses of native nitrate of soda which exist in South America, and which, at present, constitute by far the most important raw material for the nitrate industry.

This native *nitrate of soda* forms part of a salty earth known to the natives as *caliche* or *terra salitrosa*, which abounds especially in the district of Atacama and the Peruvian province of Tarapaca. The caliche there lies from ·25 to 1·5 metres deep, and stretches over a distance of forty leagues; it is covered by a layer, from a half to two metres thick, of a hard conglomerate of sand, felspar, phosphates, and other mineral matters, which is designated "costra." In other places the caliche forms part of a sandy deposit which sometimes comes to the surface and never goes down to a depth beyond 2·6 metres. The caliche contains from 48 to 75 per cent. of nitrate of soda and from 20 to 40 per cent. of common salt, which are associated with various minor saline components, including iodate of soda, and more or less of insoluble mineral, and also some organic matter, guano amongst other things, which suggests the idea that the nitrate was formed by the nitrification of this kind of excremental matter. The caliche is worked up *in loco* for crude nitrate of soda; by extracting the salts with hot water, allowing the suspended earth to settle, and then transferring the clarified liquor, first to a cistern where it deposits part of its chloride of sodium at a high temperature, and then to another where, on cooling, it yields a crop of crystals of purified nitrate. The nitre thus refined is imported chiefly from Valparaiso, whence the name of "Chili saltpetre." The mother-liquors used until a few years ago to be thrown away, but are now being utilized for the extraction of their iodine, which, although little in a relative sense, on account of the large masses of raw material wrought, amounts to a good deal absolutely, as is illustrated by the fact that Peruvian iodine has put an end to the kelp industry in Scotland. Chemically pure nitrate of soda can be obtained by repeated recrystallization of Chili saltpetre or by synthesis from pure nitric acid and pure carbonate of soda. It forms colourless transparent rhombohedra, like those of Iceland spar, only the angles are more nearly equal to right angles, so that the crystals look like cubes. Hence the name of cubic saltpetre, which is sometimes given to the salt. One hundred parts of water at 0°, 20°, 50°, 100°, 110° C. dissolve 72·9, 87·5, 112, 180, 200 parts of the salt; at 120°, the boiling-point of the saturated solution, 216 parts. It fuses at 330° C. (Carnelley); at higher temperatures it loses oxygen (more readily than the corresponding potash salt) with formation of nitrite NO_2Na, which, at very high temperatures, is reduced ultimately to a mixture of peroxide, Na_2O_2, and oxide, Na_2O. Industrially the salt is important as being the raw material for the manufacture of nitric acid and of nitrate of potash.

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[1] For the ammonia process of soda-ash manufacture, which, after having been asleep industrially for some thirty years, was brought into a remunerative form by Solvay and Mond, and is now gradually, but surely, taking the place of the old Leblanc process, see SODIUM.

Nitrate of potash (saltpetre), which forms the predominating component of gunpowder, occurs native in India and other parts of the world, and such native nitre has only to be purified by crystallization to become fit for the market. But the bulk of what occurs in commerce is made by double decomposition of Chili saltpetre with (*a*) caustic potash, (*b*) carbonate of potash, or (*c*) chloride of potassium, which processes yield (*a*) caustic soda, (*b*) carbonate of soda, (*c*) common salt as bye-products. The third form (*c*) of the method is most largely wrought, the necessary supplies of cheap chloride of potassium being furnished by the works at the Stassfurt deposits. The two raw materials are analysed, and quantities corresponding to $NaNO_3 = 85$ of nitrate of soda and $KCl = 74·5$ parts of chloride of potassium respectively are dissolved together in an iron basin in the least quantity of hot water. The solution is boiled down to 1·5 specific gravity (hot), when the common salt formed gradually crystallizes out. It is fished out, allowed to drain, and the runnings are returned to the basin. The highly concentrated mother-liquor is allowed to cool with frequent agitation, so that the saltpetre, which crystallizes and assumes the form of a "meal," is more readily freed from mother-liquor, by judicious washing with cold water. The crude saltpetre which is thus obtained is recrystallized until it is almost chemically pure, because an even slightly contaminated salt is unfit for gunpowder making. Nitrate of potash is isomorphous with the soda salt in this sense that it is possible to obtain it in the form of rhombohedra; but those rhombohedra have no great stability, and under ordinary conditions the salt always assumes the form of long six-sided prisms of the right-rhombic system. It is far less soluble in water than nitrate of soda, and, unlike it, is absolutely non-hygroscopic. One hundred parts of water at 0°, 10°, 20°, 50°, 80°, 100° C. dissolve 13·3, 21·1, 31·2, 86, 172, 247 parts of salt. The boiling fully saturated solution is at 114°, and contains 327 parts of salt per 100 of water (Mulder). It fuses at 352° C. (Carnelley) into a colourless liquid, which freezes into a hard compact mass exhibiting a coarse, fibrous fracture if the salt is pure. In an impure salt this structure becomes the less distinct the greater the proportion of impurities; with a saltpetre which contains 3·5 per cent. of common salt, the fibres appear only at the edges of the surface of fracture. This is the basis of a now almost forgotten test for purity, and explains that to the present day the term "refraction" is used to designate the sum total of impurities contained in 100 parts of nitre analysed. When heated sufficiently beyond its fusing point it decomposes similarly to nitrate of soda, only it gives up its oxygen far less readily. A mixture of nitre with charcoal, sulphur, or other combustible matter, when kindled, burns off with explosive violence. Hence its application for the manufacture of gunpowder and in pyrotechnics, and its use in the laboratory as a powerful oxidizing agent in operations of the dry way.

Nitric Acid, HNO_3 (see CHEMISTRY, p. 511 *sq.*), is prepared from nitrate of potash or soda by distillation with sulphuric acid. The scientific chemist prefers the potash salt because it is more easily purified; the manufacturer uses nitrate of soda because it is cheaper and a lower temperature and a less excess of oil of vitriol (over and above $1H_2SO_4$ for $2RNO_3$) suffice for its successful conversion into acid. For manufacturing purposes the distillation is effected from out of horizontal cylindrical or deep hemispherical retorts made of cast iron (a material which is far less attacked by the acids than one might be inclined to think). The retort communicates with a series of Woulfe's bottles made of stoneware, which are sometimes provided with taps for letting off the distillate. The retort, after having been charged and connected with the receivers, is heated over a naked fire until all the acid is driven off, and nothing but a (more or less acid) sulphate of soda is left. The details of the manufacture vary according to the kind of acid which is intended to be produced. If the manufacture of ordinary aquafortis (of 1·3 to 1·4 specific gravity) is aimed at the receivers are charged with the proper proportion of water, and less than $1H_2SO_4$ may be used for the decomposition of $1NO_3Na$, because the peroxide of nitrogen from the dissociated part of the acid, by the action of the water and the air in the receivers, is to a great extent reconverted into nitric acid. The preparation of acid of highest strength demands the full equivalent of vitriol. But even then the product, apart from the contents of the first few condenser bottles nearest to the retort, is strongly contaminated with dissolved peroxide, which imparts to the acid a deep red colour. This impurity can be brought down to about 2 per cent. by blowing air through the gently heated acid, which carries away the peroxide as a vapour. To utilize the latter, the mixture is made to ascend through a tower filled with coke kept moist by a constant rain of water running downwards against the stream of acid fumes. Water alone would convert two-thirds of the nitrogen into nitric acid, thus:—$3N_2O_4\,(+\text{aqua}) = 2NO + (2N_2O_5 + \text{aqua})$; but by the cooperation of the oxygen of the air a larger proportion of acid is being regenerated as aquafortis of about 1·3 specific gravity. Two kinds of acid are chiefly being produced, viz., (1) full-strength fuming acid of 1·5 to 1·52 specific gravity at 15° C., which is largely used (in the tar-colour industry for the making of nitro-bodies, and also for the manufacture of gun-cotton and nitroglycerin), and (2) aquafortis of 1·35 to 1·42 specific gravity, for the charging of batteries, and as a reagent generally. Either acid is sold in two qualities,—as colourless acid relatively free of peroxide of nitrogen, and as red acid charged with it, which admixture is not always an impurity in a technical sense, but desired for certain purposes to be present. Most commercial acid is contaminated with chlorine and sulphuric acid, which can both be removed by fractional distillation—most easily from the strongest acid. The chlorine accumulates in the first runnings; the sulphuric acid remains in the retort, if the distillation be stopped in time.

For most purposes the strength of an acid can be determined with sufficient accuracy by means of a hydrometer.

The following table gives the relation between the percentages p of HNO_3 and the specific gravity S according to Kolb:—

p	S at 0° C.	S at 15° C.	*p*	S at 0° C.	S at 15° C.
100	1·559	1·530	30	1·200	1·185
90	1·522	1·495	20	1·132	1·120
80	1·484	1·460	15	1·099	1·089
70	1·444	1·423	10	1·070	1·060
60	1·393	1·374	5	1·031	1·029
50	1·334	1·317	0	1·000	1·000
40	1·267	1·251			

Regarding the reactions of nitric acid with elementary substances and with inorganic compounds generally, see CHEMISTRY (*ut sup.* pp. 511–514). The general effect of the treatment of an organic substance with aquafortis is that the acid is reduced to lower oxides of nitrogen and water, while the organic substance undergoes some kind of oxidation, which sometimes assumes the character of a combustion. With regard to the more immediately formed oxidation products it is difficult to speak in general terms; suffice it to say that, according to Carius, all organic substances when heated with nitric acid in sealed-up tubes to 150° to 300° C. are burned completely into carbonic acid, water, and nitrogen or nitrogen oxides. Any other element that may be present passes into its highest state of oxidation: sulphur, for instance, becomes sulphuric acid; phosphorus, phosphoric, &c. Very remarkable is the action of real nitric acid, when employed in the cold, and under conditions precluding the accumulation of water or lower oxides of nitrogen. The acid then, if it acts at all, unites with the respective substances, with elimination of water and formation from the body B of a product $B + nHNO_3 - nH_2O$ or $B + nNO_2 - nH$. These nitro-bodies, as they are sometimes called, divide themselves into two classes:—(1) *nitric esters*, *i.e.*, real nitrates formed from alcohols, which term must be understood here to include glycerin, sugar, mannite, cellulose, and many other OH-compounds not usually called alcohols (in these the group $NO_2 . O$ stands where the OH was in the original substance); and (2) *nitro-bodies proper*, in which the NO_2-group has taken the place of an H which was combined directly with carbon. An example is the nitrobenzol, $C_6H_5(NO_2)$, produced from benzol, $C_6H_5 . H$. When such a (true) nitro-body is treated with nascent hydrogen, the NO_2 as a rule goes out and is replaced by an amidogen NH_2; thus $C_6H_5(NO_2)$ becomes $C_6H_5(NH_2)$, amido-benzol or aniline. The nitric esters, in the circumstances, yield up their NO_2 as ammonia.

For other metallic nitrates, see under the respective metals. For *nitric esters*, see METHYL, GUN-COTTON, and NITROGLYCERIN. For *nitric anhydride* (N_2O_5), *peroxide of nitrogen* (N_2O_4), *nitrous acid* (N_2O_3), *nitric oxide* (NO), *nitrous oxide* (N_2O, laughing-gas), also *chloride of nitrosyle* (*aqua regia*), see CHEMISTRY, p. 511 *sq.*

Nitrogenous Carbon Compounds.

Of this very numerous family we can only name a few of the more important groups and explain their genetic relations. Cyanides, compounds of the radical (NC),[1] are important to us here chiefly as a link between the two elements on the one hand and nitrogenous organic bodies proper on the other. Hydrocyanic acid, NCH, can be produced synthetically in a number of ways; we may, for instance, synthesize cyanide of barium, BaN_2C_2, as shown above, and decompose it by sulphuric acid. A more direct method is to first combine carbon with hydrogen into acetylene and then to subject a mixture of this and nitrogen gas to a spark-current, when hydrocyanic acid is produced, thus:—$C_2H_2 + N_2 = 2HNC$.

Alkylamines.—When hydrogen is generated within an acidified solution of hydrocyanic acid by means of zinc, the cyanide, by taking over four atoms of hydrogen, passes into (a salt of) methylamine, $NCH + 4H = NH_2 . CH_3$. It is explained under METHYL how this base may be utilized for the production of methyl-alcohol, and thus, indirectly, of iodide of methyl and of acetonitrile (pseudo-cyanide of methyl, $NC . CH_3$). This shows the possibility of producing from hydrocyanic acid, in the first instance di- and tri-methylamine, and, more indirectly, the whole series of alkylamines (NH_2R, NHR_2, NR_3; where $R = CH_3$, $CH_3 + CH_2 = C_2H_5$, $C_2H_5 + CH_2 = C_3H_7$, &c.). Closely allied to these alkylamines are the diamines, derived from the bromides of the olefines, C_nH_{2n}, as the former are from those, or the iodides, of the alcohol-radicals CH_3, C_2H_5, &c. To ethylamine, for instance, corresponds ethylene-diamine, $C_2H_4(NH_2)_2$.

Acid-amides are bodies related to acids, as alkylamines are to alcohols. Thus, for instance,

$$\underset{\text{Ethylamine.}}{C_2H_5NH_2} \text{ corresponds to } \underset{\text{Acetamide.}}{[CH_3 . CO]NH_2}.$$

Polybasic acids form each a series of amides. Thus succinic acid, $C_2H_4(COOH)_2$, forms two amides, viz.,

$$\underset{\text{Succinamic acid.}}{C_2H_4 \left\langle \begin{array}{l} COOH \\ CONH_2 \end{array} \right.} \text{ and } \underset{\text{Succinamide.}}{C_2H_4 \left\langle \begin{array}{l} CONH_2 \\ CONH_2 \end{array} \right.}.$$

All acid-amides are the anhydrides of corresponding ammonia salts, and can be produced from these by actual dehydration; there is no need of explaining by an equation what is so clearly seen in the formulæ. The two succinamides just named, and all analogous "amides," are susceptible of further dehydration: thus

$$\text{succinamic acid, } C_2H \left\langle \begin{array}{l} CO[OH] \\ CONH[H] \end{array} \right. ,$$

by losing the bracketed OH and H becomes

$$\text{succinimid, } C_2H_4 \left\langle \begin{array}{l} CO \\ CO \end{array} \right\rangle (NH);$$

$$\text{and succinamide, } C_2H_4 \begin{array}{l} C\boxed{O}N\boxed{H_2} \\ C\boxed{O}N\boxed{H_2} \end{array} ,$$

similarly becomes

$$\text{succino-nitrile, } C_2H_4 \left\langle \begin{array}{l} CN \\ CN \end{array} \right. .$$

Acid-amides must not be mixed up with amido-acids.

Amido-acids have their (NH_2) within the specific, not in the generic, radical. Thus, acetic acid, CH_3COOH, by chlorination, becomes chloracetic acid, $CH_2Cl . COOH$, and this chloro-acid again gives up its chlorine to ammonia and to caustic potash, and receives back NH_2 in the one case and OH in the other, becoming

$$\underset{\text{Amido-acetic acid.}}{CH_2(NH_2) . COOH} \text{ and } \underset{\text{Oxy-acetic or glycollic acid.}}{CH_2(OH) . COOH}$$

respectively. The latter forms an amide, $CH_2(OH)CO . NH_2$, as acetic acid does, and this amide, as is easily seen, is isomeric with amido-acetic acid, either being oxy-acetic minus OH plus NH_2; but the two differ widely from each other. The amide, when treated with aqueous potash, yields ammonia and glycollate of potash, the amido-acid water and amido-acetate of potash. The substance asparagine, which is contained in so many vegetable juices, and often appears as a decomposition product of albumenoids, is an amide and an amido-acid in one, being amido-succinamic acid.

$$\underset{\text{Succinic acid.}}{C_2H_4 \begin{array}{l} COOH \\ COOH \end{array}} \qquad \underset{\text{Asparagine.}}{C_2H_3(NH_2) \left\} \begin{array}{l} CO . NH_2 \\ CO . OH \end{array} \right.}.$$

With the so-called aromatic bodies a very general method for producing amido-bodies is first to prepare a nitro-body and then reduce it by nascent hydrogen. Thus, for instance, we can convert nitrobenzol, $C_6H_5 . NO_2$, above referred to, into amido-benzol, $C_6H_5 . NH_2$. We shall use this body as an example to explain the general mode of formation of a most interesting group of nitrogenous compounds which at present play a great part in the colour industry.

Diazo-bodies.—All NH_2 compounds, when treated with water and nitrous acid, virtually $NO . OH = \frac{1}{2}(N_2O_3 + H_2O)$, yield the corresponding hydroxyl (OH) compounds, with joint elimination of the nitrogen of substance and reagent as nitrogen gas. Thus we have—

$$\underset{\text{Aniline.}}{C_6H_5NH_2} + OH . NO = \underset{\text{Phenol.}}{C_6H_5 . OH} + H_2O + N_2$$

This is quite a general reaction; but in the case of aromatic amines the reaction takes a different turn, if, instead of the free amine, we use one of its salts, and, in a relative sense at least, exclude water as a medium. In the case of nitrate of aniline, for instance, the two atoms of oxygen in the nitrous acid combine with all the hydrogen of the generic radicals, while all the rest unites into diazo-benzol:—

$$HNO_3 . C_6H_5 . NH_2 + NO . OH = 2H_2O + \underset{\text{Nitrate of diazo-benzol.}}{C_6H_5{-}N{=}N{-}NO_3}.$$

And similarly in similar cases. Diazo-benzol has a great tendency to give off the nitrogen gas N_2 which is visible in its formula. We need only treat it with water and it yields what nitrous acid water would have given at once:—

$$C_6H_5{-}N{=}N{-}NO_3 + H . OH = HNO_3 + N_2 + C_6H_5 . OH.$$

There is something between the nitrates of amido- and of diazo-benzol, which, it is true, has only a theoretical existence in this case, but can be realized in other analogous cases.

Nitroso-bodies.—Ethylamine, under the action of water and nitrous acid, yields alcohol, $C_2H_5 . OH$, as aniline yields phenol, and other monamines yield their alcohols. With diethylamine this reaction cannot take place; what does take place is that the NO of the nitrous acid expels and takes the place of the one loose H in the amine, and forms nitroso-diethyline:—

$$N . H . (C_2H_5)_2 + NO . OH = H . OH + \underset{\text{Nitroso-diethyline.}}{N . (NO) . (C_2H_5)_2}.$$

Hydrazines.—This nitroso-diethyline is a liquid boiling at 177°, devoid of alkaline properties. When treated with zinc-dust and acetic acid it yields a basic substance diethyl-hydrazine, which contains NH_2 in lieu of the NO of the nitroso-body.

$$\underset{\text{Nitroso-diethyline.}}{N . (NO)(C_2H_5)_2} \qquad \underset{\text{Diethyl-hydrazine.}}{N . (NH_2)(C_2H_5)_2}.$$

This hydrazine is only one of a large genus, representatives of which are also obtainable from diazo-bodies by nascent hydrogen. Example—

$$\underset{\text{Sulphate of diazo-benzol.}}{C_6H_5{-}N{=}N{-}(HSO_4)} + 4H = H_2SO_4 + \underset{\text{Phenyl-hydrazine.}}{C_6H_5{-}NH . (NH_2)}.$$

Ureids are a class of bodies which are related to urea as amido-bodies are to ammonia. Thus

$$\begin{array}{l} NH_3 \\ NH_3 \end{array} \qquad (NH_2)' \qquad (2NH_2)''$$

correspond to

$$\underset{\text{Urea.}}{CO \left\} \begin{array}{l} NH_2 \\ NH_2 \end{array} \right.} \qquad CO \left\} \begin{array}{l} (NH)' \\ NH_2 \end{array} \right. \qquad CO \left\langle \begin{array}{l} (NH)' \\ (NH)' \end{array} \right. .$$

Urea radicals.

We satisfy ourselves with quoting two ureids derived from oxalic acid, $C_2O_2 \left\langle \begin{array}{l} OH \\ OH \end{array} \right.$. Just as we have two ammonia derivatives,

$$\underset{\text{Oxamic acid.}}{C_2O_2 \left\langle \begin{array}{l} OH \\ NH_2 \end{array} \right.} \text{ and } \underset{\text{Oxamide.}}{C_2O_2 \left\langle \begin{array}{l} NH_2 \\ NH_2 \end{array} \right.},$$

so there exist two urea-derivatives

$$\underset{\text{Oxaluric acid.}}{C_2O_2 \left\langle \begin{array}{l} OH \\ [NH . NH_2CO] \end{array} \right.} \text{ and } \underset{\text{Parabanic acid.}}{C_2O_2 \left\langle \left[\begin{array}{l} NH \\ NH \end{array} \right\} CO \right] \right.}.$$

The urea radicals are enclosed in square brackets. These are two examples of a large family of bodies interesting on account of their close relationship to uric acid, a constant component of urine.

Creatine is a crystalline base which was discovered by Liebig in the juice of flesh. Volhard prepared it synthetically by the successive realization of the following two reactions :—

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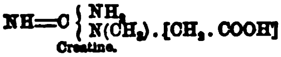
[1] See CHEMISTRY. Some of the more important cyanides will be discussed under PRUSSIC ACID.

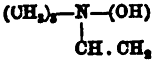
(1) $$\underset{\text{Chloracetic acid.}}{CH_2Cl.COOH} + \underset{\text{Methylamine.}}{NH_2CH_3} = HCl + \underset{\substack{\text{Methyl-amido-acetic acid.}\\ \text{(sarkosine).}}}{CH_2.NH(CH_3).COOH};$$

(2) $$\underset{\text{Sarkosine.}}{CH_2.NH(CH_3).COOH} + \underset{\text{Cyanamide.}}{(CN)NH_2} =$$



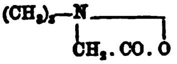
$$\underset{\text{Creatine.}}{NH{=}C\left\{\begin{matrix} NH_2 \\ N(CH_3).[CH_2.COOH]. \end{matrix}\right.}$$

Betaine and Neurine, two bases derived from trimethylamine, are of great physiological importance. Neurine



$$\begin{matrix} (CH_3)_3{-}N{-}(OH) \\ | \\ CH.CH_2 \end{matrix}$$

was discovered by Liebreich as one of the congeners of a complex substance contained in the brain. By oxidation it is converted into betaine



$$\begin{matrix} (CH_3)_3{-}N{-}\!\!-\!\!-\!\!\!\!\mid \\ | \qquad\quad | \\ CH_2.CO.O \end{matrix}$$

which Scheibler discovered in the juice of the sugar-beet. Both bases can be produced synthetically,—the betaine by first uniting trimethylamine with chloracetic acid into a chloride, $ClCH_2.COOH + N(CH_3)_3$, and then replacing the Cl by OH by means of oxide of silver and water. The hydroxide

$$N{-}[OH] < \left\{\begin{matrix} (CH_3)_3 \\ CH_2.COO[H] \end{matrix}\right.$$

formed spontaneously loses the bracketed [OH] and [H] as water, and becomes trimethyl-glycocoll, which is betaine.

Native Alkaloids.—These may be divided into (1) bodies consisting of carbon, nitrogen, and hydrogen only, generally volatile liquids (of which nicotine may be quoted as an example); and (2) such as contain oxygen in addition to the three elements named (quinine, morphia, strychnine, &c.). The more important of these bases are noticed in separate articles.

The Albumenoids.—This class comprises those substances known as albumin, fibrin, casein, &c., which, conjointly with carbohydrates and fats respectively may be said to form the basis of vegetable and animal life. They consequently are the most important of all nitrogenous carbon compounds; but unfortunately we know little of their chemical constitution. They are all solids containing 53 to 54·7 per cent. of carbon, 7·1 to 7·2 of hydrogen, 15·6 to 15·8 of nitrogen, and 1·7 to 1·8 of sulphur. Glutin and chondrin (glue) are closely allied to them. See the special articles.

Analysis.

In regard to general methods for the determination (or detection) of the element, see CHEMISTRY, vol. v. p. 546–7. But it may be added that the method there given as that of Dumas, for combustible carbon compounds, can be made to apply to metallic nitrates by simply substituting finely divided metallic copper for the oxide of copper as a burning agent, and that Varrentrapp and Will's method applies as it stands to metallic nitrides and amides, to metallic cyanides, and to all metal-amines. We confine ourselves here to the more important methods for the detection of certain classes of nitrogen compounds.

1. *Ammonia-salts* and most acid-amides and amin-acids, when treated with aqueous potash, give off their nitrogen as ammonia gas, which, if sufficient in quantity, is easily detected by (*a*) its pungent smell, (*b*) its action on turmeric or red-litmus paper, (*c*) its forming dense clouds of sal-ammoniac when brought into contact with a glass rod moistened with muriatic acid. Should the vapours of ammonia be too highly attenuated to be thus identified, condense them in dilute muriatic acid, and to the distillate obtained (after neutralization of the free acid by potash or soda) apply "Nessler's reagent" (a solution of the salt $HgI_2.2KI$ in aqueous caustic potash or soda; see MERCURY, vol. xvi. p. 34). The least trace of ammonia, if present, assumes the form of iodide of mercur-ammonium, which, if too little to come down as a precipitate, will announce itself by imparting to the liquid an intense brown or yellow colour. One-hundredth of a milligram of ammonia diffused throughout 50 c.c. of liquid (*i.e.*, five million times its weight) can thus be detected with unerring certainty.

2. *Nitrous and Nitric Acid.*—We assume the acids to be given as solutions of their alkaline salts, and may well do so because other metallic salts of either acid can easily be brought into this form by suitable operations. A solution of alkaline nitrite, when mixed with aqueous sulphuric acid, gives off brown fumes (of N_2O_3 and N_2O_4) if it is sufficiently concentrated. In more dilute solutions the liberated nitrous acid breaks up into nitric acid and nitric oxide gas, which latter forms brown fumes (of N_2O_4) as soon as it comes into contact with the air. In still more dilute solutions the liberated nitrous acid remains undecomposed, but is readily detected by a sufficiency of a strong solution of ferrous sulphate or chloride, which reagents liberate nitric oxide from it and dissolve it with formation of an inky-black solution. This is the most characteristic and a highly delicate test. But in the latter respect it is far surpassed by "Gries's reagent,"—a solution of sulphate of meta-diamido-benzol in dilute sulphuric acid. When this solution is added to even the most dilute solution of nitrous acid, a yellow coloration is developed which attains its maximum of intensity after about fifteen minutes standing. This test is fully as delicate as Nessler's for ammonia.

A nitrate solution, when mixed with aqueous sulphuric acid or that acid and ferrous salt, exhibits no visible change. But when the solution is mixed with its own volume of (concentrated) oil of vitriol, so as to not only liberate but also dehydrate the nitric acid, and a strong solution of ferrous sulphate is cautiously poured on the top of the mixture, nitric oxide is eliminated which dissolves in, and strikes an inky-black colour with, the ferrous salt layer. This is *the* test for nitrates.

When a solution containing nitrates or nitrites is distilled with concentrated caustic potash or soda and aluminium foil or zinc-foil and iron filings (or any metal or combination which, with the pure alkali-solution, would give off hydrogen), the nitrogen is gradually eliminated as ammonia, which can be condensed, and, however little it may amount to, detected by Nessler's reagent, as above explained. (W. D.)

NITROGLYCERIN (synonymes *Glonoin*, *Glonoin Oil*, *Dynamites*, *Blasting Gelatin*), $C_3H_5N_3O_9 = C_3H_5(NO_2)_3O_3$, was discovered by Sobrero in 1846, and soon afterwards was more thoroughly investigated by Railton and by De Vrij. It is formed by the action of concentrated nitric acid, in the presence of strong sulphuric acid, upon glycerin at a low temperature, and may be readily prepared upon a small scale by dropping the glycerin into the mixed acids, the mixture being kept artificially cooled, and afterwards poured into a large volume of water. The nitroglycerin then separates as a heavy liquid (sp. gr. 1·6), generally pale yellow, but quite colourless when pure. It is inodorous, and has a sweet pungent aromatic flavour; if it be touched with the tongue or even brought into contact with the skin severe headache ensues, but this effect does not recur after a while with those who habitually handle it, nor is their health premanently injured by working with it. Nitroglycerin is applied medicinally, in very minute doses, in cases of heart disease, but if taken even in small quantities it operates as a violent irritant poison. If a thin layer be spread upon a hard surface and struck sharply with a hammer it explodes violently; under favourable conditions it is more sensitive to explosion by a blow than even mercuric fulminate. It freezes (or crystallizes, in six-sided prisms) at about 40° F., and slowly liquefies again at 50°. When frozen it is less sensitive to explosion; in the United States, where nitroglycerin is extensively used, as such, in mining operations, it is transported in the frozen state for greater safety. Under some circumstances, however, the readiness with which nitroglycerin and its preparations freeze is a source of danger; they have generally to be thawed, by applying heat, before use in cold weather or after they have been frozen for some time, and disastrous explosions have resulted from this being carelessly done. Nitroglycerin is very slightly soluble in water, but is readily taken up by many solvents, especially by methyl-alcohol or wood-spirit. This solution being non-explosive, in the early days of application of nitroglycerin it was transported in that form; but if the spirit became weakened by evaporation, an explosive layer of nitroglycerin containing some spirit would separate, and, in cool weather, nitroglycerin would crystallize out of the solution. The dangers attending the use of nitroglycerin were therefore not much diminished by the use of the solvent.

Unless very carefully freed from acid and from unstable impurities, nitroglycerin will decompose more or less rapidly, especially in warm climates, and the heat developed by the chemical change may lead to spontaneous explosions. But, when manufactured and purified according to the system originated and developed by Nobel, the liquid is possessed of great stability.

The first attempts to utilize the explosive power of nitroglycerin were made by Nobel in 1863; they were only partially successful until the plan, first applied by General Pictot in 1854, of developing the force of gunpowder in the most rapid manner and to the maximum extent, through the agency of an initiative detonation (see "Detonation," art. EXPLOSIVES, vol. viii.), was applied by Nobel to the explosion of nitroglycerin. Even then, however, the liquid nature of the substance, though advantageous in one or two directions, constituted a serious obstacle to its safe transport and storage and to its efficient employment; it was therefore not until Nobel hit upon the expedient of producing plastic solid preparations by mixing the liquid with solid substances, in a fine state of division, capable of absorbing and retaining considerable quantities of it, that the future of nitroglycerin as one of the most effective and convenient blasting agents was secured. Charcoal was the first absorbent used; eventually the siliceous (infusorial) earth known as "kieselguhr" was selected by Nobel as the best material for producing DYNAMITE (*q.v.*), as it absorbs, after calcination, from three to four times its weight of nitroglycerin, and does not part with it easily when the mixture is submitted to pressure or frequent alterations of temperature. For work requiring the greatest sharpness and violence of action, the so-called No. 1 dynamite, consisting of about 75 parts of nitroglycerin and 25 parts of kieselguhr, is by far the most extensively used; other inert absorbents have been used at times, and numerous other less violent forms of dynamite (*Dynamites à base active*) are prepared by impregnating mixtures of oxidizable substances and oxidizing agents (*e.g.*, of nitrates and charcoal or carbonaceous bodies) with smaller proportions of nitroglycerin, or by using imperfectly nitrified wood-fibre, or other forms of cellulose, as the absorbent. *Lithofracteur*, *dualin*, *glyoxilin*, *potentite*, *atlas-dynamite*, *lignin-dynamite*, are examples. The last-named was employed by the Fenians in the attempted outrages in Glasgow and London in 1883. The only inert absorbent of nitroglycerin which compares in efficiency with kieselguhr is *magnesia alba*, which is extensively used for making dynamite in California. The application of nitroglycerin-preparations to industrial purposes, especially for mining, tunnelling, and blasting work in which great cleaving and shattering effects are desired, has developed very rapidly since 1867. Thus, in that year 11 tons were produced at the various works with which Nobel is associated; in 1870 the yield had increased to 424 tons, in 1877 to 5500 tons, and in 1882 to 9500 tons, while considerable quantities are now manufactured independently of Nobel.

The most recent and most perfect form in which nitroglycerin is now used is called *blasting gelatin*. This material, also invented by Nobel, is composed of the liquid and of a small proportion of so-called nitro-cotton, which consists chiefly of those products of the action of nitric acid on cellulose which are intermediate between collodion-cotton and gun-cotton (trinitro-cellulose, &c.). If the liquid is gently heated together with 5 to 7 per cent. of the finely-divided nitro-cotton, and the mixture kept stirred, the two gelatinize together, producing a translucent, plastic, and tenacious mass, which becomes hard when cooled to the freezing point of nitroglycerin, and may be kept in water for any length of time without an appreciable separation of nitroglycerin. When properly prepared, blasting gelatin is less sensitive to detonation than dynamite; and, while its action as an explosive is somewhat more gradual, it is considerably superior to dynamite in explosive power, and even slightly more powerful than pure nitroglycerin, the reason being that the latter contains somewhat more oxygen than is required for the complete oxidation of the carbon and hydrogen, and that this excess is utilized in supplying the deficiency of oxygen existing in the feebly explosive nitro-cotton. Blasting gelatin is rapidly replacing dynamite in some of its applications, and is already extensively manufactured in different countries. (F. A. A.)

NITZSCH, KARL IMMANUEL (1787–1868), theologian, was born at the small Saxon town of Borna on September 21, 1787. His father, Karl Ludwig Nitzsch, who at that time was pastor and superintendent in Borna, and afterwards became professor at Wittenberg, has also left a name of some distinction in the theological world by a number of writings, among which may be mentioned a work entitled *De discrimine revelationis imperatoriæ et didacticæ prolusiones academicæ* (2 vols., 1830). Karl Immanuel, after receiving his elementary education at home, was sent to Schulpforta in 1803, whence he proceeded to the university of Wittenberg in 1806. In 1809 he graduated, when the subject of his thesis was *De evangeliorum apocryphorum in explicandis canonicis usu et abusu*, and in the following year he "habilitated" with a dissertation *De testamentis patriarcharum, libro veteris testamenti pseudepigrapho*. Having been ordained deacon in 1811, he showed remarkable energy and zeal during the bombardment and siege of the city in 1813; and in 1817 he was appointed one of the preceptors in the preachers' seminary which had been established after the suppression of the university. From 1820 to 1822 he was superintendent in Kemberg, and in the latter year he was appointed professor ordinarius of systematic and practical theology at Bonn. Here he remained until called to succeed Marheineke at Berlin in 1847; subsequently he became university preacher, provost of St Nicolai (in 1855), and member of the supreme council of the church, in which last capacity he was one of the ablest and most active promoters of the Evangelical Union. He died on August 21, 1868.

His principal works are *System der Christlichen Lehre* (1829, 6th ed. 1851), *Praktische Theologie* (1847–60, 2d. ed. 1863–68), *Akademische Vorträge über Christliche Glaubenslehre* (1858), and several series of *Predigten*. His *Protestantische Beantwortung*, a reply to the *Symbolik* of Möhler, which originally appeared in the *Studien u. Kritiken*, may also be mentioned. Nitzsch, whose work in dogmatic theology has been already characterized (see vol. vii. p. 342), still stands out as one of the ablest and most genial and accomplished representatives of the "Vermittelungstheologie" (mediation theology), or what may be called the broad evangelical school of modern Germany.—Gregor Wilhelm Nitzsch (1790–1861), brother of Karl Immanuel, chose philology as his province, and held professorships of ancient literature successively at Kiel (from 1827) and at Leipsic (1852). He published various works, chiefly connected with the elucidation of the Homeric poems.

NIVELLES (Flem., *Nyvel*), a manufacturing town of South Brabant, Belgium, stands on the Thines, a small sub-tributary of the Scheldt, 18 miles by rail to the south of Brussels. The Romanesque church of St Gertrude, dating from the 11th century, is interesting, but the exterior suffered defacement in the 18th century, and the restoration of the tower, which suffered from fire in 1859, has not been successful. The treasury contains some valuable works of art. Nivelles has manufactures of woollen, cotton, linen, and paper, as well as a railway locomotive and carriage work, and does a considerable trade in corn and live stock, especially swine. The town owes its origin to a convent founded in 645 by Ida or Ita, the wife of Pippin of Landen. The population was 9825 in 1876, but is said to have been much larger in the 16th century.

NIZÁMÍ (1141–1203). Shaikh Nizámí or Nizám-uddín Abú Mohammed Ilyás bin Yúsuf, the unrivalled master of the romantic epopee in Persia, who ranks in poetical genius as next to Firdausí, was born 535 A.H. (1141 A.D.). His native place, or at any rate the abode of his father, was in the hills of Kumm, but as he spent almost all his days in Ganjah in Arrán (the present Elisabethpol) he is generally known as Nizámí of Ganjah or Ganjawí. The early death of his parents, which illustrated to him in the most forcible manner the unstableness of all human existence, threw a gloom over his whole life, and fostered in him that earnest piety and fervent love for solitude and meditation which have left numerous traces in his poetical writings, and served him throughout his literary career as a powerful antidote against the enticing favours of princely courts, for which he, unlike most of his contemporaries, never sacrificed a tittle of his self-esteem. The religious atmosphere of Ganjah, besides, was most favourable to such a state of mind; the inhabitants, being zealous Sunnites, allowed nobody to dwell among them who did not come up to their standard of orthodoxy, and it is therefore not surprising to find that Nizámí abandoned himself at an early age to a stern ascetic life, as full of intolerance to others as dry and unprofitable to himself. He was rescued at last from this monkish idleness by his inborn genius, which, not being able to give free vent to its poetical inspirations under the crushing weight of bigotry, claimed a greater share in the legitimate enjoyments of life and the appreciation of the beauties of nature, as well as a more enlightened faith of tolerance, benevolence, and liberality. The first poetical work in which Nizámí embodied his thoughts on God and man, and all the experiences he had gained, was necessarily of a didactic character, and very appropriately styled *Makhsan-ulasrár*, or "Storehouse of Mysteries," as it bears the unmistakable stamp of Súfic speculations (compare Háfiz, vol. xi. p. 368). It shows, moreover, a strong resemblance to Násir Khosrau's ethical poems and Saná'í's *Hadíkat-ulhakíkat*, or "Garden of Truth." The date of composition, which varies in the different copies from 552 to 582 A.H., must be fixed in 574 or 575 (1178–79 A.D.), as the author states himself in the prologue that he was forty years old when he wrote it, and the prince to whom he dedicated it—complying so far with the usual custom of his time—was Fakhr-uddín Bahrámsháh, the ruler of the principality of Arzanján, who died after a very long reign 622 A.H. Although the *Makhzan* is mainly devoted to philosophic meditations, the propensity of Nizámí's genius to purely epic poetry, which was soon to assert itself in a more independent form, makes itself felt even here, all the twenty chapters being interspersed with short tales illustrative of the maxims set forth in each. His claim to the title of the foremost Persian romanticist he fully established only a year or two after the *Makhzan* by the publication of his first epic masterpiece *Khosrau and Shírín*, composed, according to the oldest copies, in 576 A.H. (1180 A.D.). As in all his following epopees the subject was taken from what pious Moslems call the time of "heathendom,"—here, for instance, from the old Sassánian story of Sháh Khosrau Parwíz, his love affairs with the princess Shírín of Armenia, his jealousy against the architect Ferhád, for some time his successful rival, of whom he got rid at last by a very ingenious trick, and his final reconciliation and marriage with Shírín; and it is a noteworthy fact that the once so devout Nizámí never chose a strictly Mohammedan legend for his works of fiction. Nothing could prove better the complete revolution in his views, not only on religion, but also on art. He felt, no doubt, that the object of epic poetry was not to teach moral lessons or doctrines of faith, but to depict the good and bad tendencies of the human mind, the struggles and passions of men; and indeed in the whole range of Persian literature only Firdausí and Fakhr-uddín As'ad Jorjání, the author of the older epopee *Wís and Rámín* (about the middle of the 11th century), can compete with Nizámí in the wonderful delineation of character and the brilliant painting of human affections, especially of the joys and sorrows of a loving and beloved heart.

Khosrau and Shírín was inscribed to the reigning atábeg of Azerbaiján, Abú Ja'far Mohammed Pahlawán, and his brother Kizil Arslán, who, soon after his accession to the throne in 582 A.H., showed his gratitude to the poet by summoning him to his court, loading him with honours, and bestowing upon him the revenue of two villages, Hamd and Niján. Nizámí accepted the royal gift, but his resolve to keep aloof from a servile court-life was not shaken by it, and he forthwith returned to his quiet retreat. Meanwhile his genius had not been dormant, and two years after his reception at court, in 584 A.H. (1188 A.D.), he completed his *Díwán*, or collection of kasídas and ghazals (mostly of an ethical and parenetic character), which are said to have numbered 20,000 distichs, although the few copies which have come to us contain only a very small number of verses. About the same time he commenced, at the desire of the ruler of the neighbouring Shírwán, his second romantic poem, the famous Bedouin love-story of *Laila and Majnún*, which has so many points in common with Ariosto's *Orlando Furioso*, and finished it in the short space of four months. A more heroic subject, and the only one in which he made a certain attempt to rival Firdausí, was selected by our poet for his third epopee, the *Iskandarnáma*, or "Book of Alexander," also called *Sharafnáma* or *Iqbálnáma-i-Iskandarí* ("The Fortunes of Alexander"), which is split into two divisions. The first or semi-historical part shows us Alexander the Great as the conqueror of the world, while the second, of a more ethical tendency, describes him in the character of a prophet and philosopher, and narrates his second tour through the world and his adventures in the west, south, east, and north. There are frequent Súfic allegories, just as in the *Makhsan*; and quite imbued with pantheistic ideas is, for instance, the final episode of the first part, the mysterious expedition of Alexander to the fountain of life in the land of darkness.[1] As for the date of composition, it is evident, from the conflicting statements in the different MSS., that there must have been an earlier and a later recension, the former belonging to 587–589 A.H., and dedicated to the prince of Mosul, 'Izz-uddín Mas'úd, the latter made for the atábeg Nusrat-uddín Abú Bakr of Tabríz after 593 A.H., since we find in it a mention of Nizámí's last romance *Haft Paikar*, or the "Seven Beauties," which comprises seven tales related by the seven favourite wives of the Sassánian king Bahrámgúr. In this poem, which was written 593 A.H., at the request of Núr-uddín Arslán of Mosul, the son and successor of the above-mentioned 'Izz-uddín, Nizámí returned once more from his excursion into the field of heroic deeds to his old favourite domain of romantic fiction, and added a fresh leaf to the laurel crown of immortal fame with which the unanimous consent of Eastern and Western critics has adorned his venerable head. The most interesting of the seven tales is the fourth, the story of the Russian princess, in which we recognize at once the prototype of Gozzi's well-known *Turandot*, which was afterwards adapted by Schiller for the German stage. The five mathnawís, from the *Makhsan* to the *Haft Paikar*, form Nizámí's so-called "Quintuple" (*Khamsah*) or "Five Treasures" (*Panj Ganj*), and have been taken as pattern by all the later epic poets in the Persian, Turkish, Chaghatái, and Hindustání languages. Nizámí died at Ganjah in his sixty-fourth year, 599 A.H. (1203 A.D.).

The fullest account of Nizámí is given in Dr W. Bacher's *Nizámí's Leben und Werke* (Leipsic, 1871; English translation by S. Robinson, London, 1873, reprinted in the same author's *Persian Poetry for English Readers*, 1883, pp. 103–244). All the errors of detail in Bacher's work have been corrected by Dr Rieu in his *Catalogue of the Persian MSS. in the British Museum*, vol. ii., 1881, p. 563 *sq.*

Principal Editions.—The whole *Khamsah* (lithographed, Bombay, 1834 and 1838; Teheran, 1845); *Makhsan-ulasrár* (edited by N. Bland, London, 1844; lithographed, Cawnpore, 1869; English translation in MS. by Hatton Hindley, in the British Museum Add. 6961); *Khosrau and Shírín* (lithographed, Lahore, 1871; German translation by Hammer in *Shírín, ein persisches romantisches Gedicht*, Leipsic, 1809); *Laila and Majnún* (lithographed, Lucknow, 1879; English translation by J. Atkinson, London, 1836); *Haft Paikar* (lithographed, Bombay, 1849; Lucknow, 1873; the fourth tale in German by F. von Erdmann, *Behramgur und die russische Fürstentochter*, Kasan, 1844); *Iskandarnáma*, first part, with commentary (Calcutta, 1812 and 1825; text alone, Calcutta, 1853; lithographed with marginal notes, Lucknow, 1865; Bombay, 1861 and 1875; English translation by H. Wilberforce Clarke, London, 1881; compare also Erdmann, *De Expeditione Russorum Berdaam versus*, Kasan, 1826, and Charmoy, *Expédition d'Alexandre contre les Russes*, St Petersburg, 1829); *Iskandarnáma-i-Bahrí*, second part, edited by Dr Sprenger (Calcutta, 1852 and 1869). (H. E.)

NIZAM'S DOMINIONS. See Hyderabad, vol. xii. p. 428.

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[1] Compare Dr Ethé's essay, "Alexander's Zug zum Lebensquell," in *Sitzungsber. d. bayerisch. Akad.*, 1871, pp. 343–405.

NOAH (נֹחַ, Νῶε, *Noe*) is, according to the book of Genesis, the son of Lamech, and the second father of mankind after the deluge. His name, which is of obscure origin, is connected in Gen. v. 29 with a play on the word נחם (*naḥem*), to comfort. The story of the flood, the two elements of which the extant narrative is composed, and the parallel traditions of other nations, particularly of the Babylonians, have been spoken of in the article Deluge. The earlier narrative does not mention the point at which Noah left the ark, and it is doubtful if Gen. xi. 1 *sq.*, which seems to be a fragment of a still older tradition, and which makes mankind disperse from Babylonia, originally stood in any connexion with the story of Noah and the flood. The later priestly (*or*, as it used to be called, Elohistic) narrative names the mountains of Ararat, *i.e.*, one of the mountains of the land of Ararat, as the place where the ark rested. The identification of this mountain with the Ararat of modern maps (M. Masis) is tolerably old; Jerome (on Isa. xxxvii. 38) already places the land of Ararat in this quarter; but a more ancient Jewish tradition, which remained alive throughout the Middle Ages, seeks Ararat in the land of Ḳardu, *i.e.*, the mountains of the Kurds east of the Tigris (comp. Ararat). From the Bible it is only certain (Isa. xxxvii. 38; Jer. li. 27) that the kingdom of Ararat was a remote northern district. After describing the covenant which God made with Noah on leaving the ark (Gen. ix. 1-17) the priestly narrative has nothing further to tell of the patriarch's life; but an older fragment (Gen. ix. 20-27) makes him plant a vineyard and drink of the wine with consequences which lead him to pronounce a blessing on Shem and Japheth and a curse of slavery on Canaan. The story seems to require, for clearness, the omission of the words "Ham, the father of" in verse 22; and if this be so we find that in one tradition the sons of Noah are Shem, Japheth, and Canaan. So taken, the names of the three sons would represent three elements, not in the population of the world, but in that of Palestine. Shem, in Hebrew, means name, and "sons of name," as opposed to "sons of no name" (Job xxx. 8, A. V., "sons of base men"), would naturally denote the Hebrew pure-blooded aristocracy, in antithesis to the subject aborigines (Canaan). Wellhausen, to whom this ingenious theory is due, would further identify Japheth in this passage with the Philistines; Budde thinks rather of the Phœnicians. That the divisions Shem, Ham, and Japheth had not always one fixed sense is clear from Gen. x., where two distinct schemes of classification have been mixed up with such results as that Sheba and Havilah appear under Ham at ver. 7, and under Shem in ver. 28 *sq.* The one division appears to be mainly geographical, and is preserved complete, vers. 2-7, 20-23, 31; it bears the marks of the priestly narrator, and was not written before the exile. On the other hand, vers. 8-19, 25-30 belong to the older narrative, and are fragments of a classification seemingly more ethnographical in character.

NOAILLES. This great French family took its name from the castle of Noailles, in the territory of Ayen, between Brives and Turenne in the Limousin, and dated its nobility from the 11th century. It did not obtain more than local and provincial fame until the 16th century, when its head, Antoine de Noailles (1504-1562), became admiral of France, and was ambassador in England during three important years, 1553-1556, during which he maintained a gallant but unsuccessful rivalry with the Spanish ambassador, Simon Renard. Henri (1554-1623), son of Antoine, was a commander in the religious wars, and was mad. comte d'Ayen by Henry IV. in 1593. The grandson of the first count played an important part in the Fronde and the early years of the reign of Louis XIV., became a captain-general of the newly-won province of Roussillon, and in 1663 was made duc d'Ayen, and peer of France. The sons of the first duke raised the family to its greatest fame, and occupied very important positions in the later years of the reign of Louis XIV. The elder son, Anne Jules (1650-1708), was one of the chief generals of France towards the end of the reign of Louis, and, after raising the regiment of Noailles in 1689, he commanded in chief in Spain during the war of the Spanish succession, and was made marshal of France in 1693. The younger son, Louis Antoine (1651-1729), took orders, and rose to the most important position of the church in France when he was made archbishop of Paris in 1695. He held this high dignity for more than thirty years, until his death in 1729; he was made a cardinal in 1700. These two distinguished brothers had made their family the most famous in France, with the exception of the Rohans, and the name occurs with almost confusing reiteration throughout the 18th century. Adrien Maurice (1678-1766), the third duke, was also a soldier, and learned war under his father in Spain. He served in all the most important wars of the reign of Louis XV. in Italy and Germany, and became the second maréchal de Noailles in 1734. His last command in the war of the Austrian succession was not a successful one, for he was beaten by the English at the battle of Dettingen in 1743. Two sons of the third duke also attained the rank of marshal of France. The elder, Louis (1713-1793), who bore the title of duc d'Ayen till his father's death in 1766, when he became duc de Noailles, served in most of the wars of the 18th century without particular distinction, but was nevertheless made a marshal of France, as the maréchal de Noailles, in 1775. He refused to emigrate during the Revolution, but escaped the fate of most noblemen by dying in August 1793, before the Terror reached its height. On the 4th Thermidor, just before the fall of Robespierre, the aged duchesse de Noailles was executed with her daughter-in-law, the duchesse d'Ayen, and her granddaughter, the vicomtesse de Noailles. Jean Paul François (1739-1824), the fifth duke, was, like his family, in the army, but his heart was bent on scientific pursuits, and for his eminence as a chemist he was elected a member of the Academy of Sciences in 1777. He became duc d'Ayen in 1766 on his grandfather's death, and duc de Noailles on his father's in 1793. Having emigrated in 1792, he lived in Switzerland until the restoration in 1814, when he took his seat as a peer of France. He had no son, but several daughters, one of whom married La Fayette, and another her cousin, the vicomte de Noailles. He was succeeded as duc de Noailles by his grand-nephew, Paul (b. 1802), who has won some reputation as an author, and who became a member of the French Academy in the place of Chateaubriand in 1849. The grandfather of Paul de Noailles, and brother of the fifth duke, Emmanuel Marie Louis (1743-1822), marquis de Noailles, was a distinguished diplomatist of the 18th century: he was ambassador at Amsterdam from 1770-1776, at London 1776-1783, and at Vienna 1783-1792; and, like his brother, he survived the Revolution, and lived to see the Restoration.

One other branch of the family deserves notice. Philippe (1715-1794), comte de Noailles, was a younger brother of the fourth duke, and a more distinguished soldier than his brother. He served at Minden and in other campaigns, and was made a marshal on the same day as his brother, under the title of maréchal de Mouchy. He was long in great favour at court, and his wife was first lady of honour to Marie Antoinette, and was nicknamed by her Madame Étiquette. This court favour brought down punishment in the days of the Revolution, and the old marshal and his wife were guillotined on the 27th June 1794. His two sons, the prince de Poix and the vicomte de Noailles, were both members of the Constituent Assembly. The prince de Poix, who was a captain of the body guards, sat on the right of the assembly, and emigrated in 1792, but, surviving the

Revolution, he returned to Paris in 1814, and was made a lieutenant-general. Louis Marie (1756-1804), vicomte de Noailles, was the second son of the maréchal de Mouchy, and the most distinguished of all his family. He served brilliantly under his brother-in-law La Fayette in America, and was the officer who concluded the capitulation of Yorktown. He was elected to the states-general in 1789, and at once showed his enthusiasm for liberty. He began the famous "orgie," as Mirabeau called it, on 4th August, when all privileges were abolished, and with d'Aiguillon proposed the abolition of titles and liveries in June 1790. When the Revolution became more pronounced he emigrated to America, and became a partner in Bingham's bank at Philadelphia. He was very successful, and might have lived happily had he not accepted a command against the English in San Domingo, under Rochambeau. He made a brilliant defence of the mole St Nicholas, and escaped with the garrison to Cuba; but in making for Havana his ship was attacked by an English frigate, and after a long engagement he was severely wounded, and died of his wounds on 9th January 1804. The whole family of Noailles had not a more brilliant representative than the friend of La Fayette, Louis, vicomte de Noailles.

NOÁKHÁLÍ, or **Noacolly**, a district in the lieutenant-governorship of Bengal, India, lying between 22° 22′ and 23° 17′ N. lat. and 90° 43′ and 91° E. long, bounded on the N. by Tipperah, on the E. by Hill Tipperah state and Chittagong, on the S. by the Bay of Bengal, and on the W. by the main stream of the Meghná, with an area of 1641 square miles, consists of an alluvial tract of mainland, together with several islands at the mouth of the Meghná. In general, each homestead is surrounded by a thick grove of betel and cocoa-nut palms, and in the north-western tracts dense forests of betel-nut palms extend for miles. The district is very fertile; and, with the exception of some sandbanks and recent accretions, every part of it is under continuous cultivation. The process of alluvion is gradually but steadily going on, the mainland extending seawards. Wild animals and small game are numerous.

The population of the district was 820,772 in 1881, of whom 603,592 were Mohammedans. The district contains no town exceeding 5000 inhabitants. Sudharam, the civil station, is little more than a large village, with a population (in 1872) of 4752. Rice forms the great staple of cultivation; and rice, betel-nuts, and cocoa-nuts are exported. Noákhálí is peculiarly liable to destructive floods from the sea, generally caused by southerly gales or cyclones occurring at the time when the Meghná is swollen by heavy rains, and at flood-tides,—the tidal bore being sometimes 20 feet high, and moving at the rate of 15 miles an hour. The cyclone and storm-wave of 31st October 1876 was terribly disastrous, sweeping over the whole delta of the Meghná. The loss of human life was estimated at 100,000.

The Mohammedan population of the islands at the mouth of the Meghná practised piracy up to a comparatively recent date, and at the beginning of the 17th century Portuguese pirates, under Sebastian Gonzales, occupied Sandwip. They were ultimately reduced to subjection by Sháistá Khán, the governor of Bengal, about the middle of the century; and their descendants have gradually sunk to the level of the natives surrounding them, whose dress, customs, and language they have, for the most part, adopted. They are Christians, and retain the old Portuguese names. About 1756 the East India Company established factories in Noákhálí and Tipperah, the ruins of some of which still remain.

NOBILI, Leopoldo (1784-1834), was in youth an officer of artillery, but afterwards became professor of physics in the archducal museum at Florence, the old habitat of the *Accademia del Cimento*. His most valuable contributions to science consist in the suggestion of the astatic combination of two needles, by which the sensibility of a galvanometer is so greatly increased, and in the invention of the so-called thermo-multiplier or thermo-electric pile. His own experimental work with these instruments was soon eclipsed by the brilliant applications made of them by Melloni and Forbes. He also discovered the exquisitely coloured transparent films of metal deposited by electro-chemical processes, which from their common form are usually known as Nobili's rings. Guebhard has lately improved the process for producing them. Nobili has left a large number of theoretical writings, chiefly on magnetism, light, and electricity, most of which are to be found in the *Bibliothèque Universelle* of Geneva. It is worthy of note that for the measurement of currents he seems to have preferred the use of his "rings" to the use of the galvanometer.

NOBILITY. To form a true understanding of what is strictly implied in the word "nobility" it is needful to distinguish its meaning from that of several words with which it is likely to be confounded. In England nobility is apt to be confounded with the peculiar institution of the British peerage. Yet nobility, in some shape or another, has existed in most places and times of the world's history, while the British peerage is an institution purely local, and one which has actually hindered the existence of a nobility in the sense which the word bears in most other countries. Nor is nobility the same thing as aristocracy. This last is a word which is often greatly abused; but, whenever it is used with any regard to its true meaning, it is a word strictly political, implying a particular form of government. But nobility is not necessarily a political term; the distinction which it implies may be accompanied by political privileges or it may not. Again, it is sometimes thought that both nobility and aristocracy are in some special way connected with kingly government. To not a few it would seem a contradiction to speak of nobility or aristocracy in a republic. Yet, though many republics have eschewed nobility, there is nothing in a republican, or even in a democratic, form of government inconsistent with the existence of nobility; and it is only in a republic that aristocracy, in the strict sense of the word, can exist. Aristocracy implies the existence of nobility; but nobility does not imply aristocracy; it may exist under any form of government. The peerage, as it exists in the three British kingdoms, is something which is altogether peculiar to the three British kingdoms, and which has nothing in the least degree like it elsewhere.

Nobility, then, in the strict sense of the word, is the hereditary handing on from generation to generation of some acknowledged pre-eminence, a pre-eminence founded on hereditary succession, and on nothing else. Such nobility may be immemorial or it may not. There may or there may not be a power vested somewhere of conferring nobility; but it is essential to the true idea of nobility that, when once acquired, it shall go on for ever to all the descendants—or, more commonly, only to all the descendants in the male line—of the person first ennobled or first recorded as noble. The pre-eminence so handed on may be of any kind, from substantial political power to mere social respect and precedence. It does not seem necessary that it should be formally enacted by law if it is universally acknowledged by usage. It may be marked by titles or it may not. It is hardly needful to prove that nobility does not imply wealth, though nobility without wealth runs some risk of being forgotten. This definition seems to take in all the kinds of nobility which have existed in different times and places. They have differed widely in the origin of the noble class and in the amount of privilege implied in membership of it; but they all agree in the transmission of some privilege or other to all the descendants, or to all the male descendants, of the first noble.

In strictness nobility and gentry are the same thing. This fact is overshadowed in England, partly by the habitual use of the word "gentleman" in various secondary uses, partly by the prevalent confusion between nobility and peerage. But that they are the same is proved by the use of the French word *gentilhomme*, a word which has pretty well passed out of modern use, but which, as long as it remained in use, never lost its true meaning. There were very wide distinctions within the French *noblesse*, but they all formed one privileged class as distinguished from the *roturier*. Here, then, is a nobility in the strictest sense. If there is no such class in England, it is simply because the class which answers to it has never been able to keep any universally acknowledged privileges. The word "gentleman" has lost its original meaning in a variety of other uses, while the word "nobleman" has come to be confined to members of the peerage and a few of their immediate descendants.

That the English peerage does not answer to the true idea of a nobility will be seen with a very little thought. There is no handing on of privilege or pre-eminence to perpetual generations. The peer holds a great position, endowed with substantial powers and privileges, and those powers and privileges are handed on by hereditary succession. But they are handed on only to one member of the family at a time. The peer's children, in some cases his grandchildren, have titles and precedence, but they have no substantial privileges. His remoter descendants have no advantage of any kind over other people, except their chance of succeeding to the peerage. The remote descendant of a duke, even though he may chance to be heir presumptive to the dukedom, is in no way distinguished from any other gentleman; it is even possible that he may not hold the social rank of gentleman. This is not nobility in the true sense; it is not nobility as nobility was understood either in the French kingdom or in the Venetian commonwealth.

Nobility thus implies the vesting of some hereditary privilege or advantage in certain families, without deciding in what such privilege or advantage consists. Its nature may differ widely according to the causes which have led to the establishment of the distinction between family and family in each particular case. The way in which nobility has arisen in different times and places is very various, and there are several nations whose history will supply us with examples of a nobility of one kind giving way to a nobility of another kind. The history of the Roman commonwealth illustrates this perhaps better than any other. What we may call the nobility of earlier occupation makes way for the nobility of office. Our first glimpses of authentic Roman history set before us two orders in the same state, one of which is distinguished from the other by many exclusive privileges. The privileged order—the *populus*, *patres*, patricians—has all the characteristics which we commonly expect to find in a privileged order. It is a minority, a minority strictly marked out by birth from other members of the commonwealth, a minority which seems further, though this point is less clearly marked, to have had on the whole the advantage in point of wealth. When we are first entitled to speak with any kind of certainty, the non-privileged class possess a certain share in the election of magistrates and the making of laws. But the privileged class alone are eligible to the greatest offices of the state; they have in their hands the exclusive control of the national religion; they have the exclusive enjoyment of the common land of the state,—in Teutonic phrase, the *folkland*. A little research shows that the origin of these privileges was a very simple one. Those who appear in later times as a privileged order among the people had once been the whole people. The patricians, *patres*, housefathers, goodmen—so lowly is the origin of that proud name—were once the whole Roman people, the original inhabitants of the Roman hills. They were the true *populus Romanus*, alongside of whom grew up a secondary Roman people, the *plebs* or commons. As new settlers came, as the people of conquered towns were moved to Rome, as the character of Romans was granted to some allies and forced upon some enemies, this *plebs*, sharing some but not all of the rights of citizens, became a non-privileged order alongside of a privileged order. As the non-privileged order increased in numbers, while the privileged order, as every exclusive hereditary body must do, lessened, the larger body gradually put on the character of the nation at large, while the smaller body put on the character of a nobility. But their position as a nobility or privileged class arose solely because a class with inferior rights to their own grew up around them. They were not a nobility or a privileged class as long as there was no less privileged class to distinguish them from. Their exclusive possession of power made the commonwealth in which they bore rule an aristocracy; but they were a democracy among themselves. We see indeed faint traces of distinction among the patricians themselves, which may lead us to guess that the equality of all patricians may have been won by struggles of unrecorded days, not unlike those which in recorded days brought about the equality of patrician and plebeian. But at this we can only guess. The Roman patricians, the true Roman *populus*, appear at our first sight of them as a body democratic in its own constitution, but standing out as an order marked by very substantial privileges indeed from the other body, the *plebs*, also democratic in its own constitution, but in every point of honour and power the marked inferior of the *populus*.

The old people of Rome thus grew, or rather shrank up, into a nobility by the growth of a new people by their side which they declined to admit to a share in their rights, powers, and possessions. A series of struggles raised this new people, the *plebs*, to a level with the old people, the *populus*. The gradual character of the process is not the least instructive part of it. There are two marked stages in the struggle. In the first the plebeians strive to obtain relief from laws and customs which were actually oppressive to them, while they were profitable to the patricians. When this relief has been gained by a series of enactments, a second struggle follows, in which the plebeians win political equality with the patricians. In this second struggle, too, the ground is won bit by bit. No general law was ever passed to abolish the privileges of the patricians; still less was any law ever passed to abolish the distinction between patrician and plebeian. All that was done was done step by step. First, marriage between the two orders was legalized. Then one law admitted plebeians to one office, another law to another. Admission to military command was won first, then admission to civil jurisdiction; a share in religious functions was won last of all. And some offices, chiefly those religious offices which carried no political power with them, always remained the exclusive property of the patricians, because no special law was ever passed to throw them open to plebeians. In this gradual way every practical advantage on the part of the patricians was taken away. But the result did not lead to the abolition of all distinctions between the orders. Patricians and plebeians went on as orders defined by law, till the distinction died out in the confusion of things under the empire, till at last the word "patrician" took quite a new meaning. The distinction, in truth, went on till the advantage turned to the side of the plebeians. Both consuls might be plebeians, both could not be patricians; a patrician could not wield the great powers vested in the tribunes of the commons. These were greater advantages than the exclusive patrician possession of the offices of *interrex*, *rex sacrorum*, and the higher flamens. And, as the old distinction survived in law and religion after all substantial privileges were abolished, so presently a new distinction arose of which law and religion knew nothing, but which became in practice nearly as marked and quite as important as the older one.

This was the growth of the new nobility of Rome, that body, partly patrician, partly plebeian, to which the name *nobilitas* strictly belongs in Roman history. This new nobility gradually became as well marked and as exclusive as the old patriciate. But it differed from the old patriciate in this, that, while the privileges of the old patriciate rested on law, or perhaps rather on immemorial custom, the privileges of the new nobility rested wholly on a sentiment of which men could remember the beginning. Or it would be more accurate to say that the new nobility had really no privileges at all. Its members had no legal advantages over other citizens. They were a social caste, which strove to keep, and which largely succeeded in keeping, all high offices and political power in its own hands. Such privileges, even of an honorary kind, as the nobles did enjoy by law belonged to them, not as nobles, but as senators and senators' sons. Yet practically the new nobility was a privileged class; it felt itself to be so, and it was felt to be so by others. This nobility consisted of all those who, as descendants of curule magistrates, had the *jus imaginum*,—that is, who could point to forefathers ennobled by office. That is to say, it consisted of the remains of the old patriciate, together with those plebeian families any members of which had been chosen to curule offices. These were naturally those families which had been patrician in some other Italian city, but which were plebeian at Rome. Many of them equalled the patricians in wealth and antiquity of descent, and as soon as intermarriage was allowed they became in all things their social equals. The practical result of the Licinian reform was that the great plebeian families became, for all practical purposes, patrician. They separated themselves from the mass of the plebeians to form a single body with the surviving patricians. Just as the old patricians had striven to keep plebeians out of high offices, so now the new nobles, patrician and plebeian alike, strove to keep "new men," men who had not the *jus imaginum*, out of high office. But there was still the difference that in the old state of things the plebeian was shut out by law, while in the new state of things no law shut out the new man. It needed a change in the constitution to give the consulship to Lucius Sextius; it needed only union and energy in the electors to give it to Caius Marius.

The Roman case is often misunderstood, because the later Roman writers did not fully understand the case themselves. Livy could never get rid of the idea that the old struggle between patrician and plebeian was something like the struggle between the nobility and the people at large in the later days of the commonwealth. In a certain sense he knew better; at any rate, he often repeats the words of those who knew better; but the general impression given by his story is that the plebeians were a low mob and their leaders factious and interested ringleaders of a mob. The case is again often misunderstood because the words "patrician" and "plebeian," like so many other technical Roman and Greek words, have come in modern language to be used in a way quite unlike their original sense. The word "plebeian," in its strict sense, is no more contemptuous than the word *commoner* in England. The *plebs*, like the English commons, contained families differing widely in rank and social position, among them those families which, as soon as an artificial barrier broke down, joined with the patricians to form the new nobility. The whole lesson is lost if the words "patrician" and "plebeian" are used in any but their strict sense. The Catuli and Metelli, among the proudest nobles of Rome, were plebeians, and as such could not have been chosen to the purely patrician office of *interrex*, or *flamen* of Jupiter. Yet even in good writers on Roman history the words "patrician" and "plebeian" are often misapplied by being transferred to the later disputes at Rome, in which they are quite out of place.

We may now compare the history of nobility at Rome with its history in some other of the most famous city-commonwealths. Thus at Athens its history is in its main outlines very much the same as its history at Rome up to a certain point, while there is nothing at Athens which at all answers to the later course of things at Rome. At Athens, as at Rome, an old patriciate, a nobility of older settlement, a nobility which had once been the whole people, was gradually shorn of all exclusive privilege, and driven to share equal rights with a new people which had grown up around it. The reform of Clisthenes answers in a general way to the reform of Licinius, though the different circumstances of the two cities hinder us from carrying out the parallel into detail. But both at Rome and at Athens we see, at a stage earlier than the final reform, an attempt to set up a standard of wealth, either instead of or alongside of the older standard of birth. This same general idea comes out both in the constitution of Servius and in the constitution of Solon, though the application of the principle is different in the two cases. Servius made voting power depend on income; by Solon the same rule was applied to qualification for office. By this change power is not granted to every citizen, but it is put within the reach of every citizen. No man can change his forefathers, but the poor man may haply become richer. The Athenian εὐπατρίδαι, who were thus gradually brought down from their privileged position, seem to have been quite as proud and exclusive as the Roman patricians; but when they lost their privileges they lost them far more thoroughly, and they did not, as at Rome, practically hand on many of them to a new nobility, of which they formed part, though not the whole. While at Rome the distinction of patrician and plebeian was never wiped out, while it remained to the last a legal distinction even when practical privilege had turned the other way, at Athens, after the democracy had reached its full growth, the distinction seems to have had no legal existence whatever. At Rome down to the last it made a difference whether the candidate for office was patrician or plebeian, though the difference was in later times commonly to the advantage of the plebeian. At Athens, at any rate after Aristides, the eupatrid was neither better nor worse off than another man.

But, what is of far greater importance, there never arose at Athens any body of men which at all answered to the *nobilitas* of Rome. We see at Athens strong signs of social distinctions, even at a late period of the democracy; we see that, though the people might be led by the low-born demagogue—using that word in its strict and not necessarily dishonourable meaning—their votes most commonly fell on men of ancient descent. We see that men of birth and wealth often allowed themselves a strange licence in dealing with their low-born fellow-citizens. But we see no sign of the growth of a body made up of patricians and leading plebeians who contrived to keep office to themselves by a social tradition only less strong than positive law. We have at Athens the exact parallel to the state of things when Appius Claudius shrank from the thought of the consulship of Caius Licinius; we have no exact parallel to the state of things when Quintus Metellus shrank from the thought of the consulship of Caius Marius. The cause of the difference seems to be that, while the origin of the patriciate was exactly the same at Rome and at Athens, the origin of the commons was different. The four Ionic tribes at Athens seem to have answered very closely to the three patrician tribes at Rome; but the Athenian *demos* grew up in a different way from the Roman *plebs*. If we could believe that the Athenian *demos* arose out of the union of the other Attic towns with Athens, this would be an exact analogy to the origin of the Roman *plebs*; the εὐπατρίδαι would be the Athenians and the *demos* the

Atticans (Ἀττικοί). But from such glimpses of early Attic history as we can get the union of the Attic towns would seem to have been completed before the constitutional struggle began. That union would answer rather to the union of the three patrician tribes of Rome. Such hints as we have, while they set before us, just as at Rome, a state of things in which small landed proprietors are burthened with debt, also set before us the Attic *demos* as, largely at least, a body of various origins which had grown up in the city. Clisthenes, for instance, enfranchised many slaves and strangers, a course which certainly formed no part of the platform of Licinius, and which reminds us rather of Cnæus Flavius somewhat later. On the whole it seems most likely that, while the kernel of the Roman *plebs* was rural or belonged to the small towns admitted to the Roman franchise, the Attic *demos*, largely at least, though doubtless not wholly, arose out of the mixed settlers who had come together in the city, answering to the *μέτοικοι* of later times. If so, there would be no place in Athens for those great plebeian houses, once patrician in some other commonwealth, out of which the later Roman *nobilitas* was so largely formed.

Thus the history of nobility at Athens supplies a close analogy to the earlier stages of its history at Rome, but it has nothing answering to its later stages. At Sparta we have a third instance of a people shrinking up into a nobility, but it is a people whose position differs altogether from anything either at Rome or at Athens. Sparta is the best case of a nobility of conquest. This is true, whether we look on the *περίοικοι* as Achaians or as Dorians, or as belonging some to one race and some to the other. In any case the Spartans form a ruling body, and a body whose privileged position in the land is owing to conquest. The Spartans answer to the patricians, the *περίοικοι* to the *plebs*; the helots are below the position of *plebs* or *demos*. The only difference is that, probably owing to the fact that the distinction was due to conquest, the local character of the distinction lived on much longer than it did at Rome. We hardly look on the Spartans as a nobility among the other Lacedæmonians; Sparta rather is a ruling city bearing sway over the other Lacedæmonian towns. But this is exactly what the original Roman patricians, the settlers on the three oldest hills, were in the beginning. The so-called cities (*πόλεις*) of the *περίοικοι* answered pretty well to the local plebeian tribes; the difference is that the *περίοικοι* never became a united corporate body like the Roman *plebs*. Sparta to the last remained what Rome was at the beginning, a city with a *populus* (δῆμος) but no *plebs*. And, as at Rome in early times, there were at Sparta distinctions within the *populus*; there were *ὅμοιοι* and *ὑπομείονες*, like the *majores* and *minores gentes* at Rome. Only at Rome, where there was a *plebs* to be striven against, these distinctions seem to have had a tendency to die out, while at Sparta they seem to have had a tendency to widen. The Spartan patriciate could afford to disfranchise some of its own members.

The other old Greek cities, as well as those of mediæval Italy and Germany, would supply us with endless examples of the various ways in which privileged orders arose. Venice, a city not exactly belonging to any of these classes, essentially a city of the Eastern empire and not of the Western, gives us an example than which none is more instructive. The renowned patriciate of Venice was as far removed as might be from the character either of a nobility of conquest or of a nobility of older settlement. Nor was it strictly a nobility of office, though it had more in common with that than with either of the other two. As Athens supplies us with a parallel to the older nobility of Rome without any parallel to the later, so Venice supplies us with a parallel to the later nobility of Rome without any parallel to the earlier. Athens has Fabii and Claudii, but no Catuli or Metelli; Venice has Catuli and Metelli, but no Fabii or Claudii.

In one point, however, the Venetian nobility differed from either the older or the newer nobility of Rome, and also from the older nobilities of the mediæval Italian cities. Nowhere else did nobility so distinctly rise out of wealth, and that wealth gained by commerce. In the original island territory of Venice there could be no such thing as landed property. The agricultural plebeian of old Rome and the feudal noble of contemporary Europe were both of them at Venice impossible characters. The Venetian nobility is an example of a nobility which gradually arose out of the mass of the people as certain families step by step drew all political power into their own hands. The *plebs* did not gather round the *patres*, neither were they conquered by the *patres*; the *patres* were developed by natural selection out of the *plebs*, or, more strictly, out of the ancient *populus*. The *commune* of Venice, the ancient style of the commonwealth, changed into the *seigniory* of Venice. Political power was gradually confined to those whose forefathers had held political power. This was what the later nobility of Rome was always striving at, and what they did to a great extent practically establish. But, as the exclusive privileges of the nobility were never recognized by any legal or formal act, men like Caius Marius would ever and anon thrust themselves in. The privileges which the Venetian nobility took to themselves were established by acts which, if not legal, were at least formal. The Roman nobility, resting wholly on sufferance, was overthrown by the ambition of one of its own members. The Venetian nobility, resting also in its beginnings on sufferance, but on sufferance which silently obtained the force of law, lasted as long as Venice remained a separate state.

The hereditary oligarchy of Venice was established by a series of changes which took place between the years 1297 and 1319. All of them together really go to make up the "Shutting of the Great Council," a name which is formally given to the act of the first of those years. In 1172 the Great Council began as an elective body; it gradually ousted the popular assembly from all practical power. It was, as might be looked for, commonly filled by members of distinguished families, descendants of ancient magistrates, who were already beginning to be looked on as noble. The series of revolutions already spoken of first made descent from former councillors a necessary qualification for election to the council; then election was abolished, and the council consisted of all descendants of its existing members who had reached the age of twenty-five. Thus the *optimates* of Venice did what the *optimates* of Rome strove to do: they established a nobility whose one qualification was descent from those who had held office in past times. This is what the nobility of office, if left unchecked, naturally grows into. But the particular way in which oligarchy was finally established at Venice had some singular results. Some of the great families which were already looked on as noble were not represented in the council at the time of the shutting; of others some branches were represented and others not. These families and branches of families, however noble they might be in descent, were thus shut out from all the political privileges of nobility. When one branch of a family was admitted and one shut out we have an analogy to the patrician and plebeian Claudii, though the distinction had come about in quite another way. And in the Great Council itself we have the lively image of the aristocratic popular assembly of Rome, the assembly of the *populus*, that of the *curiæ*, where every man of patrician birth had his place. The two institutions are the same, only the way in which they came about is exactly opposite. The assembly of *curiæ* at Rome, originally the democratic assembly of the original people, first grew into an aristocratic assembly, and then died out altogether as a new Roman people, with its own assembly, grew up by its side. It was a primitive institution which gradually changed its character by force of circumstances. It died out, supplanted by other and newer powers, when it became altogether unsuited to the times. The Great Council of Venice was anything but a primitive institution; it was the artificial institution of a late age, which grew at the expense of earlier institutions, of the prince on the one side and of the people on the other. But the two different roads led to the same result. The Great Council of Venice, the *curiæ* of Rome, were each of them the assembly of a privileged class, an assembly in which every member of that class had a right to a place, an assembly which might be called popular as far as the privileged class was concerned, though rigidly oligarchic as regarded the excluded classes. But, close as the likeness is, it is merely a superficial likeness, because it is the result of opposite causes working in opposite directions. It is like two men who are both for a moment in the same place, though their faces are turned in opposite ways. If the later *nobilitas* of Rome had established an assembly in which every one who had the *jus imaginum* had a vote and none other, that would have been a real parallel to the shutting of the Venetian Great Council; for it would have come about through the working of causes which are essentially the same.

The nobility which was thus formed at Venice is the very model of a civic nobility, a nobility which is also an aristocracy. In a monarchy, despotic or constitutional, there cannot in strictness be an aristocracy, because the whole political power cannot be vested in the noble class. But in the Venetian commonwealth the nobility was a real aristocracy. All political power was vested in the noble class; the prince sank to a magistrate, keeping only some of the outward forms of sovereignty; the mass of the people were shut out altogether. And, if no government on earth ever fully carried out the literal meaning of aristocracy as the rule of the best, these civic nobilities come nearer to it than any other form of government. They do really seem to engender a kind of hereditary capacity in their members. Less favourable than either monarchy or democracy to the growth of occasional great men, they are more favourable than either to the constant supply of a succession of able men, qualified to carry on the work of government. Their weak point lies in their necessary conservatism; they cannot advance and adapt themselves to changed circumstances, as either monarchy or democracy can. When, therefore, their goodness is gone, their corruption becomes worse than the corruption of either of the other forms of government.

All this is signally shown in the history both of Venice and of other aristocratic cities. But we are concerned with them now only as instances of one form of nobility. The civic aristocracies did not all arise in the same way. Venice is the best type of one way in which they rose; but it is by no means the only way. In not a few of the Italian cities nobility had an origin and ran a course quite unlike the origin and the course which were its lot at Venice. The nobles of many cities were simply the nobles of the surrounding country changed, sometimes greatly against their will, into citizens. Such a nobility differed far more widely from either the Roman or the Venetian patriciate than they differed from one another. It wanted the element of legality, or at least of formality, which distinguished both these bodies. The privileges of the Roman patriciate, whatever we may call them, were not usurpations; and, if we call the privileges of the Venetian nobility usurpations, they were stealthy and peaceful usurpations, founded on something other than mere violence. But in many Italian cities the position of the nobles, if it did not begin in violence, was maintained by violence, and was often overthrown by violence. They remained, in short, as unruly and isolated within the walls of the cities as they had ever been without. A nobility of this kind often gave way to a democracy which either proved as turbulent as itself, or else grew into an oligarchy ruling under democratic forms. Thus at Florence the old nobles became the opposite to a privileged class. The process which at Rome gradually gave the plebeian a political advantage over the patrician was carried at Florence to a far greater length at a single blow. The whole noble order was disfranchised; to be noble was equivalent to being shut out from public office. But something like a new nobility presently grew up among the commons themselves; there were *popolani grossi* at Florence just as there were noble plebeians at Rome. Only the Roman commons, great and small, never shut out the patricians from office; they were satisfied to share office with them. In short, the shutting out of the old nobility was, if not the formation of a new nobility, at least the formation of a new privileged class. For a certain class of citizens to be condemned, by virtue of their birth, to political disfranchisement is as flatly against every principle of democracy as for a certain class of citizens to enjoy exclusive rights by reason of birth. The Florentine democracy was, in truth, rather to be called an oligarchy, if we accept the best definition of democracy (see Thucydides, vi. 39), namely, that it is the rule of the whole, while oligarchy is the rule of a part only.

It is in these aristocratic cities, of which Venice was the most fully developed model, that we can best see what nobility really is. It is in these only that we can see nobility in its purest form—nobility to which no man can rise and from which no man can come down except by the will of the noble class itself. In a monarchy, where the king can ennoble, this ideal cannot be kept. Nor could it be kept in the later nobility of Rome. The new man had much to strive against, but he could sometimes thrust himself through, and when he did his descendants had their *jus imaginum*. But at Venice neither prince nor people could open the door of the Great Council; only the Great Council itself could do that. That in the better times of the aristocracy nobility was not uncommonly granted to worthy persons, that in its worse times it was more commonly sold to unworthy persons, was the affair of the aristocratic body itself. That body, at all events, could not be degraded save by its own act. But these grants and sales led to distinctions within the ranks of the noble order, like those of which we get faint glimpses among the Roman patricians. The ducal dignity rarely passed out of a circle of specially old and distinguished families. But this has often been the case with the high magistracies of commonwealths whose constitutions were purely democratic.

From this purest type of nobility, as seen in the aristocratic commonwealths, we may pass to nobility as seen in states of greater extent—that is, for the most part in monarchies. There are two marked differences between the two. They are differences which seem to be inherent in the difference between a republic and a monarchy, but which it would be truer to say are inherent in the difference between a body of men packed close together within the walls of a city and a body of men—if we can call them a body—scattered over a wide territory. The member of a civic nobility is more than a member of an order; he is a member of a corporation; he has no powers, he has hardly any being, apart from the body of which he is a member. He has a vote in making the laws or in choosing those who make them; but when they are made he is, if anything, more strictly bound by them than the citizen of the non-privileged order. To be a fraction of the corporate sovereign, if it had its gains, had also its disadvantages; the Venetian noble was fettered by burthens, restrictions, and suspicions from which the Venetian citizen was free. The noble of the large country, on the other hand, the rural noble, as he commonly will be, is a member of an order, but he is hardly a member of a corporation; he is isolated; he acts apart from the rest of the body and wins powers for himself apart from the rest of the body. He shows a tendency—a tendency whose growth will be more or less checked according to the strength of the central power—to grow into something of a lord or even a prince on his own account, a growth which may advance to the scale of a German elector or stop at that of an English lord of a manor. Now many of these tendencies were carried into those Italian cities where the civic nobility was a half-tamed country nobility; but they have no place in the true civic aristocracies. Let us take one typical example. In many parts of western Europe the right of private war long remained the privilege of every noble, as it had once been the privilege of every freeman. And in some Italian cities, the right, or at least the privilege, of private war was continued within the city walls. But no power of imagination can conceive an acknowledged right of private war in Rome, Venice, or Bern.

The other point of difference is that, whatever we take for the origin and the definition of nobility, in most countries it became something that could be given from outside, without the need of any consent on the part of the noble class itself. In other words, the king or other prince can ennoble. We have seen how much this takes away from the true notion of nobility as understood in the aristocratic commonwealths. The nobility is no longer all-powerful; it may be constrained to admit within its own body members for whose presence it has no wish. Where this power exists the nobility is no longer in any strictness an aristocracy; it may have great privileges, great influence, even great legal powers, but it is not the real ruling body, like the true aristocracy of Venice.

In the modern states of western Europe the existing nobility seems to have for the most part had its origin in personal service to the prince. And this nobility by personal service seems commonly to have supplanted an older nobility, the origin of which was, in some cases at least, strictly immemorial. Of this process in England, the substitution of the later nobility of the thegns for the older nobility of the eorls, something has already been said in the article ENGLAND (vol. viii. pp. 274-5). Now the analogy between this change and the change from the Roman patriciate to the later Roman *nobilitas* is obvious. In both cases the older nobility gives way to a newer; and in both cases the newer nobility was a nobility of office. Under a kingly government office bestowed by the sovereign holds the same place which office bestowed by the people holds in a popular government. This new nobility of office supplanted, or perhaps rather absorbed, the older nobility, just as the later *nobilitas* of Rome supplanted or absorbed the old patriciate. In our first glimpse of Teutonic institutions, as given us by Tacitus, this older nobility appears as strictly immemorial (see Waitz, *Deutsche Verfassungsgeschichte*, i. 185 *sq.*), and its immemorial character appears also in the well-known legend in the *Rigsmal-saga* of the separate creation of jarl, karl, and thrall. These represent the three classes of mankind according to old Teutonic ideas—the noble, the simple freeman, and the bondman. The kingly house, where there is one, is not a distinct class; it is simply the noblest of the noble. For, as almost everywhere else, this Teutonic nobility admits of degrees, though it is yet harder to say in what the degrees of nobility consisted than to say in what nobility consisted itself. The older nobility is independent of the possession of land; it is independent of office about the sovereign; it is hard to say what were the powers and privileges attached to it; but of its existence there is no doubt. But in no part of Europe can the existing nobility trace itself to this immemorial nobility of primitive days; the nobility of mediæval and modern days springs from the later nobility of office. The nobles of modern Europe are rather *thegnas* than *eorlas*. The eorl of the old system would doubtless commonly become a thegn under the new, as the Roman patrician took his place in the new *nobilitas*; but others could take their place there also. The Old-English laws point out ways by which the churl might rise to thegn's rank, and in the centuries during which the change went on we find mention—complaining mention—both in England and elsewhere, at the court of Charles the Simple and at the court of Æthelred, of the rise of new men to posts of authority. The story that Earl Godwine himself was of churlish birth, whether true or false, marks the possibility of such a rise. A still wilder tale spoke of Hugh Capet as the son of a butcher of Paris. Stories like these prove even more than the real rise of Hagano and Eadric.

In England the nobility of the thegns was to a great extent personally displaced, so to speak, by the results of the Norman Conquest. But the idea of nobility did not greatly change. The English thegn sometimes yielded to, sometimes changed into, the Norman baron, using that word in its widest sense, without any violent alteration in his position. The notion of holding land of the king became more prominent than the notion of personal service done to the king; but, as the land was held by the tenure of personal service, the actual relation hardly changed. But the connexion between nobility and the holding of land comes out in the practice by which the lord so constantly took the name of his lordship. It is in this way that the prefixes *de* and *von*, descriptions in themselves essentially local, have become in other lands badges of nobility. This notion has died out in England by the dropping of the preposition; but it long lived on wherever Latin or French was used. And before long nobility won for itself a distinguishing outward badge. The device of hereditary coat-armour, a growth of the 12th century, did much to define and mark out the noble class throughout Europe. As it could be acquired by grant of the sovereign, and as, when once acquired, it went on from generation to generation, it answers exactly to the *jus imaginum* at Rome, the hereditary badge of nobility conferred by the election of the people. Those who possessed the right of coat-armour by immemorial use, or by grant in regular form, formed the class of nobility or gentry,—words which, it must again be remembered, are strictly of the same meaning. They held whatever privileges or advantages have attached in different times and places to the rank of nobility or gentry. In England indeed a variety of causes hindered nobility or gentry from ever obtaining the importance which they obtained, for instance, in France. But perhaps no cause was more important than the growth of the peerage (see PEERAGE). That institution at once set up a new standard of nobility, a new form of the nobility of office. The peer—in strictness, the peer in his own person only, not even his children—became the only noble; the ideas of nobility and gentry thus became divorced in a way in which they are not in any other country. Those who would elsewhere have been counted as the nobility, the bearers of coat-armour by good right, were hindered from forming a class holding any substantial privilege. In a word, the growth of the peerage hindered the existence in England of any nobility in the Continental sense of the word. The esquires, knights, lesser barons, even the remote descendants of peers, that is, the *noblesse* of other countries, in England remained gentlemen, but not noblemen,—simple commoners, that is, without legal advantage over their fellow-commoners who had no *jus imaginum* to boast of. There can be no doubt that the class in England which answers to the *noblesse* of other lands is the class that bears coat-armour, the gentry strictly so called. Had they been able to establish and to maintain any kind of privilege, even that of mere honorary precedence, they would exactly answer to Continental nobility. That coat-armour has been lavishly granted and often assumed without right, that the word "gentleman" has acquired various secondary senses, proves nothing; that is the natural result of a state of things in which the *status* of gentry carries with it no legal advantage, and yet is eagerly sought after on social grounds. If coat-armour, and thereby the rank of gentry, has been lavishly granted, some may think that the rank of peerage has often been lavishly granted also. In short, there is no real nobility in England; for the class which answers to foreign nobility has so long ceased to have any practical privileges that it has long ceased to be looked on as a nobility, and the word nobility has been transferred to another class which has nothing answering to it out of the three British kingdoms. This last class in strictness takes in only the peers personally; at the outside it cannot be stretched beyond those of their children and grandchildren who bear the courtesy titles of lord and lady.

No attempt has been here made to trace out the history of nobility in the various countries and, we must add, cities of Europe. All that has been attempted has been to point out some general truths, and to refer to some specially striking instances. Once more, it must be borne in mind that, while it is essential to the idea of nobility that it should carry with it some hereditary privilege, the nature and extent of that privilege may vary endlessly. In the last century the nobility of France and the nobility of Poland alike answered to the very strictest definition of nobility; but the political positions of the two were as broadly contrasted as the positions of any two classes of men could be. The nobility of France, keeping the most oppressive social and personal privileges, had been shorn of all political and even administrative power; the tyrants of the people were the slaves of the king. In Poland sixty thousand gentlemen, rich and poor, famous and obscure, but all alike gentlemen, rode out to choose a king by a unanimous vote, and to bind him when chosen by such conditions as they thought good. Those sixty thousand, like the *populus* of Rome, formed a narrow oligarchy as regarded the rest of the nation, but a wild democracy among themselves. Poland, in short, came nearer than any kingdom or country of large extent to the nature of an aristocracy, as we have seen aristocracy in the aristocratic cities. The chief power of the state was placed neither in the prince nor in the nation at large; it was held by a noble class. The kingly power in Poland, like the ducal power at Venice, had been so narrowed that Poland, though she still kept a king, called herself a republic no less than Venice. And whatever was taken from the king went to the gain of the noble order. But the nobility of a large country, even though used to act politically as an order, could never put on that orderly and legal character which distinguishes the true civic patriciates. It never could come so nearly as a civic patriciate could to being something like the rule of the best in any sense of those words.

The tendency of modern times has been towards the breaking down of formal hereditary privileges. In modern commonwealths, above all, they have been thought to be essentially inconsistent with republican institutions. The truth of the matter is rather that the circumstances of most modern commonwealths have been unfavourable to the preservation, and still more to the growth, of privileged bodies. Where they existed, as in Switzerland, they have been overthrown. Where they did not exist, as in America, everything has made it more and more impossible that they should arise. And, as modern changes have commonly attacked the power both of kings and of nobles, the common notion has come that kingship and nobility have some necessary connexion. It has seemed as if any form of nobility was inconsistent with a republican form of government, while nobility, in some shape or other, has come to be looked on as a natural, if not a necessary, appendage to a monarchy. And as far as regards the social side of kingship this is true. A court seems more natural where a chain of degrees leads gradually up from the lowest subject to the throne than when all beneath the throne are nearly on a level. And from one point of view, that from which the kingly house is but the noblest of the noble, kingship and nobility are closely allied. But in the more strictly political view monarchy and nobility are strongly opposed. Even the modified form of absolute monarchy which has existed in some Western countries, while it preserves, perhaps even strengthens, the social position of a nobility, destroys its political power. Under the fully-developed despotisms of the East a real nobility is impossible; the prince raises and thrusts down as he pleases. It is only in a commonwealth that a nobility can really rule; that is, it is only in a commonwealth that the nobility can really be an aristocracy. And even in a democratic commonwealth the sentiment of nobility may exist, though all legal privilege has been abolished or has never existed. That is to say, traditional feeling may give the members of certain families a strong preference, to say the least, in election to office. We have seen that this was the case at Athens; it was largely the case in the democratic cantons of Switzerland; indeed the nobility of Rome itself, after the privileges of the patricians were abolished, rested on no other foundation. It is important to bring these historical facts into notice, as they are likely to be confused or forgotten among modern practical tendencies the other way. (E. A. F.)

NOCERA INFERIORE, formerly NOCERA DEI PAGANI, a city of Italy in the province of Salerno at the foot of Monte Albino, 22½ miles east-south-east of Naples on the railway to Salerno, which lies only 10 or 11 miles distant. In 1881 it had a communal population of 15,858, that of the town was 12,830; but the interest of the place is almost exclusively historical.

Nuceria Alfaterna, first mentioned as assisting the Samnites in 315 B.C., was a few years later (308) besieged and captured by Fabius. In 216 Hannibal completely destroyed the city and dispersed its inhabitants; but the town, having been repeopled at some unknown date, appears again as a flourishing municipium in the time of Cicero. In 73 B.C. it was plundered by Spartacus, and under Augustus it received a Roman colony (Nuceria Constantia), afterwards recruited by Nero. At an early date the city became an episcopal see, and in the 12th century it sided with Innocent II. against Roger of Sicily, and suffered severely for its choice. A colony of Saracens introduced by Frederick II. probably gave rise to the epithet by which it was so long distinguished, as well as to the town of Pagani, which lies about a mile to the west. In 1385 Pope Urban VI. was besieged in the castle by Charles of Durazzo. Nocera was the birthplace of Solimena the painter; and in the list of its bishops appears the name of Paulus Jovius.

Nocera Inferiore must not be confounded with Nocera Umbria (the ancient Nuceria Camellaria), an old episcopal city 14 miles from Foligno.

NODDY, the name applied, originally by sailors, to a sea-bird from its showing so little fear of man as to be accounted stupid. It is the *Sterna stolida* of Linnæus, and the *Anous stolidus* of modern ornithology, having the figure of a TERN (*q.v.*), and belonging to the sub-family *Sterninæ*, but is heavier in flight, with shorter wings and the tail less deeply forked. The plumage is of a uniform sooty hue, excepting the crown of the head, which is light grey. The Noddy is very generally distributed throughout the tropical or nearly tropical oceans, but occasionally wanders into colder climates, and has been met with even in the Irish Sea. It breeds, often in astounding numbers, on low cays and coral-islets, commonly making a shallow nest of sea-weed or small twigs, which may be placed on the ground, on a tuft of grass, or in the fork of a tree, while sometimes it lays its eggs on a bare rock. Mr Saunders (*Proc. Zool. Society*, 1876, pp. 669-672) admits four other species of the genus:—*Anous tenuirostris*, supposed to be confined to the southern part of the Indian Ocean, from Madagascar to West Australia; *A. melanogenys*, often confounded with the last, but having nearly as wide a range as the first; and *A. leucocapillus*, hitherto known only from Torres Strait and the Southern Pacific. These three have much resemblance to *A. stolidus*, but are smaller in size, and the two latter have the crown white instead of grey. The fourth species, *A. cæruleus* (with which he includes the *A. cinereus* of some authors), differs not inconsiderably, being of a dove-colour, lighter on the head and darker on the back, the wings bearing a narrow white bar, with their quill-feathers blackish-brown, while the feet are reddish and the webs yellow. Three more species—*A. superciliosus* from the Caribbean Sea and Gulf of Mexico, *A. plumbeigularis* from the Red Sea, and *A. galapagensis* from the Galapagos—have been added by Mr. Sharpe (*Philos. Transactions*, clxviii. pp. 468, 469), who also considers (*Proc. Zool. Society*, 1878, p. 272) *A. cinereus* of the Eastern Pacific to be distinct from *A. cæruleus* of Australia and the Western Pacific. (A. N.)

NODIER, CHARLES (*c.* 1780-1844), a writer of greater intrinsic merit and more importance in the history of French literature than is generally recognized, was born at Besançon somewhat less than ten years before the outbreak of the Revolution, but the exact date is strangely uncertain. Besançon for the place and the 29th of April for the day of the month appear to be agreed upon, but the year is sometimes given as 1780, sometimes as 1781, and sometimes as 1783. The earliest seems the most probable. His father was a lawyer of some distinction and had been a teacher of law, and after the outbreak of the Revolution he was appointed mayor of Besançon and consequently chief police magistrate. He seems, from some euphemistic expressions of his friends, to have rather lent himself as an instrument to the tyranny of the Jacobins than to have shared their principles; but his son was for a time an ardent citizen, and is said to have been a club member when he could at the most have been twelve years old. His education in these troublesome times was necessarily haphazard, but appears to have been sufficient. His love of books began very early, and he combined with it, what is not perhaps very often characteristic of the bibliophile proper, a strong interest in natural science. The dates of his early life are given very sparingly, and the chief authority for the details of it is his own *Souvenirs*, a not very trustworthy source. Having obtained and then lost the post of librarian in his native town, he went to Paris and plunged into literature. He had published a dissertation on the antennæ in insects as early as 1798 at Besançon. Entomology continued to be a favourite study with him, but he varied it with philology and pure literature—*Le Peintre de Salzbourg* dates from this early period—and even political writing. A "skit" on Napoleon in 1803 got him into trouble, which was not very serious. He was obliged, or thought himself obliged, to quit Paris, and for some years lived a very unsettled life at Besançon, Dôle (where he married), and other places. In 1811 he appears at Laibach in the singular character of editor of a polyglot journal, the *Illyrian Telegraph*, published in French, German, Italian, and Slav. Then he returned to Paris, and the restoration found him, or made him, an ardent royalist. Literary and journalistic work of all kinds filled up his time, until in 1823 he was appointed to the librarianship of the Bibliothèque de l'Arsenal. He was not disturbed in this post by the revolution of July, but, on the contrary, was elected a member of the Academy in 1833, and made a member of the Legion of Honour in 1843, a year before his death, which happened on 27th January 1844. These twenty years at the arsenal were by far the most important and fruitful of Nodier's life. He had much of the Bohemian in his composition, and the wandering and unsettled life that he had led was more favourable to the cultivation of this feature of his character than to the production of solid work. His post at the arsenal was not very lucrative, and even after his appointment his way of life is said by some chroniclers not to have been extraordinarily regular. But he had the advantage of a settled home in which to collect rare books (for which he had a real vocation), and to study them; and, what was of still more importance, he was able to supply a centre and rallying place to a knot of young literary men of greater individual talent than himself—the so-called Romantics of 1830—and to colour their tastes and work very decidedly with his own predilections. Much older than most of them, possessing a literary reputation already formed, though resting on no single work of great importance, with very decided idiosyncrasies and a considerable power of personally influencing his associates, Nodier must be credited with no small part in the making of the men of 1830.

His own literary work is abundant, but much of it is obsolete, much more mere miscellanies, much injured by hasty production, and some, it is said, is not due to himself. His best and most characteristic work, some of which is exquisite in its kind, consists partly of short tales of a more or less fantastic character, partly of nondescript articles, half bibliographic, half narrative, the nearest analogue to which in English is to be found in some of the papers of De Quincey. The best examples of the latter are to be found in the volume entitled *Mélanges tirés d'une Petite Bibliothèque*, published in 1829 and afterwards continued. Of his tales the best are *Smarra* (1821), *Histoire du Roi de Bohême et de ses sept Châteaux* (1830), *La Fée aux Miettes* (1832), *Inès de las Sierras* (1837), *Légende de Sœur Béatrix* (1838), together with some fairy stories published in the year of his death, and *Franciscus Columna*, which appeared after it. The *Souvenirs de Jeunesse* (1832), already referred to, are interesting but untrustworthy, and the *Dictionnaire Universel de la Langue Française* (1823), a book of considerable merit, which, in the days before Littré, was one of the most useful of its kind, is said to have been not wholly or mainly Nodier's. His chief tales are accessible in three or four volumes of the Bibliothèque Charpentier, and the best yield to few things in French for charm of style and especially for the rendering of fantastic and picturesque sentiment, but they are very unequal. There is a so-called collection of *Œuvres Complètes*, in 12 vols., 1832, but at that time much of the author's best work had not appeared, and it included but a part of what was actually published

NOETUS, a presbyter of the church of Asia Minor about 230 A.D., was a native of Smyrna, where (or perhaps in Ephesus) he became a prominent representative of the particular type of Christology which is now technically called modalistic monarchianism (see vol. xvi. p. 719). His views, which led to his excommunication from the Asiatic church, are known to us chiefly through the controversial writings of Hippolytus, his contemporary.

NOIRMOUTIER, an island of France belonging to the department of Vendée, and protecting the Bay of Bourgneuf on the south-west. Between the island and the mainland is a sandbank laid bare at low water, and crossed by an embankment and carriage road, which is continually kept in good repair. It was not till about 1766 that people found they could walk across to the island, which lies from north-north-west to south-south-east, and is 11 miles long, its breadth varying from 1 mile in the south part to 3 or 4 miles in the north. It appears to be formed of alluvial deposits gradually accumulated round a rock of no great size situated at the meeting-place of the Gascony and Brittany currents. The area now amounts to 18 square miles, of which about a sixth part is occupied by dunes. The total population was 7726 in 1881. There are two communes: Noirmoutier and Barbâtre. The former has about 2029 of its 5908 inhabitants gathered together in a little town with narrow and winding streets. Its castle was once the residence of the abbot of Her. In the church there is a crypt of the 11th century. A mile to the north of the town lies a pleasant watering-place, rendered picturesque by the La Chaise woods (evergreen oaks and pines), and a grand confusion of rocks, among which the sea has scooped out many a delightful little beach.

A dolmen, several menhirs, and the ruins of a Gallo-Roman villa with its hot baths show that the island must have been occupied at an early date; but the first fact in its recorded history is the foundation of the Benedictine monastery of Her by St Philibert about 680. From this monastery the name Noirmoutier (Moustier) is derived. It had already attained to great prosperity when it was pillaged by the Normans in 825 and 843. In 1205 the abbey of Notre Dame la Blanche was built at the north extremity of the island to take the place of a Cistercian convent established in the Île du Pilier, at that time attached to Noirmoutier by a dyke. This abbey was ruined by the Protestants in 1562. In 1676 the island was captured by the Dutch. Having been seized by Charette during the war of Vendée, it was recovered by the republican general, Haxo, who caused the Vendean leader, d'Elbée, to be shot.

NOLA a city of Italy in the province of Caserta (Terra di Lavoro), is pleasantly situated on the plain between Mount Vesuvius and the Apennines, 14 miles east-north-east of Naples on the road to Avellino, and 20½ miles south-west of Cancello on the railway to the same town. The more conspicuous buildings are the ancient Gothic cathedral (restored in 1866), with its lofty tower rebuilt since the fire of 1860, the cavalry barracks, the ex-convent of the Capuchins at a little distance from the city, and the seminary in which is preserved the famous Oscan inscription known as the Cippus Abellanus (from Abella). Two fairs are held in Nola, on 14th June and 12th November; and the 26th of July is devoted to a great festival in honour of St Paulinus, one of the early bishops of the city. The population of the city was 10,771 in 1871, and 8489 in 1881; that of the commune 11,395 in 1871, and 11,931 in 1881.

Nola (Νῶλα) was one of the oldest cities of Campania. At the time when it sent assistance to Neapolis against the Roman invasion (328 B.C.) it was probably occupied by Oscans in alliance with the Samnites; but it had evidently passed through an Etruscan period, and had possibly received a Greek colony from Chalcis. The Romans made themselves masters of Nola in 313 B.C. In the Second Punic War it thrice bade defiance to Hannibal; but in the Social War it was betrayed into the hands of the Samnites, who kept possession till Marius, with whom they had sided, was defeated by Sulla. Whatever punishment Sulla may have inflicted, Nola "remained a municipium, with its own institutions and the use of the Oscan language." At a later date it became a Roman colony. Marcus Agrippa and Augustus died at Nola. Sacked by Genseric in 455, and by the Saracens in 806 and 904, captured by Manfred in the 13th century, and damaged by earthquakes in the 15th and 16th, Nola lost much of its importance. The remains of two great amphitheatres described by Ambrosio Leone in the first part of the 16th century were used by Carlo Caraffa and Orso Orsini in 1664 to build their palaces in Naples and Nola. Giordano Bruno and the sculptor Giovanni Marliano were natives of the city; and some of the latter's works are preserved in the cathedral.

NOLLEKENS, JOSEPH (1737-1823), sculptor, was born 11th August 1737 in London, where his father, a native of Antwerp, the "old Nollekens" of Horace Walpole, was a painter of some repute. In his thirteenth year he entered the studio of the sculptor Scheemakers, and practised drawing and modelling with great assiduity, ultimately gaining various prizes offered by the Society of Arts. In 1760 he went to Rome, and he executed a marble bas-relief, Timoclea before Alexander, which obtained a prize of fifty guineas from that society in 1762. Remunerative commissions began to come in, Garrick and Sterne being among the first English visitors who sat to him for busts; among his larger pieces belonging to this early period perhaps the most important is the Mercury and Venus chiding Cupid. Having returned to England in 1770, he was admitted an associate of the Royal Academy in 1771, and elected a member in the following year. By this time he had become known to George III., whose bust he shortly afterwards executed, and henceforward, until about 1816, he was continually and very profitably employed as the most fashionable portrait sculptor of his day. His busts were on all hands acknowledged to be excellent likenesses, and there was generally a softness in the expression and a gracefulness in the handling which never failed to please. He himself thought highly of his early portrait of Sterne. Among many others may be specially named those of Pitt, Fox, the prince of Wales (afterwards George IV.), Canning, Perceval, Benjamin West, and Lords Castlereagh, Aberdeen, Erskine, Egremont, and Liverpool. He also found leisure to elaborate a number of marble groups and statues, amongst which may be mentioned those of Bacchus, Venus taking off her Sandal, Hope leaning on an Urn, Juno, Pætus and Arria, Cupid and Psyche, and (his own favourite performance) Venus anointing Herself; all, however, although remarkable for delicacy of workmanship, are deficient in vigour and originality, and the drapery is peculiarly weak. The most prominent personal characteristic of Nollekens seems to have been his frugality, which ultimately developed into absolute miserliness. He died in London on 23d April 1823, leaving, it is said, a fortune of some £200,000.

NOLLE PROSEQUI (sometimes shortened into *nol. pros.*) is a technical term of English law, the meaning of which varies as it is used with reference to civil or criminal cases. In civil cases it applies only to actions in the Queen's Bench Division, and there signifies a formal undertaking by the plaintiff that he will proceed no further with the action (*se ulterius nolle prosequi*). The more modern practice in such cases is to proceed by way of discontinuance. In proceedings either by indictment or by information, a *nolle prosequi* or stay of proceedings may be entered by the attorney-general. The *nolle prosequi* is a matter purely for his discretion, and will not be granted unless very good ground be shown for his interference. The object of it generally is to obtain a stay of proceedings against an accomplice in order to procure his evidence. This object is, however, more usually effected by the prosecution offering no evidence and the judge directing an acquittal.

In America the term bears the same meaning as in England, with one exception. The attorney-general has not the same discretion with which English law invests him. Although in some States the prosecuting officer may enter a *nolle prosequi* at his discretion, in others the leave of the court must be obtained.

NOLLET, JEAN ANTOINE, French physicist, was born at Pimprès (now in Oise) on 19th November 1700, and died at Paris in 1770. He was of peasant origin, and was educated for the church, entering holy orders and ultimately attaining the rank of abbé; but his tastes all lay in the direction of experimental research, especially on the subject of electricity (see vol. viii. p. 6). In 1734 he was admitted a member of the London Royal Society, four years later he entered the Academy of Sciences at Paris, and in 1753 he was appointed to the newly-instituted chair of experimental physics in the Collége de Navarre. Nollet's strength lay in popular exposition rather than in profound investigation, but he cannot be denied the credit of having greatly helped by his influence and example the cause of electrical science.

NOMANSLAND. See KAFFRARIA, vol. xiii. p. 817.

NOMINALISM. See SCHOLASTIC PHILOSOPHY.

NONCONFORMITY, LAW RELATING TO. The history of the gradual relief of nonconformists in England from their disabilities will be found under ENGLAND, and under the heads of the various denominations, *e.g.*, BAPTISTS, INDEPENDENTS, METHODISM, QUAKERS, &c. See also OATHS. It is proposed here to note simply the present legal aspects of nonconformity apart from its history, that is, the matters in which the law as to nonconformists still differs from that applicable to members of the Church of England. The differences may be conveniently grouped under six heads.

(1) *Judicial notice.* The courts, both temporal and spiritual, take judicial notice of the tenets and authorities of the Church of England, the crown being head of the law and of the church. Where the tenets and authorities of a nonconformist body come in question, they must be proved by evidence. By Lord Lyndhurst's Act, 7 and 8 Vict., c. 45, where no particular religious doctrine or mode of worship has been prescribed by the deed or instrument of trust the usage of the congregation for twenty-five years is to be taken as conclusive evidence of the doctrine and worship which may be properly observed in such meeting-houses. (2) *Tribunal.* Offences against the law ecclesiastical (not being crimes) committed by clergy of the Church of England as a rule come by letters of request from the bishop of the diocese before the Arches Court of Canterbury or the Chancery Court of York (of both of which the same person is now judge). Similar matters arising in nonconformist bodies can only be tried by the ordinary secular courts, and generally depend upon the question whether a minister has done any act which is not in accordance with the rules governing the particular body of which he is a minister. A nonconformist body is in law nothing more than a voluntary association, whose members may enforce discipline by any tribunal assented to by them, but must be subject in the last degree to the courts of the realm. Brawling in a church by a person in holy orders is an offence within the Church Discipline Act, 3 and 4 Vict., c. 86, and falls under the cognizance of the spiritual courts; similar conduct by a nonconformist minister in his own place of worship can only be punished as an offence under 9 and 10 Vict., c. 59. (3) *Status of ministers.* A nonconformist minister is not in holy orders, and his chapel is not a consecrated building. His status is, however, recognized to a limited extent. By the Toleration Act, 1 Will. and M., c. 18, a minister, preacher, or teacher of a nonconformist congregation is exempt from certain parochial offices, as that of churchwarden. He is also exempt from serving in the militia or on a jury. These privileges only attach where the place of worship of which he is a minister has been duly registered, 18 and 19 Vict., c. 81, unless in the case of bodies subject to special legislation, as Quakers. Registration is not required in the case of consecrated buildings. By 45 and 46 Vict., c. 50, s. 12, a nonconformist minister cannot be elected an alderman or councillor. He cannot take a degree in divinity at Oxford, Cambridge, or Durham, 34 and 35 Vict., c. 26, and so is debarred from holding any professorship of divinity in those universities. (4) *Marriage.* Marriage by a person in holy orders was probably necessary at common law, at any rate from the Reformation up to 1836. (See MARRIAGE.) And from the date of Lord Hardwicke's Marriage Act, 26 Geo. II., c. 33 (1753), up to 1836 the ceremony must have been performed in a consecrated building. The first Act of Parliament that relieved dissenters (other than Jews and Quakers) from these restrictions was the Marriage Act of 1836, 6 and 7 Will. IV., c. 85. Since that Act the ceremony of marriage may be performed in a nonconformist place of worship, but it must be after due notice to the superintendent registrar and in his presence or in that of a registrar, and the building must be one that is duly certified for marriages. These preliminaries (except the first, and that only where the marriage is not by banns, licence, or special licence) are not necessary where the marriage takes place in a church. Marriage by banns, licence, or special licence cannot take place except in a church. (5) *Burial.* By the Burial Laws Amendment Act, 1880, 43 and 44 Vict., c. 41, burial may take place in a churchyard without the rites of the Church of England. But in such a case notice must be given in a specified form, which is unnecessary where the burial service is conducted by a clergyman of the Church of England. (6) *Parish offices.* By 1 Will. and M., c. 18, s. 5, a dissenter chosen churchwarden and scrupling to take the oaths may execute his office by deputy. His acceptance of office is made optional by the Act; there is nothing to prevent his discharging it if he see fit to do so. This seems to be still the law, although a declaration was substituted for the oath by 5 and 6 Will IV., c. 62, s. 9.

The Colonies.—In crown colonies ecclesiastical jurisdiction may be conferred by the sole authority of the crown. In colonies which have parliamentary representation the crown cannot give to a metropolitan bishop jurisdiction or coercive legal authority over suffragan bishops or over any other person. In colonies of the former kind the Church of England may still preserve the privileges which attach to her in the mother country; in colonies of the latter kind she is in the same position as any other religious body, simply a voluntary association. Since the Irish Church Act, 1869, 32 and 33 Vict., c. 42, the Church of Ireland has been practically in the same position as the Church of England in colonies which have representative government.

NONJURORS in English history are the small minority of the beneficed clergy who incurred the penalties of suspension and deprivation for refusing to swear allegiance to William and Mary in 1689. The party, which was headed by Archbishop Sancroft and Bishop Ken, with five other members of the episcopal bench, included such men as Jeremy Collier, George Hickes, William Sherlock, Charles Leslie, and Henry Dodwell. See ENGLAND, vol. viii. p. 378.

NONNUS, Greek epic poet, author of the *Dionysiaca*, was a native of Panopolis in the Egyptian Thebaid. He can scarcely have been earlier than the 5th century of our era, but probably wrote in the first half of it, as his versification is imitated by Proclus, who was born 412 A.D. Nothing is known of his personal history, but his extensive mythological erudition almost proves him to have been a grammarian. His principal work, the *Dionysiaca*, an epic in forty-eight books on the history of Bacchus, is a vast storehouse of legendary fable, embellished, especially in the long episode of Bacchus's Indian expedition, with not a little of the poet's own invention. From one point of view it may be described as the swan-song of the ancient mythology; its spirit, at the same time, is anything but Hellenic. In its vast and formless luxuriance, its beautiful but artificial versification, its delineation of action and passion to the entire neglect of character, it resembles the colossal epics of India, while its glittering but too often frigid conceits bring it near to the Italian bastard epic of Marino and his school. Like his countryman and near contemporary Claudian, Nonnus is a writer of copious learning and still more copious fancy, eminent in invention, in description, and in melody, whose faults may be charged upon his age, while his merits are his own. This is more particularly the case with the author of the *Dionysiaca*, whose reforms in versification originated with himself, while they were accepted by all succeeding poets. In his hands, says Hermann, the Homeric hexameter, greatly corrupted by time and licence, though losing something of its dignity, recovered its elegance and harmony, and was framed to so strict a pattern that no one ignorant of prosody could henceforth attempt to write an epic. His influence on the vocabulary of his successors was likewise very considerable. We also possess under his name a paraphrase of the Gospel of St John, which is chiefly interesting as apparently indicating that, notwithstanding his mythological lore, Nonnus conformed to Christianity. The style is not inferior to that of his epic, but, employed in embellishing the simple narrative of the evangelist, it produces an impression of extreme bombast and want of taste.

The first edition of Nonnus was published by Falkenburg at Antwerp in 1569 from a MS. procured at Taranto by Sambucus, an Hungarian. The standard edition is Graefe's (Leipsic, 1819-26); but the most useful is that by Count de Marcellus (Paris, 1856), accompanied by valuable notes and prolegomena, and a French prose translation. The analyses by Ouvaroff (St Petersburg, 1817) and Koehler (Halle, 1853) are useful aids to the study of so long and intricate a poem. The paraphrase on St John is edited by Passow (1834), by Marcellus (1861), and in Migne's *Patrologia*. For Nonnus's metrical innovations see Hermann, *Orphica*, pp. 869-691; and Lehrs, *Quæstiones Epicæ*.

NONPAREIL, the name under which, from its supposed matchless beauty, a little cage-bird, chiefly imported from New Orleans, has long been known to English dealers (*cf.* Edwards, *Gleanings*, i. p. 132). It is the *Emberiza ciris* of Linnæus, and the *Cyanospiza ciris* of most recent ornithologists, belonging to a small group, which, in the present state of knowledge, cannot with certainty be referred either to the Buntings or to the Finches, while some authors have regarded it as a TANAGER (*q.v.*). The cock has the head, neck, and lesser wing-coverts bright blue, the upper part of the back yellow, deepening into green, and the lower parts generally, together with the rump, bright scarlet, tinged on the latter with purple. This gorgeous colouring is not assumed until the bird is at least two years old. The hen is green above and yellow beneath; and the younger cocks present an appearance intermediate between the adults of both sexes. The species, which is often also called the Painted Bunting, after wintering in Central America or Mexico, arrives in the southern States of the American Union in April, but does not ordinarily proceed to the northward of South Carolina. In Louisiana, where it is generally known to the French-speaking inhabitants as the *Pape*—as it was to the Spaniards of Florida as the *Mariposa pintada* (painted butterfly)—it is said to be very abundant; and on its appearance in spring advantage is, or was, taken of the pugnacious disposition of the males (which so often accompanies a brilliant sexually-distinct plumage) to capture them alive in great numbers by means of the stuffed skin of one so placed in connexion with a cage-trap that they instantly fall into the latter on attacking what they conceive to be a rival. In this way many thousands are said to have been taken formerly. The prisoner usually reconciles himself to his fate, and in a few days will utter his sprightly though not very powerful song; and, if provided with a mate and proper accommodation, will breed and rear a family in confinement. Belonging to the same genus as the Nonpareil is the Indigo-bird, *Cyanospiza cyanea*, which, as a summer visitant, is widely diffused from the Missouri to the Atlantic, and extends into the provinces of Ontario and New Brunswick, being everywhere regarded with favour. Though wanting most of the bright hues of its congener, the Indigo-bird has yet much beauty, the adult cock being nearly all over of a deep blue, changing, according to the light, to green. The hen is brown above and ochreous-white beneath. This species is represented in the western part of the continent by the Lazuli-Finch, *C. amœna*, the male of which has the upper parts greenish-blue, the wings barred with white, a pectoral band of light chestnut extending to the flanks on each side, and the lower parts white. Of the three remaining species of the genus, *C. versicolor* shows in the male a plumage beautifully varied with brownish-red, violet, and blue; *C. leclancheri* is bluish-green above and yellow beneath, with an orange breast; while *C. rositæ*, though quite distinct, comes nearest in coloration to *C. ciris*. These three have a more southern range than the other three; but the first of them is believed occasionally to cross the Mexican frontier into the United States. None of the species of *Cyanospiza* are thought to occur further south than the isthmus of Panama. (A. N.)

NONSUIT (*i.e.*, *non suit*, he does not pursue) is the name given to a judgment whereby an issue is determined against the plaintiff. It was a term peculiar to the English common-law courts before the Judicature Acts, and was simply the expression of the opinion of the court that, apart from the merits, the plaintiff's case was incomplete. It did not in any way act as a bar to his bringing another action for the same cause. It might be entered either at the wish of the plaintiff himself (to whom it was of course much more beneficial than judgment for the defendant) or by direction of the court against the will of the plaintiff. The matter now is of no great importance, for, although judgment of nonsuit still exists, it has, since the Judicature Acts, the same effect as a judgment on the merits, unless the court otherwise directs. This effect of a nonsuit was specially provided for by the rules of the Supreme Court of 1875. The rules of 1883 do not deal with nonsuit, but no doubt the practice which has existed between 1875 and 1883 will still be followed.

NOODT, GERHARD (1647-1725), a celebrated jurist, was born at Nimeguen in 1647. He began his studies in his native town, continued them at Leyden and Utrecht, and finished them at Franeker, where he took his doctor's degree in law. After passing through successive grades of promotion he was ultimately appointed to a law chair at Leyden. It was in the character of a writer on jurisprudence, however, that he acquired his reputation. His Latin style, modelled after the best writers, was pure and precise; he had, for his time, an intimate acquaintance with the laws, manners, and customs of ancient Rome; his speculations were guided by a simple desire for truth, and his political opinions animated by a spirit of unusual toleration. His numerous works, as they successively appeared, soon rose to the rank of standard authorities. Two of his political treatises were translated into French by Barbeyrac, and appeared at Amsterdam in 1707 and 1714, under the respective titles of *Pouvoir des Souverains* and *Liberté de Conscience*; and his jurisprudential writings, to which he was still adding when cut off in 1725, were held in high estimation, not in Holland only, but also in Germany and Scotland, till quite the end of last century. The first edition of his collected works was published at Leyden in 1724, and the last in 1767. That of 1735 and those subsequent contain a life of the author by Barbeyrac.

NORD, the most northern of the departments of France, formed out of Flanders, French Hainault, and the district of Cambrais (Cambrésis), lies between 50° and 51° 6′ N. lat., and between 2° 5′ and 4° 15′ E. long., but in such a way that, while it has a length from south-east to north-west of 112 miles, its breadth is nowhere more than 40 miles, and contracts to 4 at the point where it is crossed by the Lys. Bounded N.W. and N. for 21 miles by the North Sea, it has the Belgian provinces of West Flanders and Hainault on the N.E. and E., the departments of Aisne and Somme on the S., and that of Pas-de-Calais on the W. The Flanders portion to the west of the Scheldt is very flat, the hill at Cassel, only 575 feet high, rising like a mountain, and looking north towards Dunkirk over a stretch of 155 square miles of richly fertile lowlands, which about a thousand years ago were still covered by the sea. To the south-east of the Scheldt the country has the character of the neighbouring district of Ardennes, is better wooded, and contains the highest point in the department (875 feet). The greater part of Nord is in the Scheldt basin, but certain portions belong to those of the Sambre (Meuse), the Oise (Seine), and the little coast-streams the Aa and the Yser. The Scheldt, flowing by Cambrai, Bouchain, Valenciennes, and Condé, receives the Scarpe, which touches Douai, Marchiennes, and St Amand. The Lys, which does not join the Scheldt till it has entered Belgium, passes Armentières, and receives the Deule, on which Lille is situated. The Sambre passes Landrecies and Maubeuge. The Aa falls into the port at Gravelines. The climate of Nord is colder than that of France in general, the mean temperature being 49° or 50° Fahr. The rainfall is 12 inches at Dunkirk and a little more

at Lille. In the arrondissement of Avesnes, rain is more abundant, and cold more severe. In population (1,603,259 inhabitants in 1881) and in agricultural and industrial importance Nord is second only to the department of the Seine.

Of the total area (2193 square miles), two-thirds are arable, one-sixth under pasture, and one-eleventh consists of forest. The live-stock comprises 93,000 horses, asses, and mules, 240,000 cattle, 125,000 sheep, 78,000 pigs, 29,000 goats, and 75,000 dogs. The grain crops yield about 19,250,000 bushels, potatoes about half as much. Beetroot, flax, tobacco, chicory, colza, rape-seed, and hops are all of importance. The natural pastures support a good breed of Flemish cows. Stone, marble, clay, and sand are obtained in the department; but its mineral wealth lies rather in its coal-pits, for the most part belonging to the Anzin Company, which employs 20,000 workmen, and raises 3½ million tons per annum. Iron mines also are worked in the arrondissement of Avesnes. The best mineral waters are those of St Amand. There are numerous foundries, rolling-mills, steel-works, file-works, agricultural implement factories, and engineering works. More than 240,000 tons of pig-iron and 279,000 tons of malleable iron, cast iron, rails, sheet-iron, and Bessemer steel were produced in 1881. Copper foundries and zinc rolling-mills also exist. Spinning is more extensively prosecuted in Nord than in any other department, Lille and its suburbs being the principal seat of the industry. About 12,000 persons are employed in flax and tow spinning, 8000 in cotton spinning, and 4000 to 5000 in the manufacture of sewing-thread. Roubaix and Tourcoing spin wool, cotton, and silk. Jute spinning employs more than 20,000 bobbins at Dunkirk. In Roubaix alone there are upwards of 300 weaving factories; carpets (Tourcoing and Roubaix), linen (Armentières), ribbons, damask, muslins, tulles, laces, &c., are all largely manufactured, and there are also sugar-factories, distilleries, oil-works (scattered throughout the department), 1000 breweries, glass-works, soap-works, dye-works. The exports of the department comprise corn, fruit, eggs, vegetables, and butter to England, oil-cake, linseed, oils, colza seed. Consuming 4,500,000 tons of coal, it has to supplement its own production by importing from Pas de Calais, Belgium, or England. Most of the foreign trade passes through Dunkirk, a much larger port than Gravelines. Abundant means of transit exist throughout the department. The total length of the navigable rivers and canals is 325 miles, and railways to a total length of 450 miles have been constructed between all the most important localities.

Nord forms the archiepiscopal diocese of Cambrai, is comprised in the first or Lille region of corps d'armée, and depends on the court of appeal at Douai. It is divided into seven arrondissements (Avesnes, Cambrai, Douai, Dunkirk, Hazebrouck, Lille, and Valenciennes), 61 cantons, and 663 communes. The number of communes of importance especially for their industries is very large—St Amand les Eaux (11,184 inhabitants), with mineral waters and an old abbey; Anzin (10,043), near Valenciennes; Armentières (25,089), Bailleul (12,712), with antiquities; Bavai (1863), the ancient *Bagacum*; Bergues (5385), with its old fortifications and a splendid belfry of the 16th century; Bouvines (565), with an obelisk in memory of the victory of Philip Augustus in 1214; Cassel (4276); Le Cateau Cambrésis (9564); Condé (4621), a fortified town with coal-mines; Cysoing (3160), with a monument of the battle of Fontenoy (1745); Denain (17,202), with coal-pits, iron-works, and a monument of Villars's victory (1712); Fourmies (15,052), with spinning and weaving of woollen goods; Gravelines (8416); and Landrecies, a garrison town on the Sambre.

NORDERNEY (*i.e.*, northern island), the most important of the fringe of sand-islands along the coast of East Friesland, belongs to the Prussian province of Hanover. It is 8 miles long and about 1 mile broad, and supports a seafaring and fishing population of (1880) 2114 souls, of genuine old Frisian stock. The village at the south-west end of the island is one of the most popular sea-bathing places in Germany, and is visited annually by 9000 visitors, for whose accommodation numerous hotels and lodging-houses have been built. On the south side rises a lighthouse 175 feet high. At low tide Norderney may be reached from the mainland by driving or walking.

NORDHAUSEN, a flourishing town in Prussian Saxony, in the district of Erfurt, is situated on the Zorge, at the south base of the Harz mountains, and at the west end of the Goldene Aue (Golden Plain), a fruitful valley watered by the Helme. It is built partly on the slope of the mountains and partly on the plain, and the upper and lower parts of the town are connected by flights of steps. Among the churches the most noteworthy are the cathedral, a late Gothic edifice with a Romanesque crypt, and the church of St Blasius, containing two pictures by Lucas Cranach. Near the mediæval town-house stands a Roland's column, the ancient symbol of free commercial intercourse and civic liberty. The chief importance of the place arises from its distilleries, which yearly produce about 8,000,000 gallons of brandy. The breweries are also important, and there are manufactures of leather, tobacco, cotton and linen goods, carpets, chicory, and chemicals. Nordhausen is sometimes called the Cincinnati of Germany on account of its extensive export trade in pork, corned beef, ham, and sausages. In 1880 it contained 26,198 inhabitants, of whom 23,943 were Protestants, 1255 Roman Catholics, and 494 Jews.

Nordhausen, one of the oldest towns in North Germany, was surrounded with walls in the 10th century, and is spoken of as a free imperial town in 1220. Several diets, tournaments, and assemblies of princes were held here during the 12th, 13th, and 14th centuries. It appears to have usually placed itself under the protection of a prince of the empire, and in 1697 we find the elector of Brandenburg selected for this purpose. It was annexed to Prussia in 1803 and again finally in 1815, having in the interim belonged to the kingdom of Westphalia.

NÖRDLINGEN, a town of West Bavaria in the district of Schwaben und Neuburg, is situated on the Eger, 40 miles to the north of Augsburg. It was formerly an imperial town, with an independent territory of 35 square miles in extent, and is still surrounded with walls and towers. The most interesting buildings are the Gothic Hauptkirche and the late Gothic town-house, both of which contain paintings by Schaufelein, who was a native of Nordlingen. There are here manufactures of carpets (sold as Tyrolese carpets), linen and woollen goods, and agricultural implements; and a brisk trade is carried on in geese, goose feathers, cattle, and grain. In 1880 the population was 7837, including 6990 Protestants.

From 898, when we first find it mentioned, down to 1215 Nordlingen was subject to the bishop of Ratisbon; but soon after the latter date it acquired the freedom of the empire. It was annexed to Bavaria in 1803. Two battles were fought near Nordlingen during the Thirty Years' War, in the former of which (1634) the Swedes sustained their first defeat on German soil, losing 12,000 men. A full account of these battles is given by Colonel Malleson in the *Army and Navy Magazine*, November 1883.

NORFOLK, an eastern maritime county of England, is bounded N. and E. by the North Sea, S.E. and S. by Suffolk, S.W. by Cambridge, and W. by Lincoln. It is of an irregular oval form, its greatest length east and west being 67 miles, and its greatest breadth about 42 miles. The area is 1,356,173 acres, or 2119 square miles.

Coast-line.—Nearly two-thirds of the boundary of the county is formed by tidal water. There are few bays or inlets, and on the northern coast no river mouths. For the most part the coast-line is flat and low, and has been greatly encroached on by the sea, several villages having been engulfed since the time of William the Conqueror. From the mouth of the Yare to Happisburgh the shore is low and sandy and is skirted by sandbanks. Thence for 20 miles it is formed of cliffs consisting of clay and masses of embedded rocks, the average height being about 50 feet, although in some cases an altitude of 200 feet is reached. These cliffs are succeeded by a low shingly or sandy coast stretching as far as St Edmund's Point. The shores of the Wash are formed of mudbanks, which are left dry at low water. West of Lynn a considerable extent of land has within recent years been reclaimed from the sea, and farther south an old Roman embankment stretches into Lincolnshire. At various points off the coast there are submarine forests, especially in Brancaster Bay and in the neighbourhood of Cromer and Happisburgh. Fossilized remains of large mammals are sometimes dragged up by the nets of fishermen, and mammoth tusks measuring from 6 to 9 feet have been found at Knole Sand off Happisburgh.

Surface and Geology.—The surface is principally an undulating plain with rising grounds skirting the river valleys and low chalk downs in the north and north-west. On the west along the Cambridgeshire border there is a stretch of fen land extending from Welney and Hilgay fen to the Wash. The watershed is nearly in the centre of the county. The principal rivers are the Yare, in the east, with its tributaries, the Bure, the Wensum, and the Waveney; and the Ouse, in the west, with its tributaries, the Little Ouse, the Wissey, and the Nar. The Yare and its tributaries frequently expand near the sea into broads or meres, covered for the most part by sedges and bulrushes, which afford shelter for a great variety of water-fowl, including the water-hen, wild duck, heron, bittern, kingfisher, mallard, snipe, and teal. The Yare is navigable for small vessels as far as Norwich, the Waveney to Beccles, and the Bure to Aylsham. The Ouse is tidal to Denver, and its tributaries are all to some extent navigable.

Nearly the whole of Norfolk is occupied by chalk, but on account of drift deposits it forms a comparatively small proportion of its surface. It exists in three forms: chalk marl, which forms part of Hunstanton cliff; lower or hard chalk, much used in west Norfolk for the construction of cottages; and upper chalk, or chalk with flint, which constitutes the bulk of the formation. The other members of the Cretaceous system in Norfolk are gault and lower greensand, which crop out beneath the chalk to the west of the county, and are succeeded by the Kimmeridge clay of oolitic age, which stretches along the coast of the Wash from Hunstanton to King's Lynn, and south nearly to Downham. The Tertiary formation is represented by bands of sand, clay, and shingle in the neighbourhood of Norwich, which contain a fine series of fossils. The drift deposits include the lower glacial beds in the north-east, stretching south to the Yare and Wensum, the middle glacial beds in the neighbourhood of Yarmouth, and the upper glacial beds, consisting of boulder clay, occupying the centre, south, and south-west of the county. A considerable extent of surface is covered by valley gravels. In west Norfolk they occupy sometimes the old beds of rivers which flowed nearly at right angles to those of the present day. In these gravels many flint implements have been found. The fen beds in the south-west were at one time nearly all under water, but this has been carried off by a system of drainage first begun in the reign of Charles I.

The county is not rich in minerals. It is supposed that beds of coal may probably exist at a depth of 1500 feet. Lime and chalk for building are plentiful. Potter's clay and good brick earth are obtained. In the fen district there is still a supply of peat. Marl is found in the valley of the Bure, and sand suitable for the manufacture of glass in the neighbourhood of Snettisham.

Climate and Agriculture.—On account of the exposed position of the coast to east and north-east winds, the climate, especially in winter and early spring, is much colder than in the adjacent counties. The air is, however, generally dry, and unhealthy fogs are not common, except in the marshy districts. Norfolk contains a greater variety of soil than any other county in England. In the north and west the soil is generally chalky; towards the south-east it is a light sand, assuming occasionally the form of blowing sand, but elsewhere capable of cultivation and of average fertility. In the centre and east the prevailing soil is loam of a very varying quality, chiefly light and workable, but sometimes composed of stiff chalky boulder clay. Alluvial clays and loams occur on the borders of Lincolnshire and Cambridgeshire, and stretch along the river valleys. The marsh lands along the coast are so subject to inundation as to make cultivation difficult; they afford, however, capital pasturage for stock.

Notwithstanding the natural defects of soil, farming is in a very advanced condition, and, by means of draining, subsoil ploughing, skilful rotation, and the liberal use of artificial manures and feeding stuffs, excellent crops are raised in many districts of the county. The farms are for the most part large and the farm buildings superior. The prevailing system of tenure in west Norfolk is by leases ranging from seven to twenty-one years; in other parts of the county yearly agreements mostly prevail. According to the agricultural returns of 1883, the area of cultivation was 1,087,270 acres,—a percentage of about 80 of the total area. Corn crops occupied 438,273 acres, green crops 202,060, rotation grasses 166,891, permanent pasture 264,938, and fallow 15,051. About seven-eighths of the area under corn crops is occupied by wheat and barley, the areas of the two being pretty nearly equal, 179,270 acres and 196,483 acres respectively in 1883, while oats occupied only 32,307 acres. As much attention is paid to the grazing of cattle and to the rearing and fattening of sheep, turnips and swedes are extensively grown—occupying 135,116 acres in 1883—while mangolds occupied 46,442 acres, and vetches 11,868 acres, but potatoes only 5269 acres.

The number of horses in 1883 was 62,613, of which 44,232 were used solely for agricultural purposes. Cattle in the same year numbered 117,497, of which 29,040 were cows and heifers in milk or in calf. Large numbers of lean cattle, principally Irish shorthorns, are brought into the county mainly for winter grazing. The old Norfolk polled stock has been recently revived and is now recognized as a distinct breed. Good pasture lands are found in many districts of the county, especially along the river-beds and in the neighbourhood of the fens. Sheep in 1883 numbered 559,146, and pigs 111,349.

According to the latest return the total number of proprietors in the county was 26,648, possessing 1,234,884 acres, yielding an annual rental of £2,403,795. The estimated extent of common or waste lands possessed by no owner was 12,870 acres. Of the owners 16,552, or about 60 per cent., possessed less than one acre. Eleven proprietors possessed upwards of 10,000 acres—viz., earl of Leicester, 43,025; Marquis Townshend, 18,130; marquis of Cholmondeley, 16,995; Rev. H. Lombe, 13,832; Lord Hastings, 12,738; earl of Orford, 12,341; Lord Walsingham, 11,983; Lord Suffield, 11,829; Sir Thomas Hare, 11,083; earl of Kimberley, 10,801; Anthony Hamond, 10,039.

Manufactures.—At an early period Norfolk was one of the principal seats of the cloth trade in England, worsted deriving its name from having been first manufactured at Worstead. The weaving of silk and wool is still carried on at Norwich and also shawl weaving, although the staple trade of the town is now boots and shoes. Silk is also manufactured at Yarmouth, Wymondham, and North Walsham. Flour-mills are numerous all over the county. and there are agricultural implement works at Norwich, Lynn, Thetford, East Harling, North Walsham, Walsingham, and East Dereham. Lime-burning, brick-making, tanning, malting, and brewing are carried on in various districts. The extensive mustard and starch works of Colman & Co. are at Norwich. One of the chief hindrances to the commercial progress of the county is the dangerous nature of the sea-coast, and its unsuitability for the formation of harbours. A large trade is carried on, however, at Yarmouth, which is the outlet for the produce of a very extensive district. The other principal port is Lynn, and there is a small trade at Burnham, Cromer, and Wells. The exports are chiefly agricultural produce, fish, and manufactured goods, and the imports timber, oil-cake, and provisions. Yarmouth possesses one of the most important herring-fisheries in England.

Railways.—The county is intersected in all directions by lines of the Great Eastern Railway, and more recently by the Eastern and Midland Railway.

Administration and Population.—Norfolk comprises 33 hundreds, the city of Norwich (87,842), the municipal borough of King's Lynn (18,539), the principal part (37,151) of Great Yarmouth (46,159), and the principal part (3228) of Thetford (4032), both of which extend into Suffolk. There are also seven urban sanitary districts—Diss (3846), Downham Market (2683), East Dereham (5640), North Walsham (3234), Swaffham (3643), Thetford (4032), and Wells (2645). The county has one court of quarter-sessions and is divided into twenty-five petty and special sessional divisions.

The city of Norwich and the boroughs of King's Lynn and Great Yarmouth have their own police. One parish, a part of a parish, and a part of an ecclesiastical district are in the diocese of Ely, a part of a parish in the diocese of Lincoln, and the rest of the county in the diocese of Norwich. The county contains 736 parishes, with parts of nine others. For parliamentary purposes it is divided into North Norfolk, South Norfolk, and West Norfolk, each division returning two members; and two members are also returned for the parliamentary boroughs of Norwich city in the southern division and of King's Lynn in the western division. The population in 1801 was 273,371, which in 1821 had increased to 344,365, in 1851 to 442,714, in 1871 had decreased to 438,656, and in 1881 had risen again to 444,749, of whom 215,266 were males and 229,483 females. The number of inhabited houses in 1881 was 100,372, and the average number of persons to the acre 0·33.

History and Antiquities.—At the Roman conquest Norfolk was inhabited by the Cenomanni, a tribe of the Iceni. The numerous groups of pits on the heaths and along the coast, such as "Grimes Graves" near Weeting and the "shrieking pits" on Aylmerton heath, appear to have been ancient villages. The whole of the district was brought to own allegiance to the Romans during the campaign of Aulus Plautius; but on account of the indignities offered to their queen, Boadicea, the Iceni revolted, and, joining with the Trinobantes, seized *Camulodunum* (Colchester), an important Roman colony, massacring every Roman on whom they could lay hands. The Romans had their revenge shortly afterwards in a battle (62 B.C.) in which the power of the Britons was finally completely crushed. The name of the tribe was retained in the Incehilde Way, an old British road passing westward from the Norfolk coast, which was utilized by the Romans. The county was traversed by four other Roman roads, and was the seat of five principal Roman stations *Brannodunum* (Brancaster), *Garianonum* (Caistor, near Yarmouth), *Venta Icenorum* (Caistor, St Edmund), *Sitomagus* (Thetford), and *Ad-Tuam* (Tasburgh). Coins and other remains have been found at all these places. In the Teutonic settlement Norfolk was occupied by the Angles, and in 870 the kingdom of East Anglia fell in turn before the Danes (see vol. viii. p. 284). New ravages were committed by the Danes from time to time; and in 1004 Sweyn brought his fleet up the river to Norwich, which he plundered and burned. After the Norman Conquest Ralph de Waher or Guader was created earl of Norfolk, but on his rebellion in 1057 the estates and title were conferred on Roger Bigod. Subsequently the title was in disuse, but it was at length revived and bestowed on Thomas Plantagenet, fifth son of Edward I. During a vacancy in the earldom John le Littester, a dyer, rose in rebellion and joined the commons under Wat Tyler. After the suppression of the rebellion the earldom with the title duke of Norfolk was bestowed on the Mowbray family, who held it till the latter part of the 15th century, when it passed by marriage to the Howards. The duke of Norfolk still exercises a peculiar and permanent jurisdiction, and appoints two coroners for his liberties.

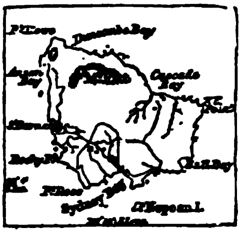
There are few or no traces of Saxon architecture in the county, unless the towers of Dunham-Magna and Newton-by-Castleacre be assigned to this period. The round towers which are specially characteristic of the district are probably Norman. Although there are several fine specimens of Norman architecture in the county in addition to Norwich cathedral, and a few good examples of Early English, the majority of the churches are Decorated or Perpendicular, or a mixture of both styles. The most notable features of the churches are the flint and stone panels, the fine rood-loft screens, and the numerous brasses. Norfolk possessed an unusually large number of monastic foundations, but of these the remains are few and comparatively unimportant. The cathedral-church of Norwich was originally connected with a very richly-endowed Benedictine monastery. A foundation of nearly equal importance was that of Augustinian canons at Walsingham, where there are remains of the church, the refectory, and a Perpendicular gateway. The other principal remains are those at Bacton, Beeston, Binham, Carrow, Castleacre, Thetford, and Wymondham. Of the old Norman keeps there are entrenchments and remains of the building at Castleacre, while Castle Rising is still a magnificent ruin, and Norwich Castle has been restored. Among the more interesting old mansions are the halls of Hunstanton, Oxborough, Blickling, Heydon, and Barningham. The larger mansions, such as Sandringham, Holkham, Rainham, Cossey, Gunton, Houghton, and Shadwell, are, however, of comparatively modern date. Among the eminent persons connected with Norfolk are Sir Edward Coke, Lord Cranworth, John Skelton, the earl of Surrey, Sir Thomas Browne, Sir Thomas Gresham, Roger L'Estrange, Horace Walpole, Tom Paine, Theodore Hooke, Mrs Opie, Porson, Harriet Martineau, Bulwer Lytton, Elizabeth Fry, Fowell Buxton, Sir Francis Palgrave, Sir Cloudesley Shovell, Lord Nelson.

See Blomefield, *An Essay towards a Topographical History of the County of Norfolk* (5 vols., 1739-1775); Chambers, *General History of the County of Norfolk* (11 vols., 1804-1810); White, *History of Norfolk* (new ed., 1883); J. O. Halliwell, *Norfolk Anthology* (1852); *Norfolk Antiquarian Miscellany*, edited by W. Rye; and Davies, *Norfolk Broads and Rivers*, 1883.

NORFOLK, a city and port of entry of the United States in Norfolk county, Virginia, opposite Portsmouth, on the north bank of Elizabeth river, an arm of Chesapeake Bay. It is the terminus of the Norfolk and Western Railroad (408 miles) and the Norfolk Southern Railroad (74 miles), has easy access to the Norfolk and Princess Anne Canal, the Dismal Swamp Canal (from Elizabeth City to the Pasquotank river), and the Albemarle and Chesapeake Canal, navigable for vessels of 500 tons, and is connected by regular lines of steamers with Richmond, Baltimore, Philadelphia, and New York. The city lies low, and is somewhat irregular in its arrangement, but the streets are generally wide. The city hall, with a cupola 110 feet high, the custom-house and post-office, the Norfolk academy, the masonic temple, the mechanics' hall, and some of the banks are the most conspicuous of the secular buildings. Apart from its naval yard, one of the largest in the United States, Norfolk has but few manufacturing establishments, but it carries on a large trade in cotton, fruits, vegetables, and oysters for the northern markets, as well as in maize, wheat, and sugar. Though the harbour has 20 feet of water at high tide, the fairway up to the city is narrow. The population was 14,620 in 1860, 19,229 in 1870, and 21,966 in 1880.

Founded in 1705, Norfolk was incorporated as a borough in 1736, and as a city in 1845. In 1776 it was burned by the British. At the opening of the Civil War it was the chief naval depôt of the Confederates, but at an early date in the contest the vessels and yard were destroyed, and in May 1862 the town was occupied by the Federal forces.

NORFOLK ISLAND, with the much smaller Nepean Island and Phillip Island, lies about 29° 3′ S. lat. and 167° 58′ E. long, 400 miles north-north-west of New Zealand, on a submarine tableland extending 18 miles to the north, and 25 miles to the south, with an average breadth of 18 miles. Measuring about 6 miles in length from north-west to south-east, Norfolk Island has an area of 8607 acres, or 13½ square miles. The breakers of the Pacific beating on its high cliff-bound coast render it difficult or even impossible to land except at two places, and even there not without danger. With a general elevation of 400 feet above the sea the surface of the island rises in the north-west into Mount Pitt, whose double summit is 1050 feet in height. The soil, of decomposed basalt, is well watered and wonderfully fertile. A rich undulating pasture-land clothed with clumps of trees and copses gives a park-like appearance to the general aspect of the country. The Norfolk Island pine (*Eutassa excelsa*), a magnificent tree, with a height at times of 200 feet and a girth of 30, forms a fine avenue between Sydney and St Barnabas, though of the forest that clothed the slopes of Mount Pitt only a few of the larger trees are left. A small species of palm is known as the Norfolk Island cabbage. The underwood is largely composed of lemon trees; and guavas, bananas, peaches, and pine-apples are to be had in abundance. Sweet potatoes are the staple crop, but common potatoes, maize, yams, and even barley and oats are cultivated. The climate is genial and healthy, the thermometer rarely sinking below 65°. In 1862 the population was 268; in 1871, 481; and in 1880, 663. The descendants of the Pitcairn Islanders, who form two-thirds of the inhabitants, have their chief settlement on the south side, on Sydney Bay, where the buildings of the old penal establishment were placed at their disposal. A thousand acres on the west side of the island are held by the mission station of St



Map of Norfolk Island

Barnabas, founded by Bishop Patteson, where 150 Melanesian boys and girls receive education.

The following are the main facts in the history of Norfolk Island. 1774. Island discovered by Captain Cook. 1788. Taken possession of by Philip G. King of the "Stirling" and twenty-four convicts from New South Wales. 1805. Settlement abandoned by order issued in 1803. 1826. Island made penal settlement for New South Wales convicts. 1842. Island transferred from New South Wales to Tasmania. 1856. Pitcairn Islanders to the number of 194 take the place of the convicts. 1867. Melanesian mission station settled at St Barnabas. 1882. Memorial church to Bishop Patteson erected at a cost of £5000, the windows being designed by Burne Jones and executed by W. Morris.

NORICUM was the ancient name of the country south of the Danube, around the rivers Inn and Drave, and extending on the south to the banks of the Save. The original population appears to have been Illyrian, but in the great emigration of the Gauls the country was occupied by a Celtic people, Taurisci or Norici. The latter name seems to be derived from their town of Noreia, now Neumarkt. The country is mountainous, and the soil poor, but it is rich in iron, and has always been one of the great European centres of the trade. A great part of the Roman weapons were made of Noric steel. The country was conquered by the Romans under Tiberius and Drusus in 15 B.C., but for a time retained its old constitution and the name of Regnum Noricum. See AUSTRIA, BAVARIA, CARINTHIA, &c.

NORMANBY, CONSTANTINE HENRY PHIPPS, MARQUIS OF (1797-1863), bore an eminent, though not a leading, part in some of the greatest movements of this century. As governor of Jamaica he had charge of the distribution of the huge compensation to owners upon the abolition of slavery in the West Indies; it fell to him as lord-lieutenant of Ireland to give effect to the Catholic Emancipation Act; he was English ambassador at Paris during the revolution of 1848, and minister in Tuscany in the years immediately preceding the struggle for Italian unity. The son of the first earl Mulgrave, and born 15th May 1797, he passed through Harrow and Trinity College, Cambridge, and sat for the family borough of Scarborough as soon as he attained his majority. But, speaking in favour of Catholic emancipation, and dissenting in other points from the family politics, he thought proper to resign his seat, and went to live in Italy for some two years. Returning in 1822, he was elected for Higham Ferrers, and made a considerable reputation by political pamphlets and by his speeches in the House. He was returned for Malton at the general election of 1826, and enrolled himself among the supporters of Canning. Previous to this, in 1825, he made his appearance as a novelist with *Matilda*; and three years later, in 1828, he produced another, *Yes and No*. Of the brilliant band of fashionable novelists who started up as by a common impulse in those years, including Ward, Lister, Bulwer, Disraeli, Lord Normanby was probably the least impressive; yet his *Matilda* ran through four editions in a year. There is a certain stiffness in the construction of his novels, as if he were either deficient in the story-teller's vivacity and fertility or, oppressed by his own sense of dignity, over-fastidious in his theory of composition. The novels are comparatively short, and move forward steadily to tragic catastrophes that present themselves ahead from a very early stage in the journey. The moral is so obtrusive that they may almost be called sermons in disguise. Especially is this true of *Yes and No*, in which two opposite types of character, the man who says "Yes" with too great facility, and the man who says "No" with too great obstinacy and suspiciousness, are very skilfully contrasted. It was chiefly character that he aimed at, as became a statesman, and his characters were drawn with fulness and keen insight, though not without too much appearance of labour.

A speech put into the mouth of one of his characters expresses very fairly Lord Normanby's political creed, a creed not uncommon among the aristocracy at the time of the Reform Bill: "I can't help thinking it but befits a gentleman to move methodically forward with the main body of the age in its regular march of mind, neither seeking foolish forlorn hopes in advance, nor lagging disgracefully in the rear." Acting on this principle, Lord Normanby reached the zenith of his career between the age of thirty and forty; after that he began to lag and to decline in political reputation. He succeeded his father as Earl Mulgrave in 1831, was sent out as captain-general and governor of Jamaica in the same year, and, in spite of certain defects of manner, gained such credit as an administrator that he was appointed lord-lieutenant of Ireland in 1835. It is significant of the reputation he then held that his appointment was received with enthusiasm as the beginning of a new order in Ireland; and during his three years of office, one of the most peaceful periods in the history of Ireland, great improvements were made. It is disputed how much was due to him and how much to his subordinate Thomas Drummond. He was created marquis of Normanby in 1838, and held successively the offices of colonial secretary and home secretary in the last years of Lord Melbourne's ministry. From 1846 to 1852 he was ambassador at Paris, and from 1854 to 1858 minister at Florence. He died in London, 28th July 1863. The publication in 1857 of a journal kept in Paris during the stormy times of 1848 (*A Year of Revolutions*) brought him into violent controversy with Louis Blanc on questions of fact as well as of policy; and his controversies with Lord Palmerston and Mr Gladstone, after his retirement from the public service, on questions of French and Italian policy, showed him to have fallen behind "the regular march of the mind" of his age.

NORMANDY (*Terra Northmannorum*, *Northmannia*, *Normannia*, *Normendie*, *Normandie*) is the name which was given to part of northern Gaul in consequence of its occupation in the early part of the 10th century by the Northmen, whose name was on Gaulish soil gradually changed into Normans. Till that time the land which has ever since borne the name of Normandy had no distinct name, nor any separate political being. In ecclesiastical geography it answers very nearly, but not quite exactly, to the province of Rouen. This includes the archdiocese of Rouen and the six suffragan dioceses of Evreux, Lisieux, Séez, Bayeux, Coutances, and Avranches. Politically it was, at the time of the Scandinavian settlement, part of the great duchy of France, of which it took in nearly the whole of the sea-coast. The name "Neustria" is sometimes used as equivalent to Normandy; but of the old Neustria Normandy formed only a small part. As France was cut off from Neustria, so Normandy was cut off from France.

Normandy, in its widest extent, reached on the eastern side to the rivers Eu and Epte, of which the Eu empties itself into the English Channel near the town of that name, while the Epte flows in the opposite direction and joins the Seine near Vernon. These streams form the boundary during nearly, but not quite, the whole of their course. Along the Epte the boundary of the duchy forsakes that of the ecclesiastical province, as the diocese of Rouen stretched a considerable way on the French side of that river. To the west Normandy is parted from Britanny by the border stream of Couësnon, but the shape of the coast makes the actual frontier very small. To the south the boundary of Normandy towards the duchy of France and the great counties which were parted off from it mainly followed the ecclesiastical frontier. But the diocese of Séez stretched beyond the duchy, while the conquests of William I. added to Normandy part of the diocese of Le Mans, and therefore of the province of Tours. The land thus marked out took in the districts of Caux, Talou, Rouen, Evreux, Lisieux, Bayeux (Bessin), Avranches, and Coutances (Cotentin, *pagus Constantinus*), with the greater part of the Hiesmois and about half the Vexin. This last was often a disputed ground between Normandy and France.

But the main feature of the country is its sea-coast and its great river. A glance at the map (Plate XIII., vol. ix.) will show that the coast of Normandy, long as it seems, is little more than the mouth of the Seine. To the west that mouth is guarded by the peninsula of Coutances, the Danish land which, it has been remarked, is the only peninsula in Europe, besides the older Danish land, which points to the north. To the west this peninsula presents a bold front to the Atlantic, forming with the Breton coast a bay in which lie the Norman islands, Jersey, Guernsey, Alderney, Sark, and some smaller ones. Normandy, in fact, was the seaboard of France in the strict sense, the coast lying between Britanny on the one side and Flanders on the other. It is that part of the Continent which lies most directly opposite Britain. The Norman duchy, in short, as long as it had an independent being, was interposed between England and France; and in that position lies the key to its whole history.

The chief city of the duchy was always the ecclesiastical metropolis of Rouen (*Rothomagus*), the great city of the lower Seine. It is to be noticed that Rouen, like the cities of southern Gaul, keeps its own local name and has not taken the name of a tribe. Evreux, Séez, Bayeux, Lisieux, Avranches, preserve tribe names. The name *Constantia* or Coutances belongs of course to the later Roman nomenclature of imperial times. Other towns which figure in Norman history, as Caen, Falaise, Alençon, are of later origin. Havre de Grâce dates only from the 16th century, long after the loss of Norman independence.

In the divisions of modern France, Normandy answers to the departments of Lower Seine (cap. Rouen), Eure (cap. Evreux), Orne (cap. Alençon), Calvados (cap. Caen), Manche (cap. St Lo), and to the modern dioceses of Rouen, Evreux, Séez, Bayeux, and Coutances. The boundaries of Rouen and Evreux have been changed; Lisieux has been joined to Bayeux, and Avranches to Coutances. The archbishop of Rouen still keeps the title of primate of Normandy; otherwise the name of the duchy has gone out of formal use.

It must be remembered that the land to which the Northmen thus permanently gave their name was only one of several Scandinavian settlements in Gaul, though it was the greatest and the only lasting one. Nor was the whole of the land which became the Norman duchy occupied at once. The whole second half of the 9th century was largely taken up in both Gaul and Britain with Scandinavian inroads, which in both countries led to important Scandinavian settlements. Settlement in Britain came first, and the great settlement in Gaul seems to have been made after its model. By the peace of Wedmore, Ælfred found his own West-Saxon kingdom untouched and indeed enlarged. But a large part of England, over which he claimed at most a vague external supremacy, was left to the Danish invaders. Their king embraced Christianity, and, like his English predecessors, accepted a formal West-Saxon supremacy. A variety of later causes made the history of the Scandinavian settlement in England to differ widely from that of the Scandinavian settlement in Gaul; but in their beginnings the two are exactly alike. The smaller Scandinavian settlements, those of Hasting at Chartres, of Ragnald at the mouth of the Loire, had no historical importance. The settlement of Rolf at Rouen grew into the duchy of Normandy. The treaty of Clair-on-Epte followed the model of that of Wedmore. The Scandinavian invader embraced Christianity, and he became the man of the king of the Western kingdom. But he received no part of the king's immediate territory. His settlement was made wholly at the cost of the duke of the French. The only difference was that the duke of the French still went on reigning at Paris, though no longer at Rouen, while the English dynasties of Mercia, East Anglia, and Deira came altogether to an end. But the two settlements are exactly alike in this, that the converted Northman becomes the man of the king, though the settlement is not made at the cost of the king's immediate dominions. In both cases the king is strengthened, though in different ways. The West-Saxon king received an actual increase of immediate territory in the shape of that part of Mercia which formed the lordship of Æthelred and Æthelflæd. The Carolingian king received no increase of territory, but his position was distinctly bettered when the great and threatening duchy of France was split into the two rival duchies of France and Normandy. That Normandy was cut off from France in the strict sense, from the duchy of the house of Paris, is a point in its history which must always be remembered. It is the key to that abiding rivalry between France and Normandy which was inherent in the position and history of the two lands. No momentary policy on the part of their rulers could ever get over it. It lived on in truth to become no unimportant element in the general history of Europe. The close connexion which arose between Normandy and England handed on to England the inheritance of rivalry which had first begun between France and Normandy, an inheritance which England kept in its fulness for ages after its separation from Normandy. It is likely enough—considering the position of the two kingdoms, we may call it certain—that, had a separate state of Normandy never existed, a rivalry between England and France would have arisen out of some other cause. As a matter of fact, it was out of the older rivalry between France and Normandy that it did arise.

The settlement of Clair-on-Epte and the beginning of the Norman state are commonly placed in the year 912. There seems some reason to think that it may have happened a few years later. There is no thoroughly trustworthy account. The writers in the Western kingdom plainly say as little as they can about the matter; they disliked the very name of the "pirates," as the Normans are called by Richer of Rheims down to the end of the century and beyond it. The earliest writer on the Norman side is Dudo, dean of St Quentin, who wrote late in the century, a rhetorical writer of the courtly school. But there is no doubt that the chief of the Scandinavian settlers was Rolf (in various spellings), known in Latin as Rollo and in French as Rou, a viking leader to whom many earlier exploits, real or mythical, are attributed. He received, as a grant from Charles the Simple, king of Carolingia or the Western kingdom, a tract of land of which Rouen was the centre and head, a tract certainly stretching as far as the Epte to the east, most likely stretching as far as the Dive to the west. It is an important part of the case that, though the land was cut off from the duchy of France, yet the grant was a grant from the king and not from the duke of the French, and that the king and not the duke received Rolf's homage. The two princes were presently at war, Robert, duke of the French, having been elected as opposition-king in 922. Rolf seems to have stuck faithfully to his own lord, King Charles, alike against Robert and against Robert's son Hugh, called the Great, and the king, Rudolf of Burgundy, whom Hugh set up. The Normans were thus at war with France almost from the moment of their settlement, and they were rewarded by a further acquisition of territory at the expense of the French duchy, namely, the Bessin or land of Bayeux. France was now nearly or wholly cut off from the sea. The Norman princes further claimed, by virtue of these early grants, a supremacy over both Britanny and Maine, which they were never able fully or lastingly to enforce.

Of the nature of the settlement made by the Northmen in the part of Gaul which they changed from France to Normandy we can judge only by the results. The new state for a while had no recognized territorial name. To the end of the century it is simply "Terra Northmannorum." "Northmannia," a name which with Einhard meant Denmark, which in Adam of Bremen commonly means Norway, becomes, in the shapes of "Nortmannia," "Normannia," "Normendie," and the like, fully established in the next century as the name of the Norman land in Gaul. In English chronicles it appears as "Ricardes land," from the princes of that name; it is not "Normandi," "Normandie," "Normandig," "Normandige," till after the Norman Conquest. The chief again has no certain titles; at Rheims he was "princeps Northmannorum," or, more heartily, "dux piratarum." In the next century he becomes regularly "dux" or "comes Normannorum"; that is, he was "dux" as regards the Norman people, "comes" as regards his overlord the Western king. The people become definitely "Normanni," "Normend." It is not easy to say to what extent the Scandinavian settlers became mingled with the earlier occupiers of the land, or again how far those earlier inhabitants were of Frankish and how far of Celtic descent. It is plain that the land was parted out among Scandinavian landowners very much as in the Danish districts of England, and many places, just as in those districts, keep the name of the first Scandinavian lord. And it can hardly fail that, after the long harryings which went before the actual settlement, the population of the lands which lay open to the Northmen must have become scanty, and many parts are likely to have been quite forsaken. On the other hand, it is certain that before the end of the 10th century there was an oppressed peasantry in the land, and it is hardly likely that descendants of the original conquerors could have sunk so low in so short a time. The actual tillers of the soil were most likely to a great extent descendants of the earlier inhabitants; that is, they would belong to the same mixed nationality as the people of the duchy from which Normandy had been cut off, to that mixture of Celtic, Latin, and Teutonic elements which has formed the modern Frenchman. Yet in Normandy, as elsewhere, the tendency would come in which makes the actual cultivators of the soil sink rather than rise, and it is by no means unlikely that the later peasantry of Normandy were largely the descendants of the Scandinavian conquerors. Anyhow, a nobility gradually sprang up among the Normans themselves, consisting chiefly, it would seem, of those who could claim any kind of kindred or affinity, legitimate or illegitimate, with the ducal house. Some of the greatest Norman houses sprang from kinsfolk of wives or mistresses of the dukes who were themselves of very lowly degree. This is always likely to happen when a nobility is first forming. Early in the 11th century the order of "gentlemen" as a separate class seems to be forming as something new. By the time of the conquest of England the distinction seems to have been fully established.

The Norman, with the softened form of his name, is distinguished from the Northman by his adoption of the French language and the Christian religion. In the case of Rolf himself, as in the case of Guthrum, his baptism formed one of the terms of the agreement. The convert took the name of Robert, from the duke of the French, who acted as his godfather; but, as in other cases of baptized Danes, he was still always spoken of by his earlier name. Whether Rolf himself learned French we are not told; his language at the time of his homage is spoken of as English. This doubtless means any Low-Dutch or Scandinavian tongue, as opposed alike to High-Dutch and to French. Among his followers the twofold change took place with very different degrees of speed in different parts of the duchy. At Rouen and Evreux and in the eastern part generally, the first grant to Rolf, the change seems to have been very speedy. In some other parts circumstances made it much slower. Thus, at Bayeux it would seem that an earlier Saxon colony coalesced with the Scandinavians; at all events, a Teutonic tongue of some kind lived on there long after Rouen had come to speak no tongue but French. In the Cotentin, a still later acquisition, both the Northern speech and the Northern creed were kept up by fresh settlements from Scandinavia. The result was a wide distinction between the eastern and the western, the French and the Scandinavian, parts of the duchy, which led to important political consequences as late as the reign of the Conqueror.

The Cotentin, with its appendage of the Channel Islands, seems not to have been added to the land of the Northmen till after the accession of its second duke, William surnamed Longsword, about 927. Whether Rolf died, or abdicated, or was killed in battle, and the exact date of his son's accession, do not seem clearly fixed. The certain point is that William became the man of King Charles in 927, and that he refused all allegiance to the rival king, Rudolf of Burgundy, as long as Charles lived. His own reign lasted till 943. It is one of the most confused periods in the history of Gaul, and a good deal of the confusion is owing to the shifting policy or caprice of William himself. He changed sides more than once in the struggles between Lewis, the Carolingian king at Laon, and the more powerful Duke Hugh of Paris. At last, there can be little doubt, he was murdered by the practice of Count Arnulf of Flanders. In Normandy itself the history and effects of his reign are more marked. We see the struggle between the heathen or Danish party and the Christian, which may be also called the French, party. By this must be understood the party of the French speech and French civilization, not at all a party in the political interest of France. Its policy was to make Normandy a Christian and French-speaking state, an independent member of the Western kingdom, alongside of France and Flanders. The two parties are distinctly marked as geographical. The first years of William's reign are marked by a revolt of the heathen party, who demand the cession of the lands west of the Risle. The Christian and French-speaking duke might reign in the region which had adopted his creed and tongue; the western Normandy should form a separate state, heathen and Scandinavian. Though all this rests on the not very high authority of Dudo, it bears the stamp of truth; it falls in with facts earlier and later; it is not the kind of story to grow up in the hands of a rhetorical panegyrist. William, successful over the rebels, appears as a Christian, not without fits of special devotion, and as anxious to take his place among the great princes of the Carolingian kingdom, notwithstanding the reproach of pirate origin that still cleaves to him. Yet he does not show himself the enemy of the other side. Himself speaking both tongues, he has his son Richard sent to Bayeux to gain a fuller mastery of the Northern speech, and he seems even to have admitted fresh settlement from the North in the western part of the duchy. The deep and clearly intentional darkness in which contemporary writers at Rheims leave the Norman history of this period makes any minute knowledge of this reign quite hopeless. But we may safely set it down as a time of struggle between the two elements in the land, a time in which things, on the whole, tended to the strengthening of the Christian, French, eastern element,—the influence of Rouen and not that of Bayeux.

It was the long reign of William's son, Richard the Fearless, which finally settled the position of Normandy and which had no small influence on the position of France. We must always remember that Normandy and France were alike vassal states of the Western kingdom, the kingdom of the Carolingian king at Laon, a king who, in all but the moral influence of his kingly dignity, was a prince of far smaller power than either of his mighty vassals. Normandy, rent away from France, bound by direct homage to the king at Laon, had hitherto been on the whole an ally of the king who dwelled beyond the dominions of the duke. The fifty years of Richard's reign changed all this. For the events of its early days we are not left wholly to Dudo; the writers at Rheims tell us enough to show that the division between the heathen and the Christian Normans was still strongly marked. The heathen party, strengthened by a new band of settlers from the North, got hold of the young Richard and persuaded or compelled him to fall back to his heathen worship. Richard was the son of William by a Breton mother, one who stood to his father in that doubtful relation which was called the Danish marriage, and who might be spoken of as wife or concubine at pleasure. At Rheims she bore the harsher name; yet it is a matter of avowed record that her son was received as his father's successor by King Lewis. But the young duke —it is hard not to give him the title, though it is perhaps premature—was presently got hold of by the heathen party, who were just then strengthened by a fresh settlement from the North. The Christians sought help both at Laon and at Paris; king and duke entered the land, seemingly in concert, in two successive years (943, 944). The heathens were defeated; the king occupied Rouen and the whole Norman land, doubtless with the intention of keeping it. Nothing could better suit the king of Laon than to rule at Rouen as well, and to hem in the duke of Paris on both sides. The Norman writers tell a romantic tale of the escape of young Richard from captivity at Laon. What is more certain is that Normandy soon rose against Lewis, and that, by the help of a Danish leader, in whom the Normans see the famous king Harold Blaatand, the king was defeated and made a prisoner. The policy of Hugh of France now obtains possession of Lewis and a commendation of Richard to himself. Lewis was released on surrendering Laon; his kingdom was cut down to Compiègne. In 946, in alliance with the Eastern king Otto, the future emperor, Lewis invaded France and Normandy, but the forces of the two kings failed before both Paris and Rouen.

These events fixed the position of the Norman duchy for some time. It is not clear whether Richard, along with the other princes, renewed his homage to Lewis; it seems certain that he became the man of the duke of the French. Things are thus turned about; Rouen, lately friendly to Laon and hostile to Paris, is now friendly to Paris and hostile to Laon. Normandy is the faithful and powerful ally of France under its successive dukes, Hugh the Great and Hugh Capet. The Norman duke is the son-in-law of the elder, the brother-in-law of the younger, of the French princes. It does not appear that Richard ever did homage to King Lothair, the successor of Lewis; he once at least, in 961, appeared in arms against him. At last, in 987, came the change which united the duchy of France with the Western kingdom. Hugh of Paris was chosen to succeed to the crown of the last Lewis of Laon. This revolution, so often mistaken for a mere change of dynasty, was in fact the making of a nation. And in the making of that nation the Norman duchy had no small share. The close union between Normandy and France which had been brought about by Hugh the Great had a double result. It made Normandy French; in the end it made Gaul French. Up to this time Carolingia had been a kingdom of many nations and languages. The kings of Laon were still German; they relied on German memories, on the slight German element still left in their kingdom, on the support of the German king beyond the Rhine. The great county of Flanders, stretching much further to the south than the present use of that name, was a land of the Nether-Dutch speech. The Bretons in the extreme west kept the Celtic tongue which they had brought over from the greater Britain. The lands south of the Loire, nominally part of the kingdom, but seldom playing any part in its history, kept their own variety of the Romance speech, and a national spirit altogether distinct from anything in northern Gaul. Most central of all lay the duchy of France, the land of which Paris was the centre and the cradle, the land of the new-born French speech and French nationality. The supremacy of Gaul was not likely to fall either to its Celtic or to its Nether-Dutch element; it might well fall either to its High-Dutch, its French, or its Aquitanian element. The close alliance between Hugh and Richard, between France and Normandy, determined to which element it should fall. Had Normandy remained Scandinavian, France, hemmed in between Teutonic Laon and Teutonic Rouen, might never have reached to the headship of Gaul. But Richard's French alliance settled the question between French and Scandinavian in Normandy. Normandy, itself become French, turned the balance in favour of the French element; it ruled that France should be the head power of Gaul, that the duke of the French and the king of the French should be the same person. The first creation of Normandy, a power shorn off from France and shutting out Paris and the whole duchy from the sea, had been a frightful blow to the French power. But the loss was more than made up when the policy of Hugh the Great won back as an ally what he had lost as a ruler, when he was chosen king by the help of the Norman duke, and when his election as king meant the final establishment of France as the leading state of Gaul, of French as its leading speech, of Paris as its ruling city.

This good understanding between France and Normandy, at all events between the kings of the French and the dukes of the Normans, lasted through the reign of Richard the Fearless, through the reigns of the second and third Richard and that of Robert, till the accession of Robert's son, William the Bastard, afterwards known as the Conqueror and the Great, in 1035. The duke is now the most faithful and the most cherished vassal of the king. His vassalage is not doubtful. If Richard the Fearless, after the recovery of his duchy, no longer acknowledged the supremacy of King Lewis of Laon, he had cordially commended himself to Duke Hugh of Paris. When the second Hugh became king, it would have been a mere question of words whether the homage of the Norman vassal was due to the French lord in his kingly or in his ducal character. More than once during this period the Norman dukes appear as the powerful helpers of the Parisian kings. They date their charters by the years of the kings, and recite the consent of their lords to their grants and other acts. All this is to be carefully noticed, because at a later period of Norman history, the period when Norman history is most closely connected with English history, all is different.

Yet English dealings both with France and Normandy began early. In the disputes of the early days of Lewis, his uncles Æthelstan and Eadmund successively interfered on his behalf, and, so far as France and Normandy were the enemies of Lewis, this was English interference directed against both Normandy and France. But direct dealings between England and Normandy begin at a later time, in the latter days of Richard the Fearless. A dispute between Richard and the English king Æthelred which arose about 991 is said to have been hindered by the intervention of Pope John XV. from growing into a war. There can be little doubt that the quarrel arose out of the close connexion which still went on between Normandy and the Scandinavian North. The Danish invaders of England were received with welcome in Norman havens and were allowed to sell the plunder of England to Norman buyers.

Richard the Fearless died in 996, known to the last at Rheims only as duke of the pirates. Yet he had made his duchy Christian and French. It might be too much to say that every trace even of heathen worship, much less of Danish speech, had died out from the lands of Bayeux and Coutances. The speech at least, we may be sure, lingered some time longer, the more so as we hear of fresh Danish settlements in the latter days of Richard. And, even if speech as well as creed died out, the two left behind them the tradition of local distinction and local enmity between the eastern and the western parts of the duchy. The true Normandy, the land which was still in some measure Teutonic, began on the left bank of the Dive. But Normandy as a state was Christian and French. The French speech of Rouen gradually supplanted the Danish speech of Bayeux. Yet, as commonly happens in such cases, a few Teutonic words, chiefly words of seafaring life, now crept into the Romance tongue of northern Gaul, in addition to the far greater infusion which had found its way in ages before as a result of the Frankish conquest. In Normandy itself the local nomenclature became Teutonic to an extent which makes itself felt on the map. Scandinavian endings like *toft* and *by* live on in the shape of *tôt* and *bœuf.* and they are constantly coupled, like the *by* of Lincolnshire and the *ton* of Pembrokeshire, with the names of Scandinavian settlers. Even in the most French part of the duchy, some places, like Caudebec and Dieppe—the *cold beck* and the *deeps*—keep Teutonic names under a very slight disguise. And the Conqueror's own Falaise, bearing a name which has passed into the general vocabulary of the French tongue, is simply the Teutonic *fals*, whether the name dates from Frankish or from Norman settlement.

Of one effect of the reign of Richard the Fearless we get a picture in the peasant revolt (which has been already spoken of) which marked the beginning of the reign of his son Richard the Good (997). A peasant revolt implies masters, and harsh masters. It is hard to say how far the distinction of oppressor and oppressed coincided with distinction of race; but it is certain that the movement had some special and promising features. The peasants of Normandy set up a *commune*—or something to which later writers gave a name which became afterwards so well known—more than sixty years before the burghers of Le Mans did the like. We seem to be reading the history of Friesland or of the Three Lands rather than that of any part of the Western kingdom. But the revolt was fully and harshly put down, and the rule of the "gentlemen" was made safe. It is noticed that Richard the Good would have none but gentlemen about him. This seems to mark the final establishment in Normandy, as in other lands, of the new nobility, the nobility of office, or rather the nobility of kindred to the sovereign. We soon begin to trace the history of the great Norman families, only one or two of which can be seen, and that dimly, before Richard the Good. It illustrates the origin of Norman nobility that Rudolf of Ivry, who put down the revolt, was the duke's uncle, but only because his father, a miller, had married the cast-off wife or mistress of William Longsword. So at least the story goes, and a story of this kind is sure to have this kind of truth; such a rise as it describes was possible and likely. After all, it may be that the revolt was not a mere failure. Villainage in Normandy was both lighter and died out earlier than in most parts of France.

The thirty years of the reign of Richard the Good continue the period of unbroken friendship between Normandy and France, and also between Normandy and Britanny. But we find the Norman duke warring, sometimes on his own account, sometimes as the ally of the French king, with his neighbour of Chartres, and in the more distant lands of the ducal and even the royal Burgundy. His relations with the North and with England are of more consequence. Richard is charged with bringing two heathen sea-kings, one of whom is said to have been afterwards the famous Saint Olaf, as helpers against Chartres; we hear also of a second quarrel with Æthelred, and even of an English invasion of the Cotentin. It is more certain that in 1002 Æthelred married Richard's sister Emma, a marriage which may be set down as the first link in the chain of events which led to the Norman conquest of England. Eleven years later, when Æthelred was driven from his kingdom, he found shelter with his wife and her children at the court of his brother-in-law. Soon after Æthelred's death and Cnut's establishment in England, Emma married Cnut. Unbroken peace reigned between Cnut and Richard, and Emma's children by Æthelred, Ælfred and Eadward and their sister Godgifu, were brought up at the court of their Norman uncle,—another stage in the drama of the Norman Conquest.

The short reign of Richard's son Richard (1026-1028) was marked only by disputes between the duke and his brother Robert, count of Hiesmes, who presently succeeded to the duchy. He too maintained the French alliance, and restored King Henry to his crown when he was driven from it by his stepmother Constance. But friendly relations both with Britanny and England now ceased. Robert seems to have married and put away Estrith, the sister of Cnut, either before her marriage with Earl Ulf or more likely after his death. This led to a quarrel between Robert and Cnut, and to an attempted invasion of England on behalf of the banished Æthelings, the sons of Æthelred and Emma. Robert at last made the pilgrimage to Jerusalem, and died on his way back in 1035. He had already made the great men of Normandy swear to the succession of his natural son William, born to him of Herleva of Falaise before his accession to the duchy. William the Bastard, one day to be the Conqueror, was about eight years of age at the death of his father.

There can be no doubt that the succession of William was most unwillingly accepted. It was the acceptance of one who was at once bastard and minor. The law of hereditary succession was nowhere very distinctly defined; but it is clear that the notion of some kind of hereditary succession, as distinguished from election even within a particular family, had made much greater advances in Normandy than it had in England. No princes were more lax as to marriage than the Norman dukes; both William Longsword and Richard the Fearless were the offspring of unions which were very doubtful in the eye of the church, and Richard the Good and the other children of Richard the Fearless were legitimated only by the after-marriage of their parents. But the son of Robert and Herleva was pre-eminently the Bastard; there was no pretence of marriage of any kind. He was accepted, so far as he was accepted, simply because there was no candidate whose right was so distinctly better than his as to unite the whole country on his behalf. Of the other member of the ducal kindred, some were themselves of doubtful legitimacy, while others could claim only through the female line. The result was that the minority of William was a time of utter anarchy, of plots, rebellions, public and private crimes of every kind, but that the young duke was never altogether set aside for any other claimant. And now for the first time since the very earliest days of the Norman state we find France unfriendly. The whole relations between the two powers change from the time of William's accession. It could not be in the beginning the personal act of the boy William himself. But the fact that William came to the duchy as a child had very likely a good deal to do with the change. The alliance had never been a natural one; it had been alliance between prince and prince rather than between people and people, and now, during William's minority, there was no prince in Normandy ready to do to the ruler of France such good service as had been done by earlier Norman princes. While the princes were personal friends circumstances might make it convenient to forget that Normandy was a land lopped away from France; as soon as those circumstances had passed away the French kings and the French people again remembered that Rouen barred the way between Paris and the sea. For a while each power stood in need of the other. Normandy owed to France its introduction into the Christian and Romance-speaking world. France owed to Normandy its new position among the powers of Gaul. As the remembrance of these benefits on each side passed away, the far more natural feeling of rivalry and dislike showed itself again. After the accession of William there still are periods of friendship between France and Normandy; but they alternate with more marked periods of enmity. The steady and faithful alliance is at an end; it is significant that the name of the French king disappears from the charters of the Conqueror. If an immediate occasion of quarrel was at any time needed, it could always be found in the disputed frontier of the Vexin, the border district between Rouen and Paris. Old grievances are rubbed up again. Norman pride tells the tale of the Norman settlement, of the humiliation of the dukes and kings of Francia. French enmity finds scornful epithets for the intruders who had cut off so goodly a land and so great a city from French dominion.

The first sign of this revival of the older and more natural feeling was shown when King Henry took advantage of the weakness of Normandy to advance his fortune at its expense. From this time the relations between king and duke are, among a good many shiftings, more often hostile than friendly. It was also during William's minority that the attempt of the Ætheling Ælfred on the English crown took place. He went with Norman companions, and in some accounts the enterprise swells into a Norman invasion. At all events, it marks another step towards a greater Norman invasion.

The ill feeling towards William finally broke out when he had reached an age to act for himself. This was in 1047, and the movement is one of special interest and importance, as bringing out more strongly than anything else the long-abiding distinction between the two parts of the duchy. Eastern or French Normandy, the land of Rouen and Evreux, clave to William; western or Teutonic Normandy, the land of Bayeux and Coutances, rose against him. The stirrer up of strife was Guy of Brionne, son of Reginald, count of the Burgundian palatinate, by a daughter of Richard the Good. The plan seemingly was that Guy should supplant William in the eastern district, and should leave the barons of the west to themselves. William asked and obtained help of his lord, the king of the French. It is not easy to see why Henry, who had hitherto acted an unfriendly part towards Normandy and who before long acted it again, should have stepped in, when the dismemberment of the duchy would seem to have been just what he would have wished. However this may be, the rebels were overthrown in the fight of Val-ès-dunes by the joint forces of king and duke; the power of William over his duchy was fully established; and, though a difference may to this day be seen between the two parts of Normandy, they never again appeared in open strife against one another.

That part of the reign of William which comes between the battle of Val-ès-dunes and the invasion of England was the great day of Normandy as a wholly distinct and practically independent power. Under the wise and vigorous rule of its great duke the duchy became one of the most flourishing parts of Gaul and of Europe. We can now for the first time call up a fairly distinct picture of the country. The great Norman families, many of whom afterwards won a second establishment in England, now stand out distinctly. They are wealthy and powerful, but under William's rule they are made to feel that they have a master. Many of them, as we have seen, were the duke's kinsfolk; some were favourites of his own advancing. The counts of Eu and of Evreux, the lords of Beaumont, Grantmesnil, and Conches, the viscounts of Avranches and Saint-Sauveur, stand out among many others. Greater than all was the mighty house that was formed by the union of the houses of Montgomery and Bellême, a house holding lands both of Normandy and of France, and ranking rather with princes than with ordinary nobles. Of those raised by William himself, we see his personal favourite William Fitz-Osbern of Breteuil, and his half-brother Robert, to whom he gave the county of Mortain, while his other half-brother Odo held the bishopric of Bayeux. These were the sons of Herleva by her husband Herlwin of Conteville, whom she married after the death of Duke Robert. That side of the feudal theory by which the noble holds of the prince and does military service for the lands which he holds was never better carried out than it was in Normandy under William. But under him the great lords were not only vassals but subjects. The reign of law was enforced; the towns grew and trade flourished; the settlement of foreigners was encouraged; Duke William in his own duchy showed all the great qualities which enabled him to become the conqueror and the ruler of England, without that darker side of his character which necessarily followed on his position as conqueror.

Nowhere do these qualities stand out more clearly than in his dealings with the church. William was neither the enemy nor the slave of the ecclesiastical power. He held the supremacy over the spiritual estate with a firm hand. He had the great advantage that the prelates of Normandy were his vassals and subjects, holding their temporal estates of him and not of a king or emperor beyond his dominions. He was advocate of all his own churches; he bestowed them at his will, and held firmly to the right of investiture. But he was a church-reformer in the best sense. He chose the best men from all lands for the bishoprics and abbeys in his gift. Among those whom he promoted and befriended are the great names of Lanfranc and Anselm. Up to this time the Norman bishoprics had been used as provisions for cadets and kinsmen of the ducal family, a custom of which the promotion of his own half-brother Odo during his minority was one of the last and most scandalous examples. Devout and strict in his own life, William backed up every effort for the enforcement of discipline and the improvement of morals. His reign was the great time for the foundation of the Norman monasteries. Some, as Jumièges, Cerisy, Bernay, Mont St Michel, are of older date; but now every noble became the founder of a monastic house. The duke's own foundation of St Stephen's at Caen was among the foremost. In short, during the reign of William Normandy was looked on as an ecclesiastical paradise. It is certain that in no part of Europe was law, temporal and ecclesiastical, more strictly enforced.

This time was also a time of wars, during which the borders of the duchy were enlarged. For a short time the friendship with France went on. William repaid the king's help at Val-es-dunes by help in his wars with Geoffrey of Anjou. This led to a long rivalry between Anjou and Normandy, which largely took the shape of a struggle for the county of Maine, which lay between the two. As early as 1048 William extended his frontier in that direction; in 1063 he obtained possession of Le Mans and the whole county. Meanwhile he had two wars with France. Henry encouraged Norman rebels, and twice, in 1054 and 1058, he invaded Normandy, each time to suffer defeat. At the time of the invasion of England Normandy was strengthened by the weakness of its neighbours. The crown of France had passed to the minor Philip, and Anjou was divided and torn in pieces by civil disputes. The duchy, under its great duke, was at the very height of its power, prosperity, and renown when the duke of the Normans won himself a higher title.

The conquest of England by William had no direct effect on the internal condition of Normandy; but it altogether changed the position of the duchy as a European power. Save for three short intervals, it never was again a wholly distinct power with a prince to itself. So far its position may be said to have been lowered; but, on the other hand, it became part of a power far greater than the single duchy of Normandy had ever been. For a while England in some sort followed Normandy; the common sovereign of the two lands could use the strength of England for Norman purposes. Then, under the Angevin house, Normandy and England alike became parts of one of those motley dominions, like that of Burgundy under the Valois dukes or of Austria in yet later times, in which a crowd of separate states are brought together without any tie but that of a common ruler. The result was that Normandy, after handing on to England its tradition of enmity towards France, itself fell back into its old union with France. And it must not be forgotten that Normandy after the Conquest of England was in itself much less strong than Normandy before the Conquest of England. A great part of the goodness, so to speak, of the land had crossed the sea into the conquered kingdom.

The rule of King William in his duchy was on the whole less prosperous than that of Duke William had been. His later years were clouded by revolts and occasional defeats. Maine revolted in 1073, and one stage of the revolt is memorable, because William had to strive, not with a rival prince, but with a commonwealth. Le Mans set up the first *commune* north of the Loire. But city and county were won back, largely by the work of Englishmen, whom the Conqueror, after overthrowing their own freedom, used to put down freedom elsewhere. In 1076 he was defeated in an attempt on Dol by the forces of Britanny and France. The next year followed the revolt of his own son Robert, and a border warfare on the frontier of Mortagne. In 1083 a single castle in Maine, that of Sainte-Susanne, successfully withstood him for three years. In 1087 the old dispute with France about the Vexin again arose, and cost William his life at Mantes. But, though this is a different picture from the uninterrupted success of the earlier part of his reign, there is no reason to think that the general peace and prosperity of the duchy was at all disturbed. The fighting was wholly on the borders, and it must have done much less damage to the country at large than the two French invasions of the earlier period.

With the death of the Conqueror the most flourishing state in western Europe became the most wretched. William's successor Robert was incapable of government. The land fell back into the same kind of anarchy which had been during William's minority. It was torn in pieces by private wars. More remarkable was the attempt of the city of Rouen to claim the position of a separate commonwealth, as Le Mans had done some years before. Some parts of the duchy were saved from anarchy by dismemberments which transferred them to other rulers. Robert sold the Cotentin to his brother Henry, by whom it was lost and recovered more than once. His other brother, King William of England, in two invasions occupied a large part of the country. Maine revolted again, but the *commune* of Le Mans was not restored; independent counts ruled once more. At last in 1097 Robert went with the crusade, and mortgaged the whole duchy to William, who occupied the country and restored some kind of order. He recovered and lost Maine more than once in warfare with its count, Helias. The death of William Rufus in 1100 again separated Normandy, England, and Maine. Robert came back to Normandy, but his misgovernment again raised up enemies against him. Henry invaded Normandy, and by the battle of Tinchebrai in 1106 the kingdom and the duchy were again united. It seems that Henry scrupled to take the title of duke while Robert lived, and he lived a captive in England till a year before the death of Henry himself in 1135. But Henry was none the less the ruler of Normandy, and he made the Normans pledge themselves to the succession of his children.

It was now no longer the duke of the Normans who reigned in England, but the king of the English who reigned in Normandy. England, deeply influenced and changed as she had been by the Norman Conquest, had now, under the English-born Henry, recovered her position as a power. Men at the time looked on Normandy as conquered by England, and saw in Henry's victory on Norman ground the reversal of his father's victory on English ground forty years before. And there was a sense in which this was true, even though Henry's foreign policy was directed far more to Norman than to English objects. England as a power was far greater than Normandy, and it was growing less and less Norman. It was as king of the English that the sovereign of Normandy appeared to the world at large. And under his rule the advantage which an island has over a continental dominion was plainly shown. The two great Norman rulers of the day, Henry of England and Roger of Sicily, each kept his island kingdom in perfect peace, and used his continental territory as a battle-ground. Henry's Norman rule was for many years disturbed by the claims of his nephew William, the son of Robert, whose side was taken both by several foreign princes and by a rebellious party in the duchy. Another cause of dispute was found in the affairs of another nephew, Theobald count of Chartres, son of Henry's sister Adela. Out of these questions several wars arose between Henry and Lewis VI. of France (1109-1137), supported commonly by the successive counts of Flanders, among whom William, the son of Robert, himself appears, as he held that county for a short time before his death (1127-1128). But there were intervals of peace. The treaty of Gisors in 1113 reads almost as if Lewis, in ceding to Normandy the borderland of Bellême, ceded with it all rights of superiority over the duchy. Yet in 1120 Henry found it convenient to make his son William, who had in 1115 received the homage of the Normans as his successor, himself do homage to the French overlord. William died almost directly afterwards in the White Ship, and in 1126 Henry procured the assent of his nobles to the succession of his daughter Matilda as lady of England and Normandy. She was now the childless widow of the emperor Henry V., who had been a firm ally of his father-in-law. The next year Henry married his daughter to Geoffrey Plantagenet, son of Falk, count of Anjou and Maine. Anjou, whose counts had been such dangerous neighbours to Normandy, was thus to be united to the duchy and to the kingdom. These schemes in the end took effect. On Henry's death in 1135 the claims of Matilda were cast aside; the rule of a woman was too great a novelty for either kingdom or duchy. England chose Henry's nephew Stephen, the younger brother of Theobald of Chartres. Normandy inclined to Theobald himself, but accepted the choice of England. The legitimate male line of the Conqueror was now extinct, and the stronger feeling with regard to legitimate birth which had grown up within the last hundred years hindered any such succession as that of the Conqueror himself. In earlier times Robert of Caen, Henry's natural son, renowned in England as earl of Gloucester, would have been a more obvious choice than either Matilda or Stephen. Now he could only assert the rights of his sister, and so plunge England into anarchy. The strife, which in England took a shape for which civil war is far too good a name, took in Normandy the less frightful shape of foreign invasion and conquest. Stephen's claim was from the first disputed in arms by Matilda's husband Geoffrey. Stephen showed himself in Normandy only for a moment in 1137, when his son Eustace did homage to King Lewis. Geoffrey gradually possessed himself of Normandy, partly by French and Flemish help (1139-1145). Five years afterwards he resigned the duchy to his son Henry, who the next year succeeded his father in Anjou and Maine. The next year (1152) he married Eleanor, the divorced wife of Lewis VII. (1137-1180), in her own right countess of Poitou and duchess of Aquitaine. By the union of all these territories a dominion was formed unlike anything which had been seen before in Gaul, but which, as has been remarked already, has had its parallel in later times. Duke Henry, in right of his father, his mother, and his wife, gathered together a crowd of dominions which made him far more powerful than his lord, the king of the French. But there was no connexion between the several duchies and counties that he held beyond the fact that he held them. And when presently the duke became a king the lack of unity became greater still. By the agreement which settled the strife of Stephen and Matilda, the crown of England passed at the death of Stephen to the son of Matilda. In 1154 began the memorable thirty-five years' reign of Henry II. of England. But the king of England was also himself duke of Normandy, count of Anjou, Maine, and Touraine, and in his wife's name count of Poitou and duke of Aquitaine. During his reign and that of his eldest son the connexion between England and the Continent was at once closer and wider than it ever was before or after.

With the formation of the great Angevin dominion, the being of Normandy as a separate power comes to an end. The mere union with England had not that effect in anything like the same degree. While the same man was king of the English and duke of the Normans, but had no dominions beyond his kingdom and duchy, there was nothing in the relation to wound Norman national pride. The common sovereign took his highest title from England; but his policy was apt to be directed at least as much by Norman as by English interests, and the men of Normandy could not forget that England was the conquest of their fathers. And, if English feeling could from one side look on Normandy as a conquered land and on Tinchebrai as the reversal of Senlac, it was equally easy to look on Tinchebrai as a strife between Norman and Norman, in which it was a mere accident that the chosen chief of one and the stronger Norman party, himself the son of the greatest of Norman princes, happened also to be king of the island kingdom. After all, a conquest of England by Normandy or of Normandy by England was a less grievance than a conquest of Normandy by Anjou. Normans and Angevins hated one another with the hatred of neighbours; nothing could be so utterly offensive to all Norman national feeling as the triumphant entry of Geoffrey into Rouen. Each accession which the Angevin prince made to his dominions made matters worse. Normandy became more and more a simple unit in the long roll-call of the possessions of its sovereign, and a unit marked out in a special way. It was not, like England, the possession which gave its ruler his rank among princes. It was not, like Anjou, the home of his direct forefathers. It was not, like Maine, the land of his own birth. What marked it out from his other possessions was that, while he had received all the rest by some form or other of peaceful succession, Normandy alone was a conquered land.

It is not likely that the rule of its Angevin dukes ever called forth much loyalty in the Norman duchy. There was no sign of open discontent, and Henry and Richard were not princes to be lightly thrown aside. The real greatness of the father, the shadowy glory of the son, went for something, even with subjects who had no special love for them or their house. On the death of Richard in 1199 the succession of John was admitted in Normandy, as in England, without dispute. To bring this about it was perhaps reason enough that Anjou took the side of Arthur. But John's victory at Mirabeau put an end to any hope of a division of the dominions of the Angevin house. And when Arthur, in the expressive phrase of Roger of Wendover, "vanished," when the French king took on himself the part of his avenger and declared John to have forfeited all fiefs that he held of the French crown, there was no zeal in Normandy to withstand French invasion. The king-duke, to be sure, himself showed as little zeal as any man; but the Normans of an earlier day, with or without the help of their prince, would assuredly have made a stouter resistance than the subjects of John made to Philip Augustus. With wonderful speed (1203-1204) Continental Normandy passed away from an Angevin duke to a French king. One was as much and as little a stranger as the other; and a union with the dominions of the Continental overlord might seem less ignominious than the position of one among many Continental provinces of the island king.

The whole duchy, however, was not lost. The mainland passed to the king of the French; the islands still clave to their duke. Guernsey, Jersey, Alderney, and their smaller fellows have ever since remained possessions of the kings of England, but forming no part of their kingdom. They still keep their own language, constitution, and laws, and they have never been incorporated with the United Kingdom. It is somewhat singular that the kings of England, still holding as they did part of the Norman duchy, should have so soon given up their Norman title. This was done when the treaty of Xaintes (Saintes) between Henry III. and Saint Lewis was finally carried out in 1259.

Normandy now ceases for a while to have a distinct history. But its earlier history largely influences the history which was to come. England, as England, had no real quarrel with France; but the abiding quarrel between France and Normandy had drawn England within its range. The kings and the people of England, used to fight with France in a Norman quarrel, kept on the feeling of rivalry towards France, even after Normandy itself had gone over to the other side. The fact that the English kings kept Aquitaine after the loss of Normandy—for the inheritance of Eleanor was not forfeited by the crime of her son—was the immediate occasion of many of the later disputes between England and France, but the traditional feeling was handed on from the days when Englishmen and Normans fought side by side against Frenchmen. In Normandy itself the memory of the connexion with England soon died out. We read, and it seems strange as we read, of the quarrel which, in the days of Edward I., arose between the crowns of England and France out of the disputes between Norman subjects of France and Gascon subjects of England. But the national feeling of the English towards France was none the less an inheritance handed on from the Norman fights of Varaville and Noyon.

From the time of John's forfeiture Normandy ceased to be a separate state. It was a dominion of the king of France, though often granted out as a separate apanage to members of the royal family. The land fell back upon its natural geographical position as the northern seaboard of France, though now the seaboard of a France that had been vastly enlarged since the land of the Northmen had been cut off from the old French duchy. The value of such a province to the kingdom was beyond words; but it was now simply a province of France, keeping much that was characteristic, holding to a strongly-marked provincial life, but not parted off by any distinction that can be called national. One cause of the ease with which the land went back to its old position in the days before Rolf doubtless was that so much of the national strength had been used up in the settlements in England and Sicily. The life of the Normans as a people—though a people, strictly so called, they hardly formed—is very far from being shut up within the duchy of Normandy.

Still, the union between Normandy and France—at all events, the possession of Normandy by the French kings of the house of Paris—was not to be altogether unbroken. The duchy was for a while to go back again to the descendants of its ancient dukes. The Normans had forgotten their connexion with England, but it was not always forgotten by English kings and statesmen. The remarkable thing is that the thought of reunion does not show itself till a much later time, when the immediate tradition must have passed away. In the two great English invasions of France Normandy plays an important part; but it does not appear that the descendants of Rolf and William were any more welcome in their ancestral duchy than in other parts of the French dominion. But Normandy holds quite a different position in the two great parts of the Hundred Years' War. Under Edward III. it was often the scene of war, because geographical causes naturally made it so; but it was so only as any other part of France might happen to be. The war of Crécy and Poitiers was not in any special way a war for Normandy. Edward was rather a French prince claiming the crown of France than an English king seeking the aggrandizement of his kingdom. When the settlement of Bretigny was made Normandy was not among the lands that were given up to England. It was otherwise with Henry V. He was before all things an English king bent on extending the power of England. If he wished to make Continental conquests, Normandy, both from geographical position and from historical associations, —associations which became keener in some sort as they grew more distant,—was the land which before all others invited his ambition. His war with France, his formal union of the crowns of England and France, were, we may be sure, only means towards his real design, the annexation of Normandy to the crown of England. In every negotiation he was ready to waive his claim to the French crown; he always insisted on the cession of the Norman duchy in full sovereignty. His war was before all things a war for Normandy. In his serious invasion of 1417—to be distinguished from the earlier military promenade which led to the fight of Agincourt—he gave himself out, though he gave himself out in vain, as the lawful duke of the duchy. He thoroughly subdued the duchy as his first work, and from 1418 to 1450 Normandy again became a possession of the English crown. The treaty of Troyes, in its 17th clause, speaks of Normandy as a land conquered from the kingdom of France, yet as actually being at the time a separate possession of the king of England, a land which, by the 21st clause, he was bound, on succeeding to the kingdom of France, to reunite with that kingdom. By that treaty England and France were to be united on the same terms as Sweden and Norway, Hungary and Austria, in later times; but by this clause Normandy is to be part of the kingdom of France, neither part of the kingdom of England nor a separate possession of the common king. Henry never succeeded to the crown of France; he died heir and regent of that kingdom. Normandy therefore was not reunited to France, and Henry, on his deathbed, revealed the object of his whole career. He was prepared for the loss of France, but not for the loss of Normandy. Things might take their course in other ways, but the guardians of his child were to conclude no peace with Charles of France unless Normandy was ceded to the crown of England in full sovereignty. Henry VI. succeeded to both kingdoms; he uses the style of both, and never uses the style of the Norman duchy; yet in documents of his time the duchy is in a marked way distinguished from the kingdom of France. Such phrases as "oure saide royaume of Fraunce and oure saide duchie of Normandie" are common. In the journal of the embassy in 1445,[1] "Guyenne et Normandie et les autres terres esquelles les rois Dangleterre avoient droit avant la question de la couronne" are pointedly distinguished from the lands which were held or claimed by the English kings only by virtue of their claim to the French crown. That Henry V.'s object, the lasting union of England and Normandy, would have been no gain to England needs no proof; but there can be little doubt that the thirty years of English occupation were a gain to Normandy. As far as was possible in a time of war—yet war between France and England was a less evil than war between Burgundians and Armagnacs—King Henry and John duke of Bedford secured to their conquest a far better administration and more of general wellbeing than it had had or than it had again under French rule. But by this time Normans had become Frenchmen. The best English rule was but the rule of a stranger, and the land willingly went back to that dominion of the house of Paris from which it had twice been cut off, at times five hundred years apart.

From this time the history of Normandy is simply part of the history of France. It is the record of such events in French history, some of the most important events in later French history among them, as took place within the bounds of Normandy. The duchy still kept a certain separate being, and its people still kept a large measure of separate feeling. Philip of Comines remarks that the Normans were always best pleased to have a duke of their own. But such a duke of Normandy, son or brother of the reigning king of France, holding a mere apanage and not a sovereign fief, remained a French subject, and had not the same independent position as a duke of Burgundy or Britanny. Philip of Comines further remarks on the wealth of the duchy—the fruit possibly in some measure of the administration of King Henry and Duke John. Normandy brought in a third of the whole income of the French crown. To this day Normandy is easily seen, by those who look below the surface, to be in many things a separate land from France; compared with southern Gaul, it has much in common with England. But the history of Normandy as a European power ends with the Angevin conquest in the 12th century. Since then it has never stood alone, even as it might still be said to stand alone under the Conqueror and under Henry I. The question from that time was whether Normandy should be a dependency of England or an integral part of France. The latter was in every way the more natural condition. The reunion under Henry V. was a striving against manifest destiny. It shows what a great man can do and what he cannot. (E. A. F.)

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[1] Stevenson's *Letters and Papers of Henry the Sixth*, i. 129.

NORMANS is the softened form of the word "Northman," applied first to the people of Scandinavia in general, and afterwards specially to the people of Norway. In the form of "Norman" (*Northmannus, Normannus, Normand*) it is the name of those colonists from Scandinavia who settled themselves in Gaul, who founded the Norman duchy, who adopted the French tongue and French manners, and who from their new home set forth on new errands of conquest, chiefly in the British Islands and in southern Italy and Sicily. From one point of view the expeditions of the Normans may be looked on as continuations of the expeditions of the Northmen. As the name is etymologically the same, so the people are by descent the same, and they are still led by the old spirit of war and adventure. But in the view of general history Normans and Northmen must be carefully distinguished. The change in the name is the sign of a thorough change, if not in the people themselves, yet in their historical position. Their national character remains largely the same; but they have adopted a new religion, a new language, a new system of law and society, new thoughts and feelings on all matters. Like as the Norman still is to the Northman, the effects of a settlement of Normans are utterly different from the effects of a settlement of Northmen. There can be no doubt that the establishment of the Norman power in England was, like the establishment of the Danish power, greatly helped by the essential kindred of Normans, Danes, and English. But it was helped only silently. To all outward appearance the Norman conquest of England was an event of an altogether different character from the Danish conquest. The one was a conquest by a people whose tongue and institutions were still palpably akin to those of the English. The other was a conquest by a people whose tongue and institutions were palpably different from those of the English. The Norman settlers in England felt no community with the earlier Danish settlers in England. In fact the Normans met with the steadiest resistance in a part of England which was largely Danish. But the effect of real, though unacknowledged, kindred had none the less an important practical effect. There can be no doubt that this hidden working of kindred between conquerors and conquered in England, as compared with the utter lack of all fellowship between conquerors and conquered in Sicily, was one cause out of several which made so wide a difference between the Norman conquest of England and the Norman conquest of Sicily.

These two conquests, wrought in the great island of the Ocean and in the great island of the Mediterranean, were the main works of the Normans after they had fully put on the character of a Christian and French-speaking people, in other words, after they had changed from Northmen into Normans. The English and the Sicilian settlements form the main Norman history of the 11th century. The 10th century is the time of the settlement of the Northmen in Gaul, and of the change in religion and language of which the softening of the name is the outward sign. By the end of it, any traces of heathen faith, and even of Scandinavian speech, must have been mere survivals. The new creed, the new speech, the new social system, had taken such deep root that the descendants of the Scandinavian settlers were better fitted to be the armed missionaries of all these things than the neighbours from whom they had borrowed their new possessions. With the zeal of new converts they set forth on their new errand very much in the spirit of their heathen forefathers. If Britain and Sicily were the greatest fields of their enterprise, they were very far from being the only fields. The same spirit of enterprise which brought the Northmen into Gaul seems to carry the Normans out of Gaul into every corner of the world. Their character is well painted by a contemporary historian of their exploits.[1] He sets the Normans before us as a race specially marked by cunning, despising their own inheritance in the hope of winning a greater, eager after both gain and dominion, given to imitation of all kinds, holding a certain mean between lavishness and greediness—that is, perhaps uniting, as they certainly did, these two seemingly opposite qualities. Their chief men, he adds, were specially lavish through their desire of good report. They were moreover a race skilful in flattery, given to the study of eloquence, so that the very boys were orators, a race altogether unbridled unless held firmly down by the yoke of justice. They were enduring of toil, hunger, and cold whenever fortune laid it on them, given to hunting and hawking, delighting in the pleasure of horses, and of all the weapons and garb of war. Several of these features stand out very clearly in Norman history. The cunning of the Normans is plain enough; so is their impatience of restraint, unless held down by a strong master. Love of imitation is also marked. Little of original invention can be traced to any strictly Norman source; but no people were ever more eager to adopt from other nations, to take into their service and friendship from any quarter men of learning and skill and eminence of every kind. To this quality is perhaps to be attributed the fact that a people who did so much, who settled and conquered in so large a part of Europe, has practically vanished from the face of the earth. If Normans, as Normans, now exist anywhere, it is certainly only in that insular fragment of the ancient duchy which still cleaves to the successor of its ancient dukes. Elsewhere, as the settlers in Gaul became French, the emigrants from Gaul became English, Irish, Scottish, and whatever we are to call the present inhabitants of Sicily and southern Italy. Everywhere they gradually lost themselves among the people whom they conquered; they adopted the language and the national feelings of the lands in which they settled; but at the same time they often modified, often strengthened, the national usages and national life of the various nations in which they were finally merged.

But Geoffrey hardly did justice to the Normans if he meant to imply that they were simple imitators of others. Their position was very like that of the Saracens. Hasty writers who forget the existence of the eastern Rome are apt to claim for the Saracens of Baghdad, or more commonly for those of Cordova, a monopoly of science and art at some time not very clearly defined by dates. In so doing they slur over the real position and the real merit of the Saracens with regard to science and art. In neither department did any Saracen, strictly speaking, invent anything; but they learned much both from Constantinople and from Persia, and what they learned they largely developed and improved. The Normans did just the same. They adopted the French tongue, and were presently among the first to practise and spread abroad its literature. They adopted the growing feudal doctrines of France, and worked them, both in Normandy and in England, into a harmonious system. From northern Italy, as it would seem, they adopted a style of architecture which grew in their hands, both in Normandy and in England, into a marked and living form of art. Settled in Gaul, the Scandinavian from a seafaring man became a landsman. Even in land-warfare he cast aside the weapons of his forefathers; but he soon learned to handle the weapons of his new land with greater prowess than they had ever been handled before. He welcomed the lore of every stranger. Lanfranc brought law and discipline; Anselm brought theology and philosophy. The gifts of each were adopted and bore fruit on both sides of the Channel. And no people ever better knew how to be all things to all men. The Norman power in England was founded on full and speedy union with the one nation among whom they found themselves. The Norman power in Sicily was founded on a strong distinction between the ruling people and the many nations which they kept in peace and prosperity by not throwing in their lot with any one among them.

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[1] Geoffrey Malaterra, i. 3—"Est quippe gens astutissima, injuriarum ultrix, spe alias plus lucrandi, patrios agros vilipendens, quæstus et dominationis avida, cujuslibet rei simulatrix, inter largitatem et avaritiam quoddam medium habens. Principes vero delectatione bonæ famæ largissimi, gens adulari sciens, eloquentiis in studiis inserviens in tantum, ut etiam ipsos pueros quasi rhetores attendas, quæ quidem, nisi jugo justitiæ prematur, effrenatissima est; laboris, inediæ, algoris, ubi fortuna expedit, patiens, venationi accipitrum exercitio inserviens. Equorum, cæterorumque militiæ instrumentorum, et vestium luxuria delectatur. Ex nomine itaque suo terræ nomen indiderunt. North quippe Anglica lingua aquilonaris plaga dicitur. Et quia ipsi ab aquilone venerant terram ipsam etiam Normanniam appellarunt."

The quality which Geoffrey Malaterra expresses by the word "effrenatissima" is also clearly marked in Norman history. It is, in fact, the groundwork of the historic Norman character. It takes in one case the form of ceaseless enterprise, in another the form of that lawlessness which ever broke out, both in Normandy and in every other country settled by Normans, when the hand of a strong ruler was wanting. But it was balanced by another quality which Geoffrey does not speak of, one which is not really inconsistent with the other, one which is very prominent in the Norman character, and which is, no less than the other, a direct heritage from their Scandinavian forefathers. This is the excessive litigiousness, the fondness for law, legal forms, legal processes, which has ever been characteristic of the people. If the Norman was a born soldier, he was also a born lawyer. Randolf Flambard, working together the detached feudal usages of earlier times into a compact and logical system of feudal law, was as characteristic a type of the people as any warrior in the Conqueror's following. He was the organizer of an endless official army, of an elaborate technical system of administration, which had nothing like it in England before, but which grew up to perfection under Norman rulers. But nothing so well illustrates this formal side of the Norman character as the whole position of the Conqueror himself. His claim to the crown of England is something without earlier precedent, something as far as possible removed from the open violence of aggressors who have no pretexts with which to disguise their aggression. It rested on a mass of legal assumptions and subtleties, fallacious indeed, but ingenious, and, as the result proved, effective. His whole system of government, his confiscations, his grants, all that he did, was a logical deduction from one or two legal principles, arbitrary certainly in their conception, but strictly carried out to their results. Even Norman lawlessness in some sort took a legal shape. In the worst days of anarchy, in the minority of William or under the no-reign of Robert, the robber-baron could commonly give elaborate reasons for every act of wrong that he did.

It is perhaps less wonderful that this characteristic should have been left out in a picture of the Normans in Apulia and Sicily than if it had been left out in a picture of the Normans in Normandy and England. The circumstances of their Apulian and Sicilian conquests certainly did not tend to bring out this feature of their character so strongly as it was brought out by the circumstances of their English conquest. Possibly the same cause may have kept the chronicler from enlarging on their religious character; yet in Sicily at least they might pass for crusaders. Crusaders in fact they were before crusades were preached. Norman warriors had long before helped the Christians of Spain in their warfare with the Saracens of the Peninsula, and in Sicily it was from the same enemy that they won the great Mediterranean island. Others had done a kindred work in a more distant field as helpers of the Eastern emperors against the Turks of Asia. All these might pass for religious wars, and they might really be so; it needed greater ingenuity to set forth the invasion of England as a missionary enterprise designed for the spiritual good of the benighted islanders. The Norman, a strict observer of forms in all matters, attended to the forms of religion with special care. No people were more bountiful to ecclesiastical bodies on both sides of the Channel; the foundation of a Benedictine monastery in the 11th century, of a Cistercian monastery in the 12th, seemed almost a matter of course on the part of a Norman baron. The Conqueror beyond doubt sincerely aimed at being a religious reformer both in his duchy and in his kingdom, while it is needless to say that his immediate successor was exceptionally ungodly, whether among Normans or among other men. But among their countrymen generally strict attendance to religious observances, a wide bounty to religious foundations, may be set down as national characteristics. On the other hand, none were less inclined to submit to encroachments on the part of the ecclesiastical power, the Conqueror himself least of all.

We thus see in the Scandinavian settlers in Gaul, after they had put on the outward garb of their adopted country, a people restless and enterprising above all others, adopting and spreading abroad all that they could make their own in their new land and everywhere else,—a people in many ways highly gifted, greatly affecting and modifying at the time every land in which they settled, but, wherever they settled, gradually losing themselves among the people of the land. The Norman, as a visible element in the country, has vanished from England, and he has vanished from Sicily. The circumstances of his settlement in his two great fields of conquest were widely different; his position when he was fully established in his two insular realms was widely different; but the end has been the same in both cases. Neither island has for ages been in any sense a Norman land, and the tongue which the Norman brought with him into both has not for ages been spoken in either. Norman influence has been far stronger in England than in Sicily, and signs of Norman presence are far more easily recognized. But the Norman, as a distinct people, is as little to be seen in the one island as in the other. His disappearance in both cases is an illustration of one of the features which we have spoken of in the Norman character, the tendency which in fact made Normans out of Northmen, the tendency to adopt the language and manners of the people among whom they found themselves. But, as far as outward circumstances are concerned, we may say that the same effect has been brought about by different and almost opposite causes. The whole circumstances of the conquest of England constrained the conquerors to become Englishmen in order to establish themselves in the conquered land. In William's theory, the forcible conquest of England by strangers was an untoward accident. The lawful heir of the English crown was driven against his will to win his rights by force from outside. But he none the less held his crown as an English king succeeding according to English law. Moreover every Norman to whom he granted lands and offices held them by English law in a much truer sense than the king held his; he was deemed to step into the exact position of his English predecessor, whatever that might be. This legal theory worked together with other causes to wipe out all practical distinction between the conquerors and the conquered in a wonderfully short time. By the end of the 12th century the Normans in England might fairly pass as Englishmen, and they had largely adopted the use of the English language. The fashionable use of French for nearly two centuries longer was far more a French fashion than a Norman tradition. When the tradition of speaking French had all but died out, the practice was revived by fashion. Still the tradition had its effect. The fashion could hardly have taken root except in a land where the tradition had gone before it.

The Normans in England therefore became Englishmen, because there was an English nation into which they could be absorbed. The Normans in Sicily could hardly be said to become Sicilians, for there assuredly was no Sicilian nation for them to be absorbed into. While the Normans in England were lost among the people of the land, the Normans in Sicily were lost among their fellow-settlers in the land. The Normans who came into Sicily must have been much less purely Norman than the Normans who came into England. The army of Duke William was undoubtedly very far from being wholly made up of Normans, but it was a Norman army; the element which was not Norman, though considerable, was exceptional. But we may doubt whether the Norman invaders of Sicily were Norman in much more than being commanded by Norman leaders. They were almost as little entitled to be called pure Scandinavians as the Saracens whom they found in the island were entitled to be called pure Arabs. The conquest of England was made directly from Normandy, by the reigning duke, in a comparatively short time, while the conquest of Sicily grew out of the earlier and far more gradual conquest of Apulia and Calabria by private men. The Norman settlements at Aversa and Capua were the work of adventurers, making their own fortunes, and gathering round them followers from all quarters. They fought simply for their own hands, and took what they could by the right of the stronger. They started with no such claim as Duke William put forth to justify his invasion of England; their only show of legal right was the papal grant of conquests that were already made. The conquest of Apulia, won bit by bit in many years of what we can only call freebooting, was not a national Norman enterprise like the conquest of England, and the settlement to which it led could not be a national Norman settlement in the same sense. The Sicilian enterprise had in some respects another character. By the time it began the freebooters had grown into princes. Sicily was won by a duke of Apulia and a count of Sicily. Still there was a wide difference between the duke of the Normans and the duke of Apulia, between an hereditary prince of a hundred and fifty years' standing and an adventurer who had carved out his duchy for himself. And, besides this, warfare in Sicily brought in higher motives and objects. Though crusades had not yet been preached, the strife with the Mussulman at once brought in the crusading element; to the Christian people of the island they were in many cases real deliverers; still, the actual process by which Sicily was won was not so very different from that by which Apulia had been won. Duke William was undisputed master of England at the end of five years; it took Count Roger thirty years to make himself undisputed master of Sicily. The one claimed an existing kingdom, and obtained full possession of it in a comparatively short time; the other formed for himself a dominion bit by bit, which rose to the rank of a kingdom in the next generation. When Count Roger at last found himself lord of the whole island, he found himself lord of men of various creeds and tongues, of whom his own Norman followers were but one class out of several. And the circumstances of his conquest were such that the true Normans among his following could not possibly lose themselves among the existing inhabitants of the island, while everything tended to make them lose themselves among their fellow-adventurers of other races, among whom, by the time the conquest was ended, they could hardly have been even a dominant element.

As far then as concerned the lands in which the settlements were made, the difference lay in this, that, as has been already said, while there was an English nation, there was no Sicilian nation. The characteristic point of Norman rule in Sicily is that it is the rule of princes who were foreign to all the inhabitants of the island, but who were not more foreign to the inhabitants of the island than different classes of them were to one another. The Norman conqueror found in Sicily a Christian and Greek-speaking people and a Mussulman and Arabic-speaking people. The relations between the two differed widely in different parts of the island, according to the way in which the Saracens had become possessed of different towns and districts. In one place the Christians were in utter bondage, in another they were simply tributary; still, everywhere the Mussulman Saracen formed the ruling class, the Christian Greek formed the subject class. We speak of the Saracen very much as we speak of the Norman; for of the Mussulman masters of Sicily very many must have been only artificial Arabs, Africans who had adopted the creed, language, and manners of Arabia. In each case the Arab or the Norman was the kernel, the centre round which all other elements gathered and which gave its character to the whole. Besides these two main races, Greek and Saracen, others came in through the Norman invasion itself. There were the conquerors themselves; there were the Italians, in Sicily known as Lombards, who followed in their wake; there were also the Jews, whom they may have found in the island, or who may have followed the Norman into Sicily, as they certainly followed him into England. The special character of Norman rule in Sicily was that all these various races flourished, each in its own fashion, each keeping its own creed, tongue, and manners, under the protection of a common sovereign, who belonged to none of them, but who did impartial justice to all. Such a state of things might seem degradation to the Mussulman, but it was deliverance to the native Christian, while to settlers of every kind from outside it was an opening such as they could hardly find elsewhere. But the growth of a united Sicilian nation was impossible; the usual style to express the inhabitants of the island is "omnes" or "universi Siciliæ populi." In the end something like a Sicilian nation did arise; but it arose rather by the dying out of several of the elements in the country, the Norman element among them, than by any such fusion as took place in England. That is, as has been already said, the Norman as such has vanished in two different ways. In England the Norman duke came in as a foreign intruder, without a native supporter to establish his rule over a single nation in its own land. He could not profess to be, as the count of Sicily could honestly profess to be, a deliverer to a large part of the people of the land. But, coming in by a title which professed to be founded on English law, establishing his followers by grants which professed no less to be founded on English law, he planted a dynasty, and established a dominant order, which could not fail to become English. The Normans in England did not die out; they were merged in the existing nation. The Normans in Sicily, so far as they did not die out, were merged, not in a Sicilian nation, for that did not exist, but in the common mass of settlers of Latin speech and rite, as distinguished from the older inhabitants, Greek and Saracen. The Norman conquest of England was at the moment a curse; the Norman conquest of Sicily was at the moment a blessing. But the gradual and indirect results of the Norman conquest of England are easily to be seen to this day, and they have been largely, though indirectly, results for good. Its chief result has been, not so much to create anything new as at once to modify and to strengthen what was old, to call up older institutions to a new life under other forms. But whatever it has done it has done silently; there has not been at any time any violent change of one set of institutions for another. In Sicily and southern Italy there is hardly any visible Norman influence, except the great historic fact which we may call the creation of Sicily and southern Italy in their modern sense. The coming of the Norman ruled that these lands should be neither Saracen nor Greek, nor yet Italian in the same sense as northern Italy, but that they should politically belong to the same group of states as the kingdoms and principalities of feudal Europe. William assuredly did not create the kingdom of England; Roger assuredly did create the kingdom of Sicily. And yet, notwithstanding all this, and partly because of all this, real and distinct Norman influence has been far more extensive and far more abiding in England than it has been in Sicily.

In Sicily then the circumstances of the conquest led the Norman settlers to remain far more distinct from the older races of the land than they did in England, and in the end to lose themselves, not in those older races of the land, but in the settlers of other races who accompanied and followed them. So far as there ever was a Sicilian nation at all, it might be said to be called into being by the emperor-king Frederick II. In his day a Latin element finally triumphed; but it was not a Norman or French-speaking element of any kind. The speech of the Lombards at last got the better of Greek, Arabic, and French; how far its ascendency can have been built on any survival of an earlier Latin speech which had lived on alongside of Greek and Arabic this is not the place to inquire.

The use of language and nomenclature during the time of Norman rule in the two countries forms a remarkable contrast, and illustrates the circumstances of the two as they have just been sketched. The chroniclers of the conquest of Apulia and Sicily use the Norman name in every page as the name of the followers of the conquerors from Hauteville. It was the natural name for a body of men who must, by the time the conquest of Sicily was over, have been very mixed, but whose kernel was Norman, whose strength and feelings and traditions all came from a Norman source. But if we turn to Hugo Falcandus, the historian of Sicily in the 12th century, the Norman name is hardly found, unless when it is used historically to point out (as in Muratori, vii. 260) that the royal house of Sicily was of Norman descent. Of the various "Siciliæ populi," we hear of Greeks, Saracens, Lombards, sometimes of Franci, for by that time there were many French-speaking settlers in Sicily who were not of Norman descent. There is a distinction between Christians and Saracens; among Christians there seems to be again a distinction between Greeks and Latins, though perhaps without any distinct use of the Latin name; there is again a further distinction between "Lombardi" and "Franci"; but Normans, as a separate class, do not appear. In England there is no room for such subtleties. The narratives of the conquest of England use both the Norman and the French names to express the followers of William. In the English chronicles "French" is the only name used. It appears also in the Bayeux Tapestry, and it is the only word used when any legal distinction had to be drawn between classes of men in the English kingdom. "Franci" and "Angli" are often opposed in Domesday and other documents, and the formula went on in charters long after all real distinction had passed away. That is to say, there were several purposes for which it was convenient to distinguish "English" and "French"—the last name taking in all the followers of the Conqueror; there were no purposes for which there was any need to distinguish Normans as such, either from the general mass of the people or from others who spoke the French tongue. We can see also that, though several languages were in use in England during the time of Norman rule, yet England was not a land of many languages in the same sense in which Sicily was. In the 12th century three languages were certainly spoken in London; yet London could not call itself the "city of threefold speech," as Palermo did. English, French, Latin, were all in use in England; but the distinction was rather that they were used for three different purposes than that they were used by three distinct races or even classes. No doubt there was a class that knew only English; there may have been a much smaller class that knew only French; any man who pretended to high cultivation would speak all as a matter of course; Bishop Gilbert Foliot, for instance, was eloquent in all three. But in Sicily we see the quite different phenomenon of three, four, five classes of men living side by side, each keeping its own nationality and speaking its own tongue. If a man of one people knew the speech of any of the others, he knew it strictly as a foreign language. Before the Norman Conquest England had two official tongues; documents were drawn up sometimes in English, sometimes in Latin, now and then in both. And the same usage went on after the Conquest; the use of English becomes gradually rarer, and dies out under the first Angevins, but it is in favour of Latin that it dies out. French, the language which the Normans brought with them, did not become an official language in England till after strictly Norman rule had passed away. French documents are unknown till the days of French fashion had come in, that is, till deep in the 13th century. So it was in Sicily also; of all the tongues of Sicily French was the most needful in the king's court ("Francorum lingua quæ maxime necessaria esset in curia," says Hugo Falcandus, 321); but it was not an official tongue. The three tongues of Palermo are Greek, Arabic, and Latin. King Roger's clock is commemorated in all three. Documents were drawn up in such and so many of these tongues as was convenient for the parties concerned; not a few private documents add a fourth tongue, and are drawn up in Greek, Arabic, Latin, and Hebrew. In neither case is the actual speech of the conquerors one of the tongues in formal use. French, as a separate tongue from Latin, already existed as a literary speech, and no people had done more than the Normans to spread it as a literary speech, in both prose and verse. But neither in England nor in Sicily did official formalism acknowledge even French, much less Italian, as a fit tongue for solemn documents. In England, English, French, Latin, were the three tongues of a single nation; they were its vulgar, its courtly, and its learned speeches, of which three the courtly was fast giving way to the vulgar. In Sicily, Greek, Arabic, Latin and its children, were the tongues of distinct nations; French might be the politest speech, but neither Greek nor Arabic could be set down as a vulgar tongue, Arabic even less than Greek.

The different positions then which the conquering Norman took in his two great conquests of England and of Sicily amply illustrate the way in which he could adapt himself to any circumstances in which he found himself, the way in which he could adopt whatever suited his purpose in the institutions of any other people, the way in which he commonly lost his national being in that of some other people. From England moreover he spread into Scotland, Wales, and Ireland, and in each land his settlement put on a somewhat different character, according to the circumstances of the land. In Scotland he was not a conqueror, but a mere visitor, and oddly enough he came as a visitor along with those whom he had himself overcome in England. Both Normans and English came to Scotland in crowds in the days of Margaret, Edgar, and David, and Scottish national feeling sometimes rose up against them. In Scotland again the Norman settlers were lost in the mixed nationality of the country, but not till they had modified many things in the same way in which they modified things in England. They gave Scotland nobles and even kings; Bruce and Balliol were both of the truest Norman descent; the true Norman descent of Comyn might be doubted, but he was of the stock of the Francigenæ of the Conquest. In Wales the Norman came as a conqueror, more strictly a conqueror than in England; he could not claim Welsh crowns or Welsh estates under any fiction of Welsh law. The Norman settler in Wales therefore did not to any perceptible extent become a Welshman; the existing relations of England and Wales were such that he in the end became an Englishman, but he seems not unnaturally to have been somewhat slower in so doing in Wales than he was in England. At least Giraldus Cambrensis, the Norman Welshman or Welsh Norman, was certainly more alive to the distinction between Normans and English than any other of his contemporaries. In Ireland the Norman was more purely a conqueror than anywhere else; but in Ireland his power of adaptation caused him to sink in a way in which he sank nowhere else. While some of the Norman settlers in Ireland went to swell the mass of the English of the Pale, others threw in their lot with the native Irish, and became, in the well-known saying, *Hibernis ipsis Hiberniores.*

There is yet one point in which we may profitably go back to our comparison between England and Sicily. Both countries are rich in works of architecture raised during the time of Norman rule. And the buildings of both lands throw an instructive light on the Norman national character, as we have described it. Few buildings, at least few buildings raised in any reasonable style of architecture which makes use of the arched construction, can be less like one another than the buildings of the Norman kings in England and the buildings of the Norman kings in Sicily. In Sicily the Normans found the two most outwardly civilized of the nations of Europe, the two which had as yet carried the arts to the highest pitch. The Greek had created the column; the Roman had developed it; the Roman Greek or Greek Roman had taught the column to bear the cupola; the Saracen had taught it to bear arches of his own favourite pointed shape. Out of these elements the Saracens of Sicily had formed a noble and beautiful style, grand and simple in its construction, rich and graceful in its characteristic detail. With the Saracen and the Greek to his subjects, the Norman had really no need to innovate; he had simply to bid the men of the land to go on working for him instead of for any other. The palaces and churches of the Norman kings at Palermo and Monreale and Cefalu and Messina are in style simply Saracenic; they were most likely the work of Saracen builders; they were beyond doubt built after Saracenic models. In these buildings, as in those of Aquitaine, the pointed arch is the surest sign of Saracenic influence; it must never be looked on as marking the approach of the Gothic of the North. With that form of art the pointed style of Sicily has nothing in common. A Sicilian church has nothing in common with a French or an English church; it is sometimes purely Oriental, sometimes a basilica with pointed arches. But, if the Saracen gave the lines of the building, the Greek gave the mosaic decorations of its walls. In such a case the ruling people, rather the ruling dynasty, had really nothing to add to what they found ready for them. They had simply to make Saracen and Greek work in partnership. In England, on the other hand, the Normans did really bring in a new style of their own, their own form of Romanesque, differing widely indeed from the Saracenic style of Sicily. This Norman form of Romanesque most likely had its origin in the Lombard buildings of northern Italy. But it took firm root on Norman soil; it made its way to England at an early stage of its growth, and from that time it went on developing and improving on both sides of the Channel till the artistic revolution came by which, throughout northern Europe, the Romanesque styles gave way to the Gothic. Thus the history of architecture in England during the 11th and 12th centuries is a very different story from the history of the art in Sicily during the same time. There were no Greeks or Saracens in England; there was no Greek or Saracen skill. England indeed had, possibly in a somewhat ruder form, the earlier style of Romanesque once common to England with Italy, Gaul, and Germany. To this style it is no wonder that the Normans preferred their own, and that style therefore supplanted the older one. A comparison of Norman buildings in England and in Normandy will show that the Norman style in England really was affected by the earlier style of England; but the modification was very slight, and it in no way affected the general character of the style. Thus, while the institutions of England in the 12th century were English with very considerable Norman modifications, the architecture of England in that century was Norman with a very slight English modification. The difference then is plain. Where, as in Sicily, the Normans felt that they could not improve, they simply adopted the style of the country. Where, as in England, they felt that they could improve, they substituted for the style of the country their own style,—that is, a style which they had not created but which they had adopted, which they had made thoroughly their own, and which they went on improving in England no less than in Normandy. That is, the discerning Norman, as ever, adapted himself, but adapted himself in an intelligent way, to the circumstances of each land in which he found himself. And this comes out the more clearly if we compare Norman work in England and in Sicily with Norman work in at least some parts of Apulia. At Bari, Trani, and Bitonto we see a style in which Italian and strictly Norman elements are really mingled. The great churches of those cities are wholly unlike those of Sicily; but, while some features show us that we are in Italy, while some features even savour of the Saracen, others distinctly carry us away to Caen and Peterborough. It is plain that the Norman settlers in Apulia were not so deeply impressed with the local style as they were in Sicily, while they thought much more of it than they thought of the local style of England. In each of the three cases there is adaptation, but the amount of adaptation differs in each case according to local circumstances. In Normandy itself, after the separation from England, architecture becomes French, but it is French of a remarkably good type. The buildings of the latest French style keep a certain purity and sobriety in Normandy which they do not keep elsewhere.

Of all the points here insisted on that which it is most necessary to bear in mind is the Norman power of adaptation to circumstances, the gift which in the end destroyed the race as a separate race. English history is utterly misconceived if it is thought that an acknowledged distinction between Normans and English went on, perhaps into the 14th century, perhaps into the 17th. Long before the earlier of those dates the Norman in England had done his work; he had unwittingly done much to preserve and strengthen the national life of a really kindred people, and, that work done, he had lost himself in the greater mass of that kindred people. In Sicily his work, far more brilliant, far more beneficent at the time, could not be so lasting. The Norman princes made Sicily a kingdom; they ruled it for a season better than any other kingdom was ruled; but they could not make it a Norman kingdom, nor could they themselves become national Sicilian kings. The kingdom that they founded has now vanished from among the kingdoms of the earth, because it was only a kingdom and not a nation. In every other way the Norman has vanished from Sicily as though he had never been. His very works of building are hardly witnesses to his presence, because, without external evidence, we should never have taken them to be his. In Sicily, in short, he gave a few generations of unusual peace and prosperity to several nations living side by side and then he, so to speak, went his way from a land in which he had a work to do, but in which he never was really at home. In England he made himself, though by rougher means, more truly at home among unacknowledged kinsmen. When in outward show he seemed to work the unmaking of a nation he was in truth giving no small help towards its second making. (E. A. F.)

NORMANTON, a township in the West Riding of Yorkshire, is situated on the Calder river, and on several railway lines, 3 miles (by rail) north-east of Wakefield and 24 south-south-west of York. The church of All Saints, an ancient stone structure in the Norman and Perpendicular styles, with a square tower rebuilt in 1717, contains a number of interesting monuments. The grammar school was founded about the end of the 16th century. Traces still remain of a moat surrounding the town and connected with a Roman encampment which at one time occupied its site. A mound in the neighbourhood called Haw Hill is supposed to be a barrow. There are numerous collieries in the neighbourhood. The population of the urban sanitary district (1227 acres) in 1871 was 3448, and in 1881 it was 8038. The parish of Normanton (2517 acres) includes three townships,—Normanton, Snydale, and Newland. Altofts (1698 acres), where Sir Martin Frobisher resided, was made into a separate parish in 1879.

NORRIS, JOHN (1657-1711), the disciple of Plato and Malebranche, was born in 1657 at Collingbourne-Kingston in Wiltshire, where his father was then incumbent. He was educated at Winchester School, and entered at Exeter College, Oxford, in 1676. In 1680 he took his degree and was elected to a fellowship at All Souls' College. He first made himself known in the university, Anthony Wood tells us, by a translation of Robert Waryng's philosophical poem, *Effigies Amoris*, entitled *The Picture of Love Unveiled*. This appeared in 1682, and was followed in 1683 by his first original work, *An Idea of Happiness*. With Plato, he places the highest happiness or fruition of the soul in the contemplative love of God—"that primitive and original Beauty, Perfection, and Harmony." Norris's poems, mostly composed about this time, are, in the main, expressions of his habitual mood of devout but somewhat abstract contemplation. They have little poetic richness, but their grave style is often not without impressiveness, and works itself out at intervals into a felicitous stanza or a memorable line. A few pieces (such, for instance, as *The Parting*) might claim even a higher praise. The poems appeared in 1684 as the first part of a volume of *Poems and Discourses occasionally written*. Three years later a new and enlarged edition was published with the title, *A Collection of Miscellanies*; and in this form the volume was popular enough to go through nine editions. In the midst of these graver productions Norris found leisure to give vent to his hereditary Tory and High-Church feeling in a satire on the Whigs and a Latin tractate aimed at the Calvinistic dissenters. All through his life his intense intellectual activity seemed to make it almost a necessity for him to mingle in whatever controversy was going on. But philosophy and philosophical theology formed his central interest. Malebranche's *Recherche de la Vérité*, which had appeared in 1674, made an easy conquest of the Oxford fellow, to whom its doctrine appeared no more than the consistent and clarified modern expression of that Platonized Christianity which met him alike in St John, in Plotinus, and in Augustine, the father whom he "loved to speak after." Perhaps it would be more correct to say that Norris reads his favourite authors in the light of the theory derived from Malebranche. It is at least doubtful whether he would have reached any definiteness of philosophic theory for himself without the aid of the French thinker. He makes no secret of his discipleship. Malebranche, he says, "is indeed the great Galileo of the intellectual world. He has given us the point of view, and, whatever further detections are made, it must be through his telescope." Norris's readings in modern philosophy were not confined, however, to Malebranche; he had studied the works of Descartes himself, and most of what had been written for and against Cartesianism on the Continent. Of English thinkers, More and Cudworth, the so-called Cambridge Platonists, had influenced him most; and in 1685 his study of their works had ripened into a correspondence with the former. After More's death Norris published the correspondence between them as an appendix to his Platonically conceived essay on *The Theory and Regulation of Love* (1688).

Some time before this Norris had taken orders, and in 1689, on being presented to the living of Newton St Loe, in Somersetshire, he married, and resigned his fellowship. In the same year he published *Reason and Religion*, the first of his riper works. The *Reflections upon the Conduct of Human Life*, which he wrote (also in 1689) "by way of letter to an excellent lady, the Lady Masham," did not advance his interests in that quarter; for the lady, whose eyes were only weak, was nettled at being set down in the preface as blind. In 1690 Norris published a volume of *Discourses upon the Beatitudes*, which proved decidedly popular, and induced the author to follow it up by three more volumes of *Practical Discourses* between 1690 and 1698. The year 1690 is memorable as the year of the publication of Locke's *Essay*, and the book came into Norris's hands just as his volume of *Discourses* was passing through the press. He at once appreciated its importance, but its whole temper was alien from the modes of thought in which he had been reared, and its main conclusions moved him to keen dissent. He hastened to "review" it in an appendix to his sermons. These *Cursory Reflections* constitute Norris the first critic of the *Essay*; and they anticipate some of the arguments that have since been persistently urged against Locke from the transcendental side. Though holding to the "grey-headed, venerable doctrine" of innate ideas as little as Locke himself, Norris finds the criticism in the first book of the *Essay* entirely inconclusive, and points out its inconsistency with Locke's own doctrine of evident or intuitively perceived truths. He also suggests the possibility of subconscious ideation, on which Leibnitz laid so much stress in the same connexion. He next complains that Locke neglects to tell us "what kind of things these ideas are which are let in at the gate of the senses." In other words, while giving a metaphorical account of how we come by our ideas, Locke leaves unconsidered the intellectual nature of the ideas or of thought in itself. Unless we come to some conclusion on this point, Norris argues, we have little chance of being right in our theory of how ideas "come to be united to our mind." He also puts his finger upon the weakness of Locke's doctrine of nominal essences, showing how it ignores the relation of the human mind to objective truth, and instancing mathematical figures as a case "where the nominal essence and the real essence are all one."

In 1691 Norris was transferred to Bemerton, a pleasant rural charge near Salisbury, where George Herbert had been parish priest in the earlier part of the century. A few miles distant is Langford Magna, where from 1704 onwards Norris had a congenial metaphysical neighbour in the person of Arthur Collier, the future author of *Clavis Universalis*. The remaining twenty years of Norris's life were spent at Bemerton, the flight of time marked only by the works that still came in rapid succession from his pen. In 1691-92 he was engaged in controversy with his old enemies the "Separatists," and with the Quakers, his Malebranchian theory of the divine illumination having been confounded by some with the Quaker doctrine of the light within. In 1697 he wrote *An Account of Reason and Faith*, one of the best of the many answers to Toland's *Christianity not Mysterious*. Norris adopts the distinction between things contrary to reason and things above reason, and maintains that the human mind is not the measure of truth. In 1701 appeared the first volume of the systematic philosophical work by which he is remembered, *An Essay towards the Theory of the Ideal or Intelligible World*. The first volume treats the intelligible world absolutely; the second, which appeared in 1704, considers it in relation to human understanding. In 1708 Norris wrote *A Philosophical Discourse concerning the Natural Immortality of the Soul*, defending that doctrine against the assaults of Dodwell. But after the completion of his *magnum opus* his appearances in print became less frequent. His health was not robust, and perhaps he was a little disappointed at his failure to reach the larger public. Norris died in 1711 at the comparatively early age of 54.

It will hardly be claimed for Norris that he was either an original thinker or a master of style. As Molyneux writes to Locke, he is "overrun with Malebranche and Plato;" his philosophy is hardly more than an English version of Malebranche, enriched by wide reading of "Platonic" thinkers of every age and country. His style is too scholastic and self-involved. Nevertheless he was an acute and strenuous thinker. His *Theory of the Intelligible World* is an attempt to explain the objective nature of truth, which he blamed Locke for leaving out of regard. By the intelligible world Norris understands the system of ideas eternally existent in the mind of God, according to which the material creation was formed. This ideal system he identifies with the Logos—the second person of the Trinity, the light that lighteth every man that cometh into the world. For it is these ideas and their relations that are alone the object-matter of science; whenever we know, it is because they are present to our mind; or, as Malebranche says, we see all things in God. Material things are wholly dark to us, except so far as the fact of their existence is revealed in sensation. The matter which we say that we know is the idea of matter, and belongs, like other ideas, to the intelligible world. When stripped of its semi-mythical form of statement, Norris's emphatic assertion of the ideal nature of thought and its complete distinction from sense as such may be seen to contain an important truth. He stands somewhat aside from the main course of English philosophical thought. But, as the disciple and correspondent of More, he is, in a sense, the heir of the Cambridge Platonists, while, as the first critic of Locke's *Essay*, he may be said to open the protest of the church against the implicit tendencies of that work. He occupies a place, therefore, in the succession of churchly and mystical thinkers of whom Coleridge is the last eminent example. (A. SE.)

NORRISTOWN, a borough of the United States, capital of Montgomery county, Pennsylvania, lies on the north bank of the Schuylkill river, opposite Bridgeport (with which it is connected by two bridges), and 16 miles north-west of Philadelphia by the Germantown and Norristown branch of the Philadelphia and Reading Railroad. It is a well-built and pleasant town, and contains blast-furnaces and rolling-mills, wool and cotton mills, glass-works, an oil refinery, and various other manufacturing establishments, considerably indebted for their success to the water-power of the Schuylkill river. The hospital for the insane of the south-eastern district of Pennsylvania is situated here. The most conspicuous buildings are the marble county court-house (1855), the music-hall, and the jail. The population was 6024 in 1850, 8848 in 1860, 10,753 in 1870, and 13,063 in 1880. The town occupies the site of the old Swedes' Ford, and owes its name to Isaac Norris, who purchased the ground from William Penn. It was incorporated as a borough in 1812, and enlarged in 1853.

NORRKÖPING, the "Manchester of Scandinavia," a town of Sweden in the province of Östergötland, 113 miles south-west of Stockholm by rail, situated on both banks of the Motala, the wide and rapid emissary of Lake Wetter, and not far from the head of Bråvik Fjord. The river, which here forms the two islands of Laksholm and Bruxholm, is spanned by a number of bridges. Having been burned by the Russians in 1719 and visited by further conflagrations in 1812, 1822, and 1826, the whole town, since rebuilt, has quite a modern appearance, with wide and regular streets. Among the more conspicuous buildings are St Olaf's church (erected by Gustavus Adolphus in 1616, and rebuilt after 1765-67); St Hedwig's, built by the German colony in 1670; the town-house, dating from the beginning of the 19th century; the theatre, the Gustavus orphanage, and the palatial high school (1868). The industrial importance of Norrköping has steadily increased from the close of the 18th century Woollen cloth is the great staple (thirty-three factories in 1876), but cotton goods, paper, sugar, flour, tobacco and snuff, soap, starch, &c., are also manufactured. Steamers, gun-boats, and ironclads, as well as smaller craft, are constructed in the ship-yards on the lower Motala. At the close of the 17th century Norrköping was a place of from 5000 to 6000 inhabitants; after the Russian invasion it sank to 2600, but afterwards gradually rose, until in 1861 the total amounted to 20,828, and in 1878 to 27,410.

A bull of Pope Lucius III. shows that Norrköping existed in 1185. Margaret held a meeting of the states in the town in 1404. Its fortress, known as Knäppingsberg, was destroyed in 1567. At the meeting of the states in 1604 Duke Charles assumed the Swedish crown as Charles IX.; and not long afterwards Duke John of Östergötland introduced German craftsmen into Norrköping, and thus originated its industrial activity. Under Charles XII. the town suffered not only from war but from pestilence,—2700 of its inhabitants perishing in 1710-11.

NORTH, Lord (1732-1792). Frederick North, second earl of Guilford, but better known by his courtesy title of Lord North, was prime minister of England during the important years of the American War. The only son, by his first marriage, of Francis, seventh Lord North (grandson of Lord Keeper North), who was created earl of Guilford in 1752, Frederick was born on 13th April 1732, and after being educated at Eton and Christ Church, Oxford, was sent to make the grand tour of the Continent. On his return he was, though only twenty-two years of age, at once elected M.P. for Banbury, of which town his father was high steward; and he sat for the same town in parliament for nearly forty years. In 1759 he was chosen by the duke of Newcastle to be a lord of the treasury, and continued in the same office under Lord Bute and George Grenville till 1765. He had shown himself such a ready debater that on the fall of the first Rockingham ministry in 1766 he was sworn of the privy council, and made paymaster-general by the duke of Grafton. His reputation for ability grew so high that in December 1767, on the death of the brilliant Charles Townshend, he was made chancellor of the exchequer. His popularity with both the House of Commons and the people continued to increase, for his good temper was never ruffled, and his quiet humour perpetually displayed; and, when the retirement of the duke of Grafton was necessitated by the hatred he inspired and the attacks of Junius, no better successor could be found for the premiership than the chancellor of the exchequer. Lord North succeeded the duke in March 1770, and continued in office for twelve of the most eventful years in English history. George III. had at last overthrown the ascendency of the great Whig families, under which he had so long groaned, and determined to govern as well as rule. He knew that he could only govern by obtaining a majority in parliament to carry out his wishes, and this he had at last obtained by a great expenditure of money in buying seats, and by a careful exercise of his patronage. But in addition to a majority he must have a minister who would consent to act as his lieutenant, and such a minister he found in Lord North. How a man of undoubted ability such as Lord North was could allow himself to be thus used as a mere instrument cannot be explained; but the confidential tone of the king's letters seems to show that there was an unusual intimacy between them, which may account for North's compliance. The path of the minister in parliament was a hard one; he had to defend measures which he had not designed, and of which he had not approved, and this too in a House of Commons in which all the oratorical ability of Burke and Fox was against him, and when he had only the purchased help of Thurlow and Wedderburne to aid him. The most important events of his ministry were those of the American War of Independence. He cannot be accused of causing it, but one of his first acts was the retention of the tea-duty, and he it was also who introduced the Boston Port Bill in 1774. When the war had broken out he earnestly counselled peace, and it was only the earnest solicitations of the king not to leave his sovereign again at the mercy of the Whigs that induced him to defend a war which from 1779 he knew to be both hopeless and impolitic. At last, in March 1782, he insisted on resigning after the news of Cornwallis's surrender at Yorktown, and no man left office more blithely. He had been well rewarded for his assistance to the king: his children had good sinecures; his half-brother, Brownlow North, was bishop of Winchester; he himself was chancellor of the university of Oxford, lord-lieutenant of the county of Somerset, and had finally been made a knight of the Garter, an honour which has only been conferred on three other members of the House of Commons, Sir R. Walpole, Lord Castlereagh, and Lord Palmerston. Lord North did not remain long out of office, but in April 1783 formed his famous coalition with his old subordinate, Fox, and became secretary of state with him under the nominal premiership of the duke of Portland. He was probably urged to this coalition with his old opponent by a desire to show that he could act independently of the king, and was not a mere royal mouthpiece. The coalition ministry went out of office on Fox's India Bill in December 1783, and Lord North, who was losing his sight, then finally gave up political ambition. He played, when quite blind, a somewhat important part in the debates on the Regency Bill in 1789, and in the next year succeeded his father as earl of Guilford. He did not long survive his elevation, and died peacefully on 5th August 1792.

It is impossible to consider Lord North a great statesman, but he was a most good-tempered and humorous member of the House of Commons. In a time of unexampled party feeling he won the esteem and almost the love of his most bitter opponents. Burke finely sums up his character in his *Letter to a Noble Lord*: "He was a man of admirable parts, of general knowledge, of a versatile understanding, fitted for every sort of business; of infinite wit and pleasantry, of a delightful temper, and with a mind most disinterested. But it would be only to degrade myself," he continues, "by a weak adulation, and not to honour the memory of a great man, to deny that he wanted something of the vigilance and spirit of command which the times required."

For Lord North's administration, by far the best authority is *The Correspondence of George III. with Lord North*, edited by W. Bodham Donne, 2 vols., 1867. The histories of the period may also be consulted, particularly Lord Mahon's *History of England from 1713 to 1783*, Sir T. E. May's *Constitutional History of England from the reign of George III.*, and Lord Brougham's admirable sketch in his *Statesmen of the Reign of George III.*

NORTH, SIR DUDLEY (1641-1691), political economist, was third son of Dudley, fourth Lord North, who published, besides other things, *Passages relating to the Long Parliament*, of which he had himself been a member. He was born 16th May 1641. In his early years he was carried off by Gipsies and recovered with some difficulty by his family,—an incident curiously similar to that which befell Adam Smith in his infancy. He entered the mercantile profession, engaged in foreign trade, especially with Turkey, and spent a number of years at Constantinople and Smyrna. Some notices of the manners and customs of the East were printed from his papers by his brother. Having returned to London with a considerable fortune, he continued to prosecute trade with the Levant. His ability and knowledge of commerce attracted the attention of the Government, and he was further recommended by the influence of his brother Lord Guilford. During the Tory reaction under Charles II. he was a pliant instrument in the hands of the court, and was one of the sheriffs forced on the city of London with an express view to securing verdicts for the crown in the state trials of the period. He obtained the honour of knighthood, and was appointed a commissioner of customs, afterwards of the treasury, and again of the customs. Having been elected a member of parliament under James II., "he took," says Roger North, "the place of manager for the crown in all matters of revenue." After the Revolution he was called to account for his alleged unconstitutional proceedings in his office of sheriff, and did not show much highmindedness in his defence. He died 31st December 1691.

The work by which he has obtained an honourable place in the history of political economy is his *Discourses upon Trade, principally directed to the cases of the interest, coinage, clipping and increase of money*. This tract was published anonymously in 1691. It is supposed that for some unknown reason it was suppressed soon after its appearance; however this may be, it became very scarce, so that, in his brother's words, "it hath been ever since utterly sunk, and a copy not to be had for money." It does not seem to have been much noticed on its publication, or used by subsequent writers. A copy was purchased at the sale of the Rev. Rogers Ruding, author of a work on the coinage, and from this a gentleman of Edinburgh printed some copies for distribution. Other copies of the original impression were afterwards discovered, and from them J. R. M'Culloch edited the tract in the *Select Collection of Early English Tracts on Commerce* printed by the Political Economy Club of London in 1856. North is named by Roscher as one of that "great triumvirate" which in the 17th century raised the English school of economists to the foremost place in Europe, the other members of the group being Locke and Petty. His tract, Roscher further remarks, reads like a chapter of the *Wealth of Nations*. It does, indeed, in a very remarkable manner anticipate the doctrines of Adam Smith and the later free-trade school. Its author was quite free from the errors and prejudices of the mercantilism which was dominant in his day, and which had misled on some subjects even so able a writer as Child, against whom, though without naming him, North's arguments on the legal limitation of the rate of interest appear to be in part directed. At the end of the preface to the *Discourses* are brought together a number of propositions, embodying the author's views, which he announces as "paradoxes, no less strange to most men than true in themselves." They are so remarkable for the time at

which they appeared, more than eighty years before Smith's great work, that they deserve to be quoted in full.

"That the whole world as to trade is but as one nation or people, and therein nations are as persons. That the loss of a trade with one nation is not that only, separately considered, but so much of the trade of the world rescinded and lost, for all is combined together. That there can be no trade unprofitable to the public, for, if any prove so, men leave it off; and wherever the traders thrive, the public, of which they are a part, thrive also. That to force men to deal in any prescribed manner may profit such as happen to serve them; but the public gains not, because it is taking from one subject to give to another. That no laws can set prices in trade, the rates of which must and will make themselves; but, when such laws do happen to lay any hold, it is so much impediment to trade, and therefore prejudicial. That money is a merchandise, whereof there may be a glut as well as a scarcity, and that even to an inconvenience. That a people cannot want money to serve the ordinary dealing, and more than enough they will not have. That no man shall be the richer for the making much money, nor have any part of it, but as he buys it for an equivalent price. That the free coinage is a perpetual motion found out whereby to melt and coin without ceasing, and so to feed goldsmiths and coiners at the public charge. That debasing the coin is defrauding one another, and to the public there is no sort of advantage from it, for that admits no character, or value, but intrinsic. That the sinking money by alloy or weight is all one. That exchange and ready money are the same, nothing but carriage and re-carriage being saved. That money exported in trade is an increase to the wealth of the nation, but spent in war and payments abroad is so much impoverishment. In short, that all favour to one trade or interest against another is an abuse, and cuts so much of profit from the public." The tract closes with these weighty words: "No people ever yet grew rich by policies; but it is peace, industry, and freedom that bring trade and wealth, and nothing else."

NORTH, Roger (1650-1733), in writing his *Examen* of Kennet's *History of England*, and the "Lives" of his brothers, Lord Keeper Guilford, Sir Dudley North, and John, master of Trinity College, Cambridge, became one of the original authorities for the political and social history of the reigns of Charles II. and James II. He was a weak man, a humble worshipper of his elder brothers, and especially of the lord keeper, by whose politic energy the family of North had been raised from a very decayed condition; but the simplicity of his prejudices and the laborious minuteness of his details, notwithstanding the forensic pedantry of his style, give his writings some value. Whatever his great brother did he thought both right and noteworthy; hence he is a useful contributor to the moral history of the period.

NORTH, Sir Thomas, son of Edward North, first Baron North of Kirtling, is memorable as the author of the English version of Plutarch's *Lives* that supplied Shakespeare with materials for his classical plays. Materials for a biographical notice are extremely scanty; and neither the exact date of his birth nor that of his death is known. His literary career was long, for he was living in decayed old age in 1603 when a third edition of his Plutarch was published, with a supplement of other translated biographies. His first appearance in literature was in 1557, when Wayland published for him a translation of Guevara's *Diall of Princes*, a compendium of moral counsels pleasantly interwoven with incidents in the life of Marcus Aurelius. The English of this work is one of the earliest specimens of the more ornate, copious, and pointed style for which educated young Englishmen had acquired a taste in their Continental travels and studies, and which such fashionable tutors as Ascham and Wilson inculcated by both precept and example. North translated from a French copy of Guevara. The first edition of his Plutarch, translated from the French of Amyot, appeared in 1579.

NORTH ADAMS, a township, manufacturing village, and important railway junction of the United States in Berkshire county, Massachusetts, on the Hoosac river, 143 miles from Boston by the Troy and Boston Railroad. Cotton and wool-weaving and shoemaking are the leading industries. The population of the township, formerly included in Adams township, was 10,191 in 1880. About a mile to the east of the village the Hudson's Brook is arched over for a considerable distance by a romantic cave from 30 to 60 feet in height. Nathaniel Hawthorne, who spent the summer of 1838 at North Adams, gives a fine description of the spot.

NORTHALLERTON, a market town and parliamentary borough in the North Riding of Yorkshire, is situated on a small stream, the Sun Beck, a tributary of the Wiske, and on the North-Eastern Railway, about 40 miles north of Leeds and 17 north of Ripon. It consists principally of a long and wide street running north and south. The church of All Saints is a large cruciform structure in the Early English and Perpendicular styles, with a square tower 80 feet in height rising from the centre. There is a grammar school of royal foundation. Among the charities are a hospital founded in 1476 by Richard Moore and a cottage hospital opened in 1877. A town-hall was erected in 1874. There are no traces of the fortified palace of the bishops of Durham, of the White Friars monastery founded in 1354, or of the Austin priory founded in 1341. The town possesses a manufactory of brattice cloth. The population of the parliamentary borough in 1871 (10,381 acres) was 4961, and in 1881 it was 5445. The population of the urban sanitary district (3650 acres) in the same years was 3164 and 3692 respectively.

Northallerton is supposed to have been a Roman station and subsequently a Saxon burgh. In Domesday it is called Alvertune and Alreton. The prefix "North" was added to distinguish it from Allerton Mauleverer. Near it took place (22d August 1138) the Battle of the Standard, when the Scots under King David were defeated by the English with a loss of 12,000 men. The town was given by William Rufus to the bishops of Durham. The demolition of their palace was ordered by Henry II. In 1318 the Scots under Robert Bruce plundered the town. It was occupied by Charles I. during the Civil War, and in 1745 the English army encamped on Castlehill above it.

NORTHAMPTON, an inland county of England, is bounded N. by Lincoln, N.W. by Rutland and Leicester, W. by Warwick, S.W. and S. by Oxford, S.E. by Buckingham, and E. by Bedford, Huntingdon, and Cambridge. It has an area of 629,912 acres, or about 982 square miles. Its greatest length from north-east to south-west is about 70 miles; in breadth it varies from 7 to 26 miles. The surface is hilly and undulating, but the hills are for the most part small and rounded and the undulations monotonous, notwithstanding that the country is richly cultivated and in some parts finely wooded. The highest summits are Albury (804 feet) and Naseby (697 feet). In the western and south-western districts the scenery becomes almost picturesque, and in the centre and east, where greater monotony prevails, numerous fine trees add a pleasing aspect of richness. For a long period Northampton has been famed for its ash trees, and there are also some very old oaks, as well as a few fine avenues of elm. The north-eastern extremity belongs to the great fen district. The county forms the principal watershed of central England, nearly all the more important rivers of this region having their sources within its boundaries. The Avon with a westward course forms for some distance the northern boundary of the county, till near Lilbourne it passes into Warwickshire. The Nene passes southward through Northampton, whence it takes an easterly course, skirting the eastern boundary of the county. The Welland flows in an easterly direction, forming the boundary of the county with Leicester, Rutland, and Lincoln. The Cherwell, after passing into Oxfordshire, forms for a considerable distance the southernmost portion of the western boundary with that county; the Leam forms a portion of the boundary with Warwickshire. The Ouse, which rises near Brackley, soon afterwards leaves the county, but again touches it near Stony Stratford, separating it for some distance from Buckingham. The Grand Junction Canal, which is connected with the Oxford Canal, enters the county at Braunston on the borders of Warwickshire and passes by Daventry and Blisworth into Buckinghamshire, a branch connecting it with Northampton. The Grand Union Canal unites with the Grand Junction near Daventry and runs north until it joins the Leicester Canal at Foxton. branches passing to Welford and Market Harborough.

Geology.—Lias forms the foundation of Northamptonshire, and above it rest the Oolite formations which crop to the surface throughout the greater part of the county. Lias prevails as the surface formation in the west and north-west. Its total thickness is about 800 feet, the Lower Lias clays which stretch in from Warwickshire having a thickness of 500 to 600 feet, the Middle Lias or marlstone of about 30 feet, and the Upper Lias clays, which form numerous outliers scattered over the marlstone plateau and also appear along the beds of several of the streams, a thickness of from 150 to 200 feet. Immediately above the lias come the inferior Oolite beds of Northamptonshire sand, which reach their greatest thickness in the neighbourhood of Northampton. The sandstone is strongly impregnated with oxide of iron, supposed to have been deposited by the percolations of water through the stone. Brown hæmatite iron is also found at Addington. The iron of Northamptonshire was made use of by the Romans, but the rise of the modern industry dates from about 1850. In 1881 iron was worked at thirty different places in the county, the total quantity obtained being 1,270,544 tons with an estimated value of £176,427. About one-fourth is smelted in the district, but the greater quantity is sent raw to Merthyr-Tydfil and Staffordshire. East and north-east of the county sandstone is largely quarried for building purposes, and is both easily worked and richly coloured. It is highly fossiliferous, containing many species not known in other districts. The upper division consists of a nearly white silicious sandstone frequently intercalated with clay. Above the sandstone rest beds of Lincolnshire limestone, and, where it is absent, a sandy clay. The slopes of the hills are frequently capped with cornbrash, sometimes overlaid with Oxford clay. Various isolated portions are covered with drift deposits. Where sandstone and limestone join the clay numerous springs occur, the proximity to which has in many cases determined the sites of villages and towns.

Soil and Agriculture.—The climate of Northamptonshire is mild and genial, while the absence of lofty hills renders it much drier than many other inland districts. The prevailing soil is a rich brown but light and crumbling mould, sometimes with a rocky subsoil. The richest soil is the black mould of the fen district, which is specially suited for grass, as are all the heavier soils. Nearly all the land is capable of cultivation, although there is some stiff wet soil on the slopes of the hills. In 1883 there were 559,536 acres, or about 88 per cent. of the total area under cultivation, of which no fewer than 304,654 acres were under permanent pasture, many of the heavier soils having been laid down during the past few years. Leases are the exception, and on this account grass land is more in request than arable. The farms in general are not large. Isolated houses are rare, both farmers and labourers living for the most part in villages. The farm buildings are thus frequently inconveniently situated as well as badly constructed, although improvements in both respects are being introduced. The usual rotation of crops is fallow, wheat, beans, and oats on heavy soils; but on the lighter soils wheat, pease or barley, with clover and roots, on a four or five years' rotation is the system generally adopted. Frequently the land is left three years in grass. Of the 158,445 acres under corn crops in 1883, 59,613 were under wheat, 50,866 under barley or bere, 24,914 under oats, 16,770 beans, and 6121 pease. Green crops occupied only 38,143 acres, 23,923 of these being under turnips and swedes, 4894 under mangolds, and only 2520 under potatoes. Clover occupied 34,137 acres, and fallow 24,157. Horses in 1883 numbered 21,901, of which 16,209 were used solely for agricultural purposes. Cattle numbered 117,790, of which 26,036 were cows and heifers in milk or in calf, the fattening of cattle being the chief occupation of the Northamptonshire farmer. The favourite stock for breeding purposes is the shorthorn, which has now almost entirely superseded the longhorn; but the most common custom is to buy in Hereford, Scotch, Welsh, and Irish cattle in the spring and fatten them off the rich pasture with or without artificial food, a few being retained and fed up for the Christmas market. In autumn additional cattle are bought in to eat the coarse grass off the pastures, and these are usually retained during winter. Sheep in 1883 numbered 413,075, of which 255,737 were one year old and above. The most common breed on the rich pastures is the improved Leicester, which is preferred on account of its length of wool; but the Southdown, on account of its superior flesh, is also largely kept.

According to the latest returns the land was divided among 14,665 proprietors, possessing 592,771 acres, with a gross estimated rental of £1,637,370, an average of about £2 15s. 3d per acre. Of the owners 10,010, or about 79 per cent., possessed less than one acre each; 33 proprietors possessed between 2000 and 5000 acres, 11 between 5000 and 10,000, and the following over 10,000 each:—Hon. G. W. Fitzwilliam, 18,116; duke of Buccleuch, 17,965; Earl Spencer, 17,031; Lord Overstone, 15,046; and the marquis of Exeter, 13,546.

Manufactures.—The iron industry is of great importance, and, though only a small proportion of the metal is smelted in the county, the number of furnaces in blast is increasing. The staple and the only manufacture of importance is that of boots and shoes, which is chiefly carried on in Northampton and the towns and villages in the centre of the county and along the eastern border.

Railways.—The main lines of the London and North-Western, the Great Northern, and the Midland Railways pass through portions of the county, and branch lines traverse it in all directions.

Administration and Population.—In Domesday Northampton is mentioned as containing 30 hundreds, but it then included a considerable part of Rutlandshire. These divisions were first reduced to 28, and in the reign of Henry II. to 20, their present number. The county includes the municipal boroughs of Daventry (3859) and Northampton (51,881); the principal part (20,123) of the city of Peterborough, which was incorporated under the Municipal Act in 1874; part (1171) of the borough of Stamford, of which the greater part is in Lincolnshire; part (2412) of the borough of Banbury, the greater part of which is in Oxfordshire; the borough of Higham-Ferrers (1468); and the urban sanitary districts of Hardingstone (4866), Kettering (11,095), Oundle (11,196), and Wellingborough (13,794). Before the Reform Act of 1832 Northamptonshire sent nine members to parliament, two for the shire, two each for the city of Peterborough and the boroughs of Northampton and Brackley, and one for the borough of Higham-Ferrers. By that Act the number was fixed at eight, Brackley and Higham-Ferrers being disfranchised, while the county was formed into two divisions, a northern and a southern, each returning two members. There are two courts of quarter-sessions, one for the county and the other for the liberty or soke of Peterborough, and nine petty and special sessional divisions, exclusive of the liberty of Peterborough. The boroughs of Northampton and Stamford have commissions of the peace and separate courts of quarter-sessions. The boroughs of Daventry and Higham-Ferrers form parts of the petty and special sessional divisions of Daventry and Wellingborough, the county justices having concurrent jurisdiction. The county contains 344 civil parishes, with parts of four others. It is almost entirely in the diocese of Peterborough. The population of Northamptonshire in 1801 was 131,757, which in 1821 had increased to 162,483, in 1871 to 243,891, and in 1881 to 272,555 (135,662 males and 136,893 females). The number of inhabited houses in 1881 was 57,540, and the average number of persons to an acre 0·43.

History and Antiquities.—The Coritani, who at the time of the Roman invasion inhabited Northamptonshire, are supposed to have been dependent on the Iceni. Of this period the only remains are a few traces of camps and earthworks, the principal being those at Borough Hill near Daventry, where some rude pottery of supposed British origin has been discovered; at Arbury Hill near Staverton; and at Rockingham, on the site of the present old castle. Under the Romans Northamptonshire formed part of *Flavia Cæsariensis*. It was crossed by two great Roman roads, the Watling Street and the Ermine Street: the former entered the county near Stony Stratford and passed by Towcester and Weedon to Lilbourne, where it crossed the Avon; the latter crossed over from Castor near Peterborough into Lincolnshire. From the large number of remains discovered within its limits Northamptonshire would appear to have been very extensively occupied by the Romans. The principal Roman stations within its limits were Irchester, on the north side of the Nene, where numerous pieces of pottery, coins, and slabs with inscriptions have been found; Castor, the seat of a celebrated Roman pottery, the extent of which and the finish of whose workmanship are attested by the tesselated pavements and other relics, as well as by the kilns for bricks and earthenware, that have been dug up; Benaventa, supposed to be Borough Hill, where excavations have brought to light traces of very extensive buildings; Lactodurum, supposed to be Towcester, where, however, very few Roman remains are now visible; Isannavatia, probably at Burnt Walls, a large field covered with remains of Roman buildings; and Tripontium, supposed to be Lilbourne, where there are traces of camps on both sides of the river. There were also encampments at Arbury Hill, Barrow Hill, Castle Dykes, Chesterton, Guilsborough, Hunsborough, Rainsborough, Sulgrave, and Wallow Bank, besides numerous small camps and posts at other places, especially along the valley of the Nene, which is thickly strewn with tesselated pavements and other remains.

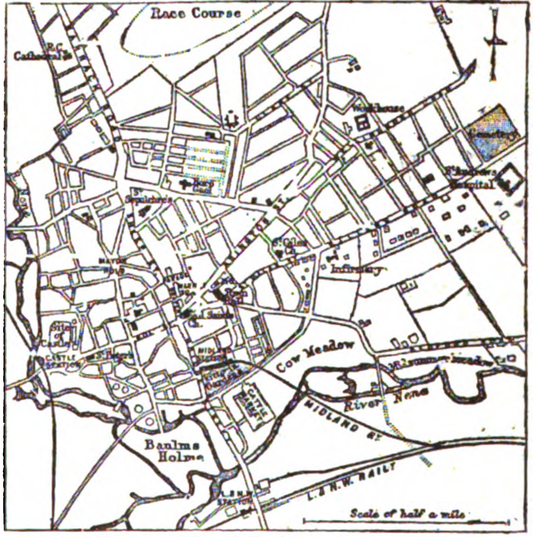
Northampton formed part of Middle Anglia, and was included in the Saxon kingdom of Mercia. In the time of Tostig, and according to some at an earlier period, it was attached to Northumberland, and formed no part of Mercia. When the Northumbrians in 1065 rebelled against Tostig and chose Morkere for their earl they marched southwards to Northampton, where they were met by Harold and received from him the confirmation of Morkere in the earldom; but the shires of Northampton and Huntingdon were detached from it, and bestowed on Siward's young son Waltheof, who became earl of Northampton and Huntingdon. After the Conquest the district became on account of its extensive forest, a favourite resort of the kings of England, who occupied the castles of Northampton and Rockingham. During the Civil War Northamptonshire was the scene of many skirmishes in addition to the great fight at Naseby, while the battle of Edgehill took place on its borders.

Although Northamptonshire was rich in monastic foundations, remains, except of the abbey-church of Peterborough, afterwards the cathedral, are of small importance, the principal being the foundation and parts of the walls of St James's Abbey at Duston near Northampton, part of the church of the Cistercian abbey of Pipewell near Daventry and of the Cluniac priory at Daventry, and the priory church at Ashby. At Geddington, and also at Northampton, there is an Eleanor cross in good preservation. For the architecture of its churches Northampton holds a place scarcely inferior to any other English county. To the Saxon period belong the tower of Earls Barton church, which stands on an eminence, probably the mound of an old English strong-house; the tower and other portions of Brigstock; the ground plan and other portions of Wittering; the remarkable tower of Barnack; and Brixworth church, constructed in part of Roman materials, and supposed to include part of a Roman basilica. Of Norman, besides the cathedral of Peterborough, the finest examples are St Peter's and St Sepulchre's, Northampton, and the tower of Castor. Higham-Ferrers, formerly a collegiate church, Early English and Decorated, is one of the most remarkable churches in the county, both on account of the beauty of its architecture and the number of monuments and brasses it contains. Of the other churches, most of them representing more than one style of architecture, Early English, Decorated, and Perpendicular, the standard of excellence is generally so high that it is impossible to select a few for special notice in preference to others.

The last surviving fragments of the enclosing wall of Northampton Castle were only demolished in 1878. A gateway at Rockingham, and earthworks at Higham-Ferrers and Brackley are worthy of mention. Some castellated ruins remain of Fotheringhay Castle, which was founded soon after the Conquest by Simon de St Liz, was rebuilt by Edmund, son of Edward III., and for many years was a favourite residence of the princes of the house of York. To it Mary Queen of Scots was removed in September 1586, and it was the scene of her trial in the October following, and of her execution, 8th February 1587. The current statement that the castle was rased by James I. after his accession to the English throne is a mistake, but it was allowed to go to decay, and its materials were gradually used for other buildings. Barnwell Castle, founded by William the Conqueror, and an interesting example of the defensive construction of the period, is still a fine ruin, which includes four of the round towers and an imposing gateway. Holdenby Manor House, where Sir Christopher Hatton was born, and where Charles I. was staying when he was carried away by Cornet Joyce, has been demolished. Among the ancient mansion-houses are Castle Ashby, the seat of the Comptons, the oldest portion belonging to the reign of Henry VIII.; Althorp, the seat of the Spencers, of various dates; Drayton House, of the time of Henry VI.; the vast pile of Burghley House, founded by Lord Burghley, but more than once altered and enlarged; and Kirby Hall, built by Sir Christopher Hatton.

There are histories of Northamptonshire by Norden (written 1610, pub. 1720), Bridges (1746, 1791), Baker (vol. i. 1822, 2 parts of vol. ii. 1841), and Whellan (1849, 2d edition 1874). See also Sternberg, *The Dialect and Folklore of Northamptonshire* (1851); *Architectural Notices of the Churches in the Archdeaconry of Northampton* (1848-49); Hudson, *Brasses of Northamptonshire* (1853); and North, *Church Bells of Northamptonshire* (1878).

NORTHAMPTON, a municipal and parliamentary borough, and the county town of Northamptonshire, is situated on the slope and summit of an eminence rising above the river Nene, on the main line of the London and North-Western Company, on several branch railway lines, and on a branch canal connecting it with the Grand Junction Canal, 65 miles north-north-west from London. It is divided into four nearly equal parts by two main streets, each about a mile in length, running north and south and east and west, and crossing each other at right angles. In the centre of the town there is a very spacious market square, with a fine drinking fountain, erected in 1860 on the site of the old cross, destroyed by the fire of 1675 which levelled a great part of the town. The older houses are substantially built of stone, the newer ones of brick with stone facings. Formerly there were seven parish churches, but of these only four now remain. All Saints, St Giles's, St Peter's, and St Sepulchre's. All Saints was rebuilt after the fire of 1675, but retains its old Decorated Gothic embattled tower, which scarcely harmonizes with the style of the modern building, the principal feature of which is the fine Ionic portico. The church of St Giles's was originally a cruciform structure of the beginning of the 12th century, but has been greatly changed, and, besides a fine Norman doorway, contains specimens of Early English, Decorated, and Perpendicular. St Peter's, near the ancient castle, is supposed to be of the same date with it, and its interior is a fine specimen of Norman architecture. St Sepulchre's, one of the four round churches still remaining in England, is supposed to have been built by the Knights Templars at the close of the 11th century. The Roman Catholic cathedral, in the Gothic style, was founded in 1844, and greatly enlarged in 1863. Among the educational establishments are a free grammar school (1552), a Government school of art (1871), and a bluecoat school, in addition to charity, church, and school-board schools. The charitable foundations comprise St John's Hospital, founded in the 12th century; St Thomas Hospital, founded 1450, in honour of Thomas Becket; the general



Plan of Northampton.

infirmary (1747), the general lunatic asylum (1837), the union workhouse (1837), and the Royal Victoria Dispensary (1844). Among the public buildings are the town-hall in the Gothic style (1864), the county-hall in the Grecian, the corn exchange buildings in the Italian, the county jail, the borough jail, the barracks, and the theatre. There is a fine public promenade, and a racecourse with an area of 117 acres. A new cattle market was opened in 1873. Northampton is unrivalled in England for the manufacture of boots and shoes. There are also currying works, breweries, maltings, iron-foundries, flour and paper mills, and brick and tile works. The population of the municipal borough (area 1342 acres) in 1801 was 7020, which in 1831 had increased to 15,357, in 1851 to 26,658, in 1871 to 41,168, and in 1881 to 51,881, of whom 25,249 were males and 26,632 females. The parliamentary borough was enlarged in 1868 to 2046 acres, and the population in 1871 was 45,080, which in 1881 had increased to 57,544.

There is a tradition that Northampton was founded by Belinus, a British king, while according to some it is of Roman origin. Neither of these suppositions is supported by any tangible evidence. In the *Saxon Chronicle* it is called Hamptune. From 917 to 921 it was in possession of the Danes, and in 1010 was nearly wholly destroyed by Sweyn. After the Norman Conquest it was defended by embattled walls, bastion towers, and a strong fortress. Northampton has been more than once the scene of a parliament. The priory of St Andrew, founded before the Norman Conquest, was rebuilt by Simon de St Liz, and was of very great extent. During the Civil War the town was fortified for the Parliament. The borough received its charter of incorporation from Henry II., which was subsequently extended by the 36 of George III., and this continued to be the governing charter until the passing of the Municipal Act of 1835, when the government was vested in a mayor, six aldermen, and eighteen councillors, the town being divided into three wards. Northampton has returned two members to parliament since the time of Edward I.

NORTHAMPTON, a city of the United States, the county seat of Hampshire county, Massachusetts, is situated on the west side of the Connecticut river, 17 miles by rail north of Springfield, and is connected with Hadley by a bridge 1230 feet long. The village of Northampton lies in rich alluvial meadow-land, about a mile from the bank of the river, and with its semi-rural streets and venerable trees has the reputation of being one of the prettiest villages in New England. Of note among its buildings are Smith College (1871; endowment, $500,000) for the higher education of women, the free public library (18,000 volumes) and memorial hall, the Clarke institution for deaf-mutes (1867; endowment, $300,000) on rising ground to the west, and the State lunatic asylum (1858; 460 patients). A tramway runs 3 miles to Florence, a manufacturing village producing sewing-machines, silk goods, paper, &c. The population of the township was 5278 in 1850, 6788 in 1860, 10,160 in 1870, and 12,172 in 1880.

Nonotuck, bought from the Indians in 1653, became the village of Northampton in 1654, and was incorporated as a city in 1883. Jonathan Edwards was pastor from 1727 to 1750, and David Brainerd died under his roof in 1747. Timothy Dwight, Arthur, Benjamin, and Lewis Tappan, and W. D. Whitney were born at Northampton.

NORTHAMPTON, Henry Howard, Earl of (*c.* 1539-1614), the second son of the earl of Surrey, the poet, born about 1539, was restored in blood by the first parliament of Elizabeth. He bore a high character for learning, but during the greater part of Elizabeth's reign he remained in obscurity, sharing the fortunes of his family. Towards the end of the century he attached himself first to Essex and afterwards to Cecil, and took part in the secret correspondence of the latter with James VI. of Scotland. When James became king of England, Lord Henry Howard at once sprang into favour. Though a Catholic in principle, he was ready to attend the Protestant service to please the king, and it is probable that he was one of the few who, in consideration of the services which they were able to render, were authorized by the authorities of that church to take this course. He was a good flatterer, and in 1603 he became a privy councillor. In 1604 he was made lord warden of the Cinque Ports and earl of Northampton. In 1608 he became lord privy seal, and in 1612 one of the commissioners of the treasury.

In politics he gave his support to the Spanish alliance and to the toleration of the Catholics, believing, as was said by a Catholic agent, that the restoration of the Catholic religion in England was the only bulwark against Puritan democracy. After the signature of the treaty with Spain in 1604 he accepted a pension from the king of Spain. After Salisbury's death in 1612 he won over Carr, who was then earl of Rochester, to his interests by countenancing the favourite's intimacy with his great-niece, Lady Essex, and by supporting the divorce which made a marriage possible between them. Rochester, who soon became earl of Somerset, placed himself completely at Northampton's service in supporting an alliance with Spain. Northampton died in 1614, before the detection of the murder of Overbury, which brought about the fall of Somerset, and ultimately the exclusion from office of the Howard family.

NORTHAMPTON, Spencer Compton, Earl of (1601-1643), born in 1601, was the son of the Lord Compton who obtained a large fortune by his wife, the daughter of Sir John Spencer, the rich lord mayor, and who was created earl of Northampton in 1618. The young Lord Compton accompanied Prince Charles to Spain in 1623. He succeeded to the earldom in 1630. Though he sometimes appeared at court ceremonies, he preferred a home life. In the Civil War he took the king's side, opposing Lord Brook in Warwickshire in 1642, and taking part in the battle of Edgehill. When Banbury was taken he was placed in command of the garrison, and was active on the Royalist side in Staffordshire and Northamptonshire, as well as in his own county of Warwick. On 19th March 1643 he was dismounted in the fight at Hopton Heath near Stafford. His life was offered to him, but he answered that "he scorned to take quarter from such base rogues and rebels as they were," and was immediately slain.

NORTH BIERLEY, an urban sanitary district in the West Riding of Yorkshire, England, about 2 miles south of Bradford, includes the villages of Bierley Lane, Wibsey, and Low Moor, and other smaller hamlets. There are extensive collieries in the district as well as blast and puddling furnaces and rolling-mills, the ironworks at Low Moor employing between 3000 and 4000 persons. The church of the Holy Trinity at Low Moor was erected in 1606 in the Early English style, but has undergone restoration. The manor of North Bierley originally belonged to the Swillingtons of Swillington, who were strong adherents of the house of Lancaster. The population of the urban sanitary district (area 4309 acres) in 1871 was 18,616, and in 1881 it was 20,935; that of the township of North Bierley (area 3342 acres) in the same years was 14,433 and 15,620.

NORTH CAROLINA, one of the original thirteen States that formed the American Union, is situated on the Atlantic seaboard between 33° 50′ and 36° 33′ N. lat. and between 75° 27′ and 84° 20′ W. long. It stretches 500 miles east and west across the entire breadth of the Atlantic slope of the Appalachians in a long narrow rudely triangular belt, its western extremity, less than 20 miles wide, resting on the highest plateau and summits of that continental system of mountains, while its eastern end spreads out to a breadth of 200 miles in a low, level, and gently undulating plain on the Atlantic coast, with a curving shore-line of more

than 300 miles. Its area is 52,286 square miles, of which 3620 are covered by water.

Physical Features.—The western section is a rugged mountainous plateau; it forms a narrow, irregular, much indented trough, lying between the bifurcating chains of the western and dominant arm of the southern prolongation of the Appalachians,—the Smoky Mountains and the Blue Ridge,—the former being the western boundary of the State. The length of this plateau from north-east to south-west is more than 200 miles, its breadth 15 to 50 miles, and its area nearly 6000 square miles. The Smoky chain has a general elevation of from 5000 to 6000 feet, rising in many summits to 6500 feet and upwards, but is broken down by half a dozen deep water-gaps or cañons to the level of 2000 and even 1200 feet. The Blue Ridge, which constitutes the eastern boundary of the plateau, is a very sinuous and angular and straggling mountain chain, with a general elevation of from 3000 to 4000 feet and upwards, a few of its higher summits about midway in the State, reaching nearly 6000 feet.

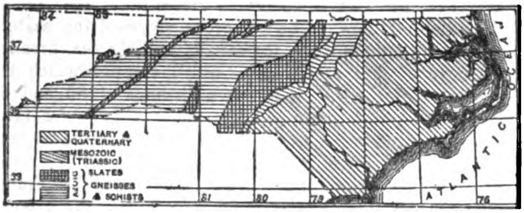
These two bounding chains are connected by many north and south cross-chains, of equal elevation with themselves, or greater, and separated by deep valleys. On one of these cross-chains, called the Black Mountains, is Mitchell's Peak, the highest point east of the Mississippi, its altitude being 6688 feet (400 feet above Mount Washington in New Hampshire). The cross-valleys or river-basins have an altitude of from 2000 to 3000 feet, with smaller benches and marginal plateaus of from 3500 to 4000 feet. Seen from the east or Atlantic side, the Blue Ridge appears as a steep, ragged, and broken escarpment, springing suddenly 2000 to 3000 feet above the Piedmont plateau at its base. This plateau has along its western margin an altitude of 1200 to 1500 feet above sea-level, and is mountainous, with high and precipitous spurs projected eastward and southward from the Blue Ridge. A few of these extend in irregular straggling ranges all across the breadth of the Piedmont section, which is 60 to 75 miles wide, and carries an elevation of 1000 feet to its eastern margin.

This middle region of the State is a country of hills and valleys and rolling uplands, its prominent topographical features being a succession of broad-backed swells with eastward or south-eastward trends, constituting the water-sheds between a number of large rivers, which take their rise in the Piedmont or on the flanks of the Blue Ridge, and reach the Atlantic through a system of wide valleys, 300 to 500 feet below the intervening divides. The area of this region is about 20,000 square miles; its altitude, descending gradually from 1000 to about 200 feet, averages about 650 feet. Eastward, to the sea, lies a great champaign, 100 to 120 miles wide, and 20,000 square miles in area. The surface is generally quite level, but in places undulating and hilly towards the western border, especially near the larger rivers. Towards the coast it is diversified by numerous and extensive sounds, bays, rivers, lakes, marshes, swamps, and islands, the whole surface for 50 miles inland from Hatteras and the eastern shore being less than 20 feet above sea-level. The sea is walled off from this low-lying territory by a long linear chain of sand-islands or dunes, ranging from 75 to 100 feet and upwards in height, and separated in half a score places by inlets which connect the sounds with the ocean.

Rivers and Drainage.—The features above described give the main outlines of the drainage system, the Blue Ridge being obviously the chief factor. The streams which rise east of that chain empty into the Atlantic, either directly through the territory of this State or by crossing also that of South Carolina; those which rise west of it seek the Mississippi and the Gulf of Mexico, partly by way of the Tennessee, many of whose chief affluents have cut their way in a north-westerly course across the mountain plateau and through the Smoky range, and partly by way of the Ohio, leaving the plateau in a north-easterly direction and reaching that river by the Kanawha through Virginia. Several of the most considerable rivers take their rise in the midland region. The numerous rivers of the eastern section, as they approach the sounds and the sea, broaden into bays of 2, 3, and 5 miles width, through which the movement of the tide is felt to a distance of 50 and 60 miles inland, and many of them are navigable for more than a hundred miles to the lower falls near the western border of the alluvial region.

Climate.—In climate North Carolina resembles France and Italy. The position of the eastern end on the Atlantic and its projection southward beyond the parallel of 34°, together with the near approach of the Gulf Stream, give this part of the State a sub-tropical climate, its isotherm (66°) being that of the southern half of the Gulf States and of Nicolosi in Sicily, while the great elevation and inland recession of the western section bring its climate to that of the cold temperate zone, the isotherm for the higher plateaus (51°) being that of New England and Upper Canada. The average annual mean temperature of the State is 59°; for the eastern region it is 61°, for the middle 58°, and for the mountainous region 52°. The summer temperature is, for the State 77°, and for the several regions respectively 79°, 77°, 70°; and the winter temperature, 43° for the State, and for the regions named 46°, 44°, 38°. During a recent winter of unusual severity the thermometer several times indicated 30° and 40° below zero in Michigan and New England, while in North Carolina 10° *above* zero was reached but once. The average of the minimum temperature for the State is 15°, for the middle region 13°, and for the west 8°; a record of 10° is rarely made east of the Blue Ridge, or of 0° west of it. The mean annual rainfall is nearly double that of England and France, the average for the State being 52 inches, and for the east, middle, and west respectively 60, 45, 58 inches. This precipitation is distributed nearly uniformly through the different seasons, with a slight preponderance in the amount of summer rain and a correspondingly less quantity in the autumn. Notwithstanding this large amount of rainfall, the tables of humidity show that the climate is as dry as that of France; and the cultivation of the vine, cotton, silk, &c., furnishes the strongest practical proof of the fact. The prevalent winds are westerly, south-west winds being more common in the east, north-west winds in the middle, and west winds in the mountain region. The rain-bearing winds are mostly from the west and south-west, but the winter rains often come from the north-east. Situated westward of the track of the Atlantic cyclones, and sheltered by high mountains and by distance from the western tornado, the State enjoys almost complete immunity from these destructive visitations. The climate is favourable to human health, except in limited malarial tracts in the lowlands on some of the rivers. The death-rate for this State is less than the average for the United States, and one of the two areas where consumption is unknown is found here.

Geology.—The geological structure of the State is very simple; the formations are arranged quite regularly in zones parallel to the Appalachian axis and the Atlantic coast, and belong almost entirely to two horizons, the Archæan (or Azoic) and the Tertiary. The rocks of the several subdivisions of the former, the Laurentian, Montalban, Huronian, &c., occupy the western and middle regions and succeed each other in broad terranes, consisting of granites, gneisses, and schists, separated by narrow belts of quartzites, limestones, sandstones, and slates. The dip of these rocks is almost uniformly eastward and generally at a high angle. Across the middle of the State lies an extensive zone, 20 to 40 miles wide, of the Archæan slates, with a predominance of chlorite and felsite slates, schists, clay slates, and shales, with steep westerly dips. This is succeeded in the region of Raleigh by another terrane of gneisses and schists about 20 miles wide, inclined eastward at high angles and disappearing southward and eastward under the Tertiary formation, and giving place in turn, farther eastward, to an equal breadth of slates and felsites, (with occasional bosses of granite), which are only seen where they have been uncovered in the beds and bluffs of the larger rivers. The whole eastern region is mantled over with a thin covering of Tertiary rocks. These consist of sands, gravels, and clays, and of shingle beds and earths rudely stratified, towards the western border. The thickness of this formation ranges from a few feet to 25 and 50 feet, occasionally reaching 100 and 200 feet. Throughout the eastern and larger part of the division, in the ravines and in the beds and banks of the streams, are numerous outcrops of Middle Tertiary marls, Lower Tertiary shell-limestones, and coarse chalk beds. And in the southern half of this section, in the river beds and near the water-lino of their banks, the Cretaceous formation appears in beds of half-compacted greensand, occasionally filled with shells. Overlying the Tertiary are sporadic patches of Quaternary clays, gravels, and shingle beds, the latter chiefly near the great channel ways of the rivers, where they sometimes reach a thickness of 30 and 50 feet. The Mesozoic formation is represented by two long narrow trough-like terranes of Triassic sandstones, conglomerates, clay slates, and shales, with bituminous coal. One of these, 5 to 6 miles wide with a south-easterly dip of 10° to 20°, enters the State from South Carolina a few miles west of the Pedee river and, passing within 10 miles (west) of Raleigh, disappears within 15 miles of the Virginia line; the other, about 40 miles long and 2 to 4 miles wide, lies along the valley of the Dan river, nearly east and west in direction and near the Virginia line. These beds have a north-westerly dip of 30° to 70°. The rocks of these two belts have a thickness of several thousand feet and are evidently the remnant fringes of a broad, flat anticlinal which has suffered extensive erosion. These two outcrops converge in the direction of the Richmond coal-beds, and were no doubt once continuous with them and with the Mesozoic of New Jersey and Connecticut. The former of these belts carries a 6-foot seam of bituminous, the other a 3-foot seam of semi-bituminous coal. Both are of good quality, but have been little worked. The Palæozoic rocks are entirely wanting, and the Primordial cross the State line from Tennessee only in a few places along the Smoky Mountains.



Geological Map of North Carolina.

Minerals.—In consequence of the wide distribution of the older rocks there is a notable abundance and variety of minerals. More than 180 species have been discovered, some of great rarity; and one of them has recently yielded to science two new metallic chemical elements. Nearly a score different species of gems have been found, including the diamond, ruby, sapphire, emerald, beryl, lazulite, amethyst, garnet, agate, and zircon. There occur also many minerals having special applications in the useful arts, viz., mica, corundum, asbestos, baryte, chromic iron, garnet, zircon, kaolin, black oxide of manganese, talc, pyrophyllite, &c. Mica is found in large veins or dykes in all the terranes of Montalban gneisses, but the most extensive and valuable mines are found in the mountain region, where workable veins are numerous and extensive and the sheets of mica of unusual size and excellence. Corundum is about as widely distributed as mica, and occurs in the same series of rocks, as well as in some of the slate belts. The chief sources of supply of both corundum and mica for the arts, in the United States and in Europe, are the deposits of the mountains of this State. In this region are also numerous beds of white and variously-coloured marbles. Building stones of every variety are found in nearly all the sections, and whetstone, millstone, and grindstone grits, as well as potter's clay and fire-clay; and in the seaboard section are immense beds of peat. Iron, copper, and gold ores are coextensive with the outcrops of the metamorphic rocks. Several parallel ranges of magnetic and hæmatite iron-ore beds cross the State in a north-east direction, in both the middle and the mountain regions. These ores are of a high grade and are in great demand at the Bessemer furnaces in Pennsylvania and elsewhere. Beds of limonite are numerous and extensive in all parts of the State. Blackband ore is associated with the coal, and spathic ore occurs as the gangue of several copper and gold mines in the middle region. Iron for domestic consumption has been manufactured for a hundred years in the middle region and half as long in the other sections. Gold occurs in both placers and veins from Halifax county on the upper margin of the eastern champaign, within 110 miles of the sea-coast, through all the intermediate sections to Cherokee county in the extreme south-west. The more extensive and productive deposits are found in the midland region in the southern half of the great slate belt, and in the central part of the Piedmont region among the foot hills and spurs of the mountains. These placers consist of coarse shingle in the beds of the streams and the bordering level bottoms; climbing the slopes and benches of the hills adjacent, they pass insensibly from half-stratified shingle, gravel, and sand beds into unstratified earths with mingled fragments of stone. These deposits cover several hundred square miles of territory, and are of Quaternary or more recent age. Compared with those of California, they are of very slight thickness, generally not above 5 or 10 to 20 feet, and only occasionally reaching 40 and 50 feet. The most important and valuable vein mines are also found in the midland region. One of these, the Gold Hill mine near Salisbury, has been wrought to a depth of 750 feet, and its total produce exceeds two million dollars of bullion. In the same section are several noted silver mines,—Silver Hill, Silver Valley, and others. Many of the gold veins of the midland region carry also copper ores, and there are numerous copper veins in various parts of the middle and western regions. The more common ore is chalcopyrite, but there are also important lodes of grey copper.

Soils.—The soils of the eastern region are transported sands, gravels, and clays, of Tertiary and Quaternary origin, the assorted detritus of the abraded hills of the metamorphic rocks in the midland country to the westward. The upland soils of the region (the common characteristic cotton soils) are generally sands and loams of moderate fertility, with here and there considerable areas in long narrow ridges or oval patches called pine barrens, that are very sandy and sterile. Between these, on the benches and lower levels, stretch wide and fertile alluvial tracts, especially along the borders of the streams and the shores of the sounds and bays. On the flattish swells between the lower reaches of the great bay-like rivers and around the margins of the lakes, as well as along the borders of many of the creeks, are extensive tracts of swampy lands with a black peaty soil of great depth and inexhaustible fertility. These soils resemble those of the prairies of the north-western States, but contain a larger percentage of organic matter, and are more productive and more durable, producing 50 to 60 bushels of corn (maize) to the acre for a hundred years in succession without rotation and without manure. In the middle and western regions of the State the soils are of every variety of texture and composition and of every grade of fertility. They may be generally described as clayey, sandy, and gravelly loams; but there is a considerable proportion of clay soils, not only in the alluvions of the numerous creek and river bottoms, which are commonly of this description, but on the uplands as well; these are the more productive and durable. There are no prairie lands in the State, and the highest and ruggedest mountains are covered with soil and forests to their summits.

Forests.—The whole area of the State was originally forest-covered, and about two-thirds of it is still in the primitive condition, except that the woods are much denser in consequence of the cessation of the annual burnings by which the Indians kept down the brush and preserved them in an open park-like condition. The great variety of soils, together with the wide range of climate, gives rise to a remarkably rich and varied flora. While the higher mountains of the western section are covered with forests of spruces and firs and other trees common to Canada and the lake States, the seaboard section borrows from the Gulf States their live oak and long-leaf pine, their magnolias and palmettos. Of twenty-two species of oak found in the United States east of the Rocky Mountains, nineteen occur here; of eight pines, all are found in one section or another; of five maples, all; of nine hickories, six; of seven magnolias, all; of five birches, three; and so on. And nearly every one of the twenty kinds of timber used in New York shipyards is found here. There are three well-marked and broadly-distinguished forest regions in the State, corresponding to the three geographical divisions. Pines, chiefly the species *australis* and *tæda*, constitute the characteristic feature of the eastern forests, giving place in the lower swampy tracts, especially in the seaboard section, to the cypress and juniper. Oaks predominate in the middle and western regions, but the mountain forests contain oak, chestnut, hemlock, and white pine. The oaks, however, are also found in some of their species as a subordinate constituent of the forests throughout the eastern region, and several species of pine (chiefly *P. mitis*) are frequently mingled with the oaks to the western extremity of the State. The chestnut (*Castanea vesca*) is very abundant, and, reaching a diameter of 8 to 10 feet and a height of 80 and 100 feet, often constitutes extensive forests throughout the mountains. The poplar (*Liriodendron tulipifera*) is found in all the sections, but is most abundant in the western, where it equals the chestnut in dimensions. Hickories are distributed throughout the State wherever the soil is above average quality. This timber exceeds all the others in weight and strength. The total number of species of trees found in the State is 112, and there are just twice as many of shrubs, many of them 20 feet and upwards in height, which together give these forests everywhere an aspect of wonderful richness and variety, "comparing favourably with almost any portion of the tropics."[1] Among the trees are many valuable and popular cabinet woods, such as the walnut, holly, cherry, ash, cedar, birds-eye-maple, sycamore, &c. These forests are rapidly increasing in value as those of the northern States disappear and as the demand for timber increases.

Population.—In 1790, at the first United States census, the population was 390,000. In 1860, the year before the beginning of the Civil War, it had risen to 992,622, of whom 361,522 were coloured. In 1870 it was 1,071,361, an increase during this decade of less than 8 per cent. In 1880 it was 1,399,750 (531,277 coloured, and 1230 Indians). The foreign-born population numbered but 3742. The increase during the ten years 1870-80 was 30·6 per cent.; the number of persons to the square mile was 29. The people of this State are among the most rural in the United States. The largest city does not contain 20,000 people, and only four exceed 4000, viz., Wilmington, 17,350; Raleigh, 9265; Charlotte, 7094; New Berne, 6443.

Industries.—Agricultural pursuits engage three-fourths of the inhabitants, cotton and rice being staple products of the east, and hay, live stock, buckwheat, and other north-temperate zone products, of the mountain region; in one section or another may be found every agricultural product grown between the great lakes and the Gulf, except the orange. Indian corn occupies the largest acreage, and this and the other cereals are common to all sections. Cotton is raised in two-thirds of the counties. It is the chief market crop of the eastern and of the southern half of the middle region. The limit of cotton culture has extended northward 20 to 50 miles in the last fifteen years, and the produce has increased nearly threefold. In the northern half of the middle and Piedmont districts tobacco replaces cotton as the market crop. Within ten years its culture has extended into a large portion of the mountain region. The northern tier of counties, next to the Virginia border, is known as the Bright Tobacco Belt,—the larger part of the yellow or gold-leaf tobacco of commerce being produced in this narrow zone. This crop has also largely increased in the last ten years. The cultivation of the vine is also increasing in all sections of the State. According to Humboldt's thermal criteria the whole State lies within the zone most favourable to this industry. His conclusions are confirmed by experience in every part of the State, and by the fact that several of the most popular grapes have originated here, such as the Catawba, Isabella, and Scuppernong.

The following table gives the principal crops and their relative amounts at the two last enumerations:—

	1870.	1880.	
Indian corn	18,454,215	28,019,839	bushels.
Wheat	2,859,879	3,397,393	"
Oats	3,220,105	3,838,068	"
Rye	352,006	285,160	"
Potatoes, Irish	738,803	722,773	"
" sweet	3,071,840	4,576,148	"
Rice	2,059,281	5,609,191	pounds.
Tobacco	11,150,087	26,986,213	"
Cotton	144,935	389,598	bales.

The total number of farms in 1880 was 157,609; the average size 142 acres.

Mining and other Industries.—These, although of very subordinate interest, have long given occupation to a small portion of the population. Gold was first discovered in 1819, and between that date and 1850 hundreds of gold and copper mines were opened in the middle and western sections, and many thousands of the population were occupied in these industries. The total product of the gold mines between those dates is estimated at about $10,000,000. In the last few years mining industries have received a new impulse. Iron ores are mined on a considerable scale for export, many new gold and copper mines have been opened, and the amount of the output of the various mining industries is increasing very notably. Mica mining began fifteen years ago in the mountain region, and has grown to considerable importance, much the larger part of this material found in commerce being produced here. The annual yield is about 40,000 ℔, and is continually increasing.

The fisheries of the eastern rivers and sounds are large and profitable, and give employment to several thousand people. And in this region the getting of lumber, both in the pine forests and in the cypress and juniper swamps, has been an important source of profit since its first settlement.

The manufactures of North Carolina occupy a very subordinate place, and are mainly domestic and auxiliary to the one dominant agricultural interest. The value of the total annual output, as given by the census of 1880, is $20,095,037. Of this sum $2,554,482 is derived from the manufacture of cotton goods, $2,215,154 from that of tobacco, $1,758,488 from turpentine and tar.

Railroads and Waterways.—In ten years the number of miles of railroad has been nearly doubled and is now within a few score miles of 2000. There are 1000 miles of waterways open to steamboat navigation, including rivers, bays, sounds, and canals, forming a nexus of lines of communication extending over the whole eastern and seaboard region and connecting with the various ports along the coast from Wilmington to Norfolk in Virginia.

Government, Taxes, Education.—The executive power is vested in a governor, lieutenant-governor, secretary of state, auditor, treasurer, superintendent of public instruction, and attorney-general, who are elected by ballot and hold office four years. The legislative power is vested in a general assembly, which consists of a senate of 50 members and a house of representatives of 120 members, who are elected for two years and hold biennial sessions. The judicial power is vested in a supreme court, superior courts, and courts of justices of the peace. The supreme court consists of a chief justice and two associate justices. The State is divided into nine judicial districts, and there is one superior court judge to each. The judges of the supreme and superior courts are elected by popular vote for a term of eight years. The justices of the peace, who administer the law in the counties, are appointed by the legislature. A capitation tax, which may not exceed $2, is levied for the support of a system of education. Other State taxes are levied *ad valorem*, and amount at present to 25 cents on each $100 worth of property, and this on a very low valuation. The public debt is $5,706,616. The total assessed valuation of property is $156,100,202; the real value is about $300,000,000. A system of public schools is established by law and supported by funds derived from State taxes, and increased by county and municipal levies. The schools are required to be kept open four months in the year. The receipts of the school fund for 1880 were $553,464.

History.—The coast of North Carolina was the scene of the first effort of the English to colonize America. In the years 1585 to 1587 Sir Walter Raleigh despatched hither five fleets in succession, and planted three small colonies, which disappeared one after the other and left no trace. In consequence of these failures, due in large measure to the peculiar conformation of this difficult coast and the want of good harbourage, the next expedition, twenty years later, was directed to strike the coast farther north, about the mouth of the James river, where the first permanent settlement was effected; and no further attempt at direct colonization from Europe was made for three quarters of a century. Thus, instead of being the first of the American colonies in point of time, the colony of

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[1] See Dr Cooper, in "Forests and Forest Trees of North America," *Smithsonian Report*, 1858.

Carolina came very near being the last. The southern boundary of the colony of Virginia was the parallel of 36° 30′ N. lat., although the whole continent was still called by that name, and all the country south of this limit to the Gulf was granted by Charles II. in 1663 and 1665 to a company of English noblemen styled the lords proprietors, with full powers of colonization and government. In this territory, called Carolina in compliment to the royal grantor, the colony of Carolina was planted by them under a new form of colonial government called the proprietary government, consisting of a governor appointed by themselves, a legislative assembly elected by the freeholders, and a council of twelve, six appointed by the governor and six by the assembly. Colonists were eagerly solicited for the new "plantations" by liberal grants of lands, and by a guarantee of full religious liberty and of exemption from taxation except with the consent of the legislature. These favourable terms were so much in contrast with the state of things in some of the other colonies, especially in Virginia, where tithes were rigorously exacted for the support of the Established Church, dissent punished as a crime, and laws enacted which allowed only the alternatives of conformity or enforced exile, that the new colony soon received a large accession of Quakers and other Dissentors. In 1669 the first legislative assembly met, and a new and remarkably liberal government was successfully organized. The next year an attempt was made to introduce a new system of government and form of social order called the Fundamental Constitutions, drawn up by the celebrated philosopher John Locke at the request of the lords proprietors; but this and several subsequent attempts were so stoutly resisted by the colonists that the absurd and tyrannous scheme was formally abandoned in 1693. And so strong was the spirit of liberty that one of the lords proprietors who had been sent over as governor was deposed and exiled for extortion, and another governor with his council was imprisoned for misgovernment and infringement of the guaranteed rights of the colony, a new governor and legislature elected, and the government carried on for two years by the colonists themselves. In 1729 the proprietary was replaced by the royal authority, the form of government remaining unchanged. At this date also the territory of Carolina was formally divided into the two colonies of North and South Carolina. The population at this time, estimated at 13,000, was mostly limited to the seaboard region, within 50 miles of the coast. Ten years later a great tide of emigration set in upon the interior and midland country, both from the older settlements to the north, especially from Virginia and Pennsylvania, and from the British Islands and the continent of Europe; so that in less than forty years the population wanted little of 300,000, and at the beginning of the revolution of 1776 a continuous chain of settlements extended from the sea-coast to the mountains. The new-comers were generally of the best class of immigrants, Scotch, Scotch-Irish, English, Swiss, Germans, and Dutch. They were Presbyterians, Moravians, Lutherans, Huguenots, and Quakers. Devoted to liberty and impatient of tyranny and of privilege, these people were attracted to the colony not alone or chiefly by the fame of its broad and fertile "mesopotamias" and its salubrious climate, but above all else by the liberal and popular form of its government, especially by its freedom of religion. When attempts were made, as they frequently were, in violation of guaranteed rights, to establish the English Church and collect church rates, they were everywhere met with stubborn and not always passive resistance. The execution of the famous Stamp Act in 1766 was forcibly resisted, and the royal vessel bringing the obnoxious papers was not even allowed to enter port. Extortion practised by the officers of the crown in some of the interior counties led to repeated remonstrances and appeals for redress to the governor and afterwards to parliament, and finally ended in 1771 in insurrection and open war. The controversy culminated in the battle of Alamance, in which the recusants were defeated by Governor Tryon. And thus, in one way and another, a spirit of suspicion or resentment, of irritation or open hostility, was constantly kept alive in the colony. This spirit found expression in the famous Mecklenburg resolutions adopted by the Scotch-Irish settlers about Charlotte in May 1775, in which "all laws and commissions by authority of king and parliament" are declared to be annulled and vacated, and a new government was organized for the county recognizing only the authority of the provincial congress. Thus North Carolina was fully ripe for measures of open and combined resistance when movements were begun towards a union of the colonies for this purpose, and was the first of all the colonies to instruct its delegates to the continental congress to vote for formal independence of the British crown. Early in 1776 the militia of the colony met and defeated on the lower Cape Fear river a body of 1500 British troops under skilful officers, directed by the royal governor and supported by a British fleet of thirty sail off the port of Wilmington. The colony furnished its full quota of troops to the continental armies north and south, and lost most heavily in the fall of Charleston. But beyond this, situated far from the seat of war and weakened by the pressure of several recent settlements of adherents of the British crown, the colony did not bear a conspicuous part in the revolution until in the later campaigns, during the closing years of the war, its territory became the theatre of the conflict. The defeat and capture of an important detachment of Cornwallis's army under Ferguson at King's Mountain in 1780 by a sudden gathering of untrained backwoodsmen and hunters, chiefly from the mountain settlements, checked the victorious march of the British; and a similar volunteer gathering of her yeomanry from all the surrounding region at the battle of Guilford Court House in 1781 contributed largely to give the victory of Cornwallis the character of a defeat, and forced his speedy retreat to the coast and ultimately to Yorktown for the final catastrophe.

On the formation of the Federal Union, North Carolina, having had abundant and long experience of usurpation and misgovernment, did not make haste to enter the new compact, but moved with slow and cautious steps, and was one of the last of the colonies to adopt the constitution. At the breaking out of the war between the States in 1861, North Carolina, strongly averse to secession, sought by every means to avert the conflict, remaining unmoved after all the surrounding States had seceded, and was forced into the struggle last of all the Southern States, and when there remained only the alternative of a choice of sides. Being near the seat of war and yet for the most part outside of it, the State contributed more largely to the commissary supplies of the Confederacy, and also sent into the field a larger number of troops and lost more men in battle than any other State, her soldiers having a conspicuous share in all the great battles from Bull Run to Petersburg. Since the close of the war, which left her utterly bankrupt, North Carolina has entered on a career of prosperity unexampled in her previous history. Population has increased far more rapidly than at any previous period, the number of miles of railroad has been doubled, the area of land under cultivation enlarged, agriculture improved in its methods and results, and industries diversified to an extent and with a rapidity never known before. (W. C. K.)

NORTHCOTE, James (1746-1831), historical and portrait painter, was born at Plymouth on the 22d October 1746. Though he early showed an inclination for art, his father, a poor watchmaker of the town, insisted that he should be bound with himself for an apprenticeship of seven years. During his spare hours the boy was diligent with brush and pencil, and on the expiry of the term, in 1769, he started as a portrait painter. Four years later he went to London, and was admitted as a pupil into the studio and house of Reynolds, who had been the object of his warmest admiration from early boyhood. At the same time he studied from the round and the life in the Academy schools, making, it would seem, rather slow progress in the technical processes of art. In 1775 he left Reynolds, and about two years later, having acquired the requisite funds by portrait-painting in Devonshire, he set out for Italy. There he remained for three years, studying the portraits of Titian, looking, as he tells us, twice at Michelangelo for every time he looked at Raphael, and forming the resolution that in the future he would paint portraits for bread and historical subjects for fame. On his return to England he revisited his native county, and then settled in London, where Opie and Fuseli were his rivals. He was elected associate of the Academy in 1786, and full academician in the following spring. The Young Princes murdered in the Tower, his first important historical work, dates from 1786, and it was followed by the Burial of the Princes in the Tower, both paintings, along with seven others, being executed for the Shakespeare gallery of Alderman Boydell. The Death of Wat Tyler, now in the Guildhall, was exhibited in 1787; and shortly afterwards Northcote began a set of ten subjects, entitled the Modest Girl and the Wanton, which were completed and engraved in 1796. They were suggested by the Pamela of Richardson and the Idle and Industrious Apprentices of Hogarth,—a painter for whom Northcote professed little admiration. The series was popular at the time, but neither in truth of dramatic conception nor in technical qualities does it approach the parallel works of the older master. Among the productions of Northcote's later years are the Entombment and the Agony in the Garden, besides many portraits, and several animal subjects, like the Leopards, the Dog and Heron, and the Lion, which were more successful than the artist's efforts in the higher departments of art, as was indicated by Fuseli's caustic remark on examining the Angel opposing Balaam—"Northcote, you are an angel at an ass, but an ass at an angel." The works of the artist number about two thousand. By unwearied diligence, combined with extreme frugality, he was enabled to accumulate, before his death on 13th July 1831, a fortune of £40,000.

His works possess a certain dignity, and they tell their story clearly; but they are marred by defective drawing and dull colouring, and by the gross anachronisms and inconsistencies in costume common to the historical painters of the period. Northcote was emulous of fame as an author, and his first essays in literature were contributions to *The Artist*, edited by Mr Prince Hoare. In 1813 he embodied his recollections of his old master in a *Life of Reynolds*. His *Fables*—the first series published in 1828, the second posthumously in 1833—were illustrated with woodcuts by Harvey from Northcote's own designs. In the production of his *Life of Titian*, his last work, which appeared in 1830, he was assisted by William Hazlitt, who previously, in 1826, had given to the public in the *New Monthly Magazine* his recollections of Northcote's pungent and cynical "conversations," the bitter personalities of which caused much trouble to the painter and his friends.

NORTHFLEET, a village and urban sanitary district in the county of Kent, forming part of the parliamentary borough of Gravesend, is situated on the Thames and the North Kent Railway, 20 miles east of London and 2 west of Gravesend. The church of St Botolph, chiefly in the Later Decorated style, dates from the middle of the 13th century; but the nave is of later date, and the old tower, having fallen down, was rebuilt in 1628. The church contains a brass of the 14th century and other interesting monuments. The nave and chancel have undergone modern restoration. Huggens College, with residences for forty decayed gentry, was established in 1847. A factory club for the use of those engaged in the chemical works was opened in 1878. Besides chemical manufactures there are chalk, lime, cement, and brick works, and a large shipbuilding yard. Rosherville pleasure-gardens are in the neighbourhood. The population of the urban sanitary district (3934 acres) in 1871 was 6515 and in 1881 it was 8790.

NORTH SEA. The North Sea or German Ocean lies between Great Britain and the continent of Europe. It communicates with the North Atlantic by the Straits of Dover in the south, and by the Pentland Firth and the various openings between the Orkney and Shetland Islands in the north. Between the Shetlands and Norway it passes by a wide opening into the sub-polar basin, now generally known as the NORWEGIAN SEA (*q.v.*), of which indeed it may be regarded as a southern extension. It has communication with the Baltic by the Skagerrack and the Cattegat. The shores of the North Sea have from the earliest times been inhabited by brave and hardy races of men famous for their maritime exploits; and at the present day it is surrounded by many of the most prosperous and enterprising commercial nations, and is, in consequence, one of the most important highways of the world. Its fisheries give employment to thousands of persons, and are the most valuable that exist. Lighthouses are situated on nearly every available point where they are required, and there are numerous light-ships along the coasts.

The North Sea lies between the parallels of 51° and 61° N. lat. and 2° 30′ W. and 8° E. long., its greatest length being about 600 miles, its breadth (from St Abb's Head to the shores of Denmark) 360 miles, and its area about 140,000 square miles. It may be said to be without islands if we except the Orkneys, the Shetlands, and those islands which are situated along the coasts. Its coasts present considerable variety in appearance and geological formation. Scandinavia, composed of ancient rocks, is elevated, deeply indented by fjords, and skirted with numerous islands. The coasts of Britain are bold and rocky in the north, while towards the south they present a succession of low rocky or chalky cliffs and sandy beaches. Denmark, Germany, Holland, and Belgium have low shores, composed of recent formations, and deeply indented. Many parts of Holland and Belgium are indeed below the level of the sea, and are protected from inundation by artificial dykes and extensive natural sand dunes. The sea has repeatedly broken through these artificial and natural barriers and submerged large tracts of country. The Dollart Zee and the Zuyder Zee were formed in this way in 1277 and 1282. Some of the most important rivers of Europe enter the North Sea, as the Elbe, Weser, Ems, Rhine, Scheldt, Thames, Humber, Tyne, Tweed, Forth, and Tay. If we include the Baltic, which enters into it, we may regard the North Sea as receiving the drainage of about one-fourth of the European continent.

Its greatest depth is in a deep gully following closely the trend of the southern portion of the Scandinavian peninsula, where soundings of 160, 200, 300, and 400 fathoms are common. It has been suggested that this deep gully, which extends into the Skagerrack, may have been the bed of a river at a time when the continent of Europe stood at a higher level, and that the Elbe and some of the other rivers now entering the Baltic and North Sea may have united and flowed into the Norwegian basin of the Atlantic through this depression. With the exception of this gully the depth of the North Sea is less than 100 fathoms. It is to be noticed, however, that the bottom of the whole basin is very irregular. The southern half is the shallower, and, generally speaking, the depths in this portion are greater on the eastern and western sides than in the centre, where the Dogger Bank is situated. On this bank the depth is from 8 to 16 fathoms, whereas in the "Silver Pit" immediately to the south there is a depth of 45 fathoms. Similar irregularities are met with in various other parts of this sea-bed, and are called by the fishermen "pits" and "banks," with various distinguishing names. In the northern half the depth gradually increases towards the north, until a depth of 2000 fathoms is reached in the Norwegian Sea. It is probable that these irregularities met with in the bottom of the North Sea are chiefly due to the moraines and detrital matter left by the great glacier which filled it during the Glacial period. There are besides a great number of shoals and sandbanks lying along the coasts of Holland, Belgium, France, and Britain, which assume the form of ridges running in a direction nearly parallel to the shores, and consist of sand and detrital matter brought down by rivers and arranged apparently by tide streams. The deposits vary considerably in their composition. In the shallow parts a sand predominates, composed of fragments of quartz, felspars, micas, hornblende, augite, magnetite, and calcareous fragments consisting of triturated pieces of mollusc shells, Echinoderms, Polyzoa, Alcyonarian spicules, calcareous Algæ, and many Foraminifera. In the deeper water we generally find a mud or clay composed of the above-mentioned mineral and organic fragments, with the addition of fine argillaceous matter, very minute mineral particles, and Diatom frustules. In some places we have stones and gravel, and indeed stones may be met with in all the varieties of deposit.

Fogs, mists, and rain occur at all seasons. The winds are variable, the moisture-laden winds from the south-west being the most prevalent, and storms are frequent. The currents depend chiefly upon the direction of the winds, and the navigation is most difficult. The great tidal wave from the Atlantic on reaching the British Islands breaks into two portions, one passing through the Straits of Dover and the other round the north of Scotland into the North Sea. These two portions meeting produce nodal lines, where they partially neutralize each other, for instance in the Straits of Dover, and less distinctly in lines stretching from the Wash and Moray Firth to the north of Denmark. The North Sea lies between the January isotherms of 31° and 40°, and the July isotherms of 55° and 65° Fahr., so that the difference between the mean winter and summer temperature is about 24°. The temperature of the surface water ranges in January between 39° and 45° Fahr., and in July between 53° and 63°. Hence the contrast between the temperature of the water and that of the air is greater in winter than in summer, and indeed except during the warmest months the air is colder than the water. In the southern part of the North Sea, south of the Dogger Bank, where the sea is comparatively shallow, there is in summer only a difference of a degree or so between the surface and the bottom water, the bottom water being a little the colder. The difference is greatest in the hollows like the "Silver Pit," where the depth reaches 45 fathoms. The temperature along the British coast appears to be in summer about 3° colder both at the surface and at the bottom than along the coast of Denmark. We have no very reliable information as to the temperature of the water at different depths during the winter months, but we know it takes a very long time before the cooling of the surface water affects the temperature at the depth of a few fathoms, therefore it is most probable that the water at the bottom in the southern part of the sea is much warmer than the surface or intermediate water, and this is likely to be the case especially in the "pits" where the depth is greatest. This is very probably the chief reason why such large catches of soles and other fish are made in these "pits" during very cold winters.

North of the Dogger Bank there is a very considerable difference of temperature between the surface and the bottom water in summer. Off Aberdeen there is a difference of 11°, the surface temperature in summer being 56° Fahr. and the bottom 45°, while in the Norwegian gully there is a difference of 17°. Farther north in the Norwegian Sea, at a depth of 300 or 400 fathoms, the water is below 32° Fahr. all the year round. The specific gravity ranges between 1·0249 and 1·0270, the saltest water being found at the bottom in the Norwegian gully. The lightest water is found in the Skagerrack where the Baltic water enters the North Sea, and in the southern half of the sea where the Continental rivers discharge their waters.

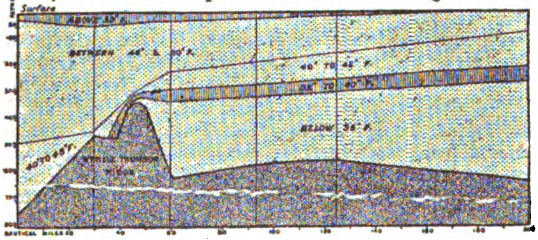

FIG. 1.—Distribution of temperature in the Faroe Channel.

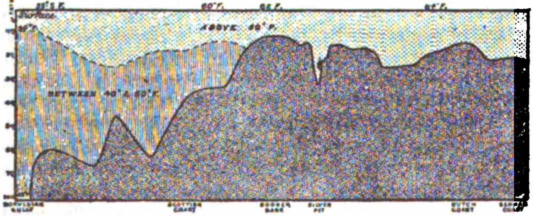

FIG. 2.—Section showing distribution of temperature in summer in the North Sea along a meridian line.

The North Sea has an abundant flora. Algæ in great abundance and variety grow on all the shores and in all the shallower waters, while a few species are found at depths of even 50 and 100 fathoms. The surface and subsurface waters swarm with Diatoms, Peridinias, Coccospheres, and other minute Algæ. It is a matter of observation that where there is a low specific gravity, indicating a mixture of fresh with salt water, there is usually a great abundance of Diatomaceæ in the surface waters. This is the case in bays and estuaries, and in the arctic and antarctic regions, where melting ice lowers the specific gravity. The North Sea has all the characteristic features of a great bay, and has a great abundance of plant life. Its surface or intermediate waters are at times quite discoloured by the enormous abundance of Diatoms or Peridinias which are met with in vast floating banks. The cause of the rapid and great development of these minute organisms at particular times and places appears to depend on physical conditions which are not at present understood. With such a vast food supply it is not surprising that a prolific fauna swarms in the North Sea. Everywhere on the bottom we find Foraminifera, Sponges, Cœlenterates, Echinoderms, Worms, Polyzoa, Tunicata, Mollusca, Crustacea, and Fishes. At all depths in the intermediate water we find Protozoa, Medusæ, Copepods, Amphipods, Schizopods, Sagitta, and various other pelagic animals, together with a great abundance of the larvæ of animals living on the bottom. The invertebrates living on the bottom and in the water at various depths, in their adult as well as in their larval stages, supply food for those fishes which are so much desired for the table. Most valuable food fish, as the cod, haddock, herring, sprat, holibut, sole, coal-fish, and many others, frequent the North Sea, and are captured in great numbers by the fishermen of all the nations occupying the seaboard. There are also important fisheries for crustaceans such as lobsters, crabs, prawns, and shrimps, and for molluscs such as oysters, mussels, whelks, and periwinkles. Whales and porpoises are numerous, and sea-birds are found in vast numbers on the islands along the shores. The annual value of the North Sea fisheries of various kinds is enormous. In a recent lecture the duke of Edinburgh estimated that the labours of British fishermen supplied annually "fish food amounting to about 615,000 tons weight, which at £12 per ton represents a money value of £7,380,000." By far the larger part of this comes from the North Sea. If we consider that these waters are also fished by Norwegians, Danes, Germans, Dutchmen, Belgians, and Frenchmen, we may form some idea of its fertility. It is very probable that the annual value of all the fisheries exceeds £25,000,000.

No systematic investigation of the North Sea has yet been undertaken, and in consequence our knowledge is in many respects very meagre. This is all the more astonishing when we remember the value of the fisheries and the enterprise of the nations engaging in them. The Admiralty employed a ship for several seasons to examine the currents and tides; the results are published in the North Sea pilot and admiralty tide tables. The German ship "Pommerania" was engaged during the year 1872 in examining the North Sea. See *Die Expedition zur physicalisch-chemischen und biologischen Untersuchung der Nordsee im Sommer* 1872 (Berlin, 1875). (J. MU.)

NORTHUMBERLAND, the northernmost county of England, is of a somewhat triangular form, roughly resembling that of England itself. It lies between 54° 47′ and 55° 46′ N. lat. and 1° 25′ and 2° 41′ W. long., and is in its extremes about 70 miles long and 53 broad. Its area is 2016 square miles, ranking it fifth among English counties. Northumberland lies entirely on the easterly slope of the country. Its boundaries are the German Ocean, Scotland, and the counties of Cumberland and Durham. In physical aspect it is a tumbled incline of fells and ridges, intersected by valleys and subsiding eastwards from the hill-borders of Scotland and Cumberland into lessening undulations and a shelving coast. The Cheviot range (separating Northumberland from Scotland) is divided by

nature into two groups. What may be called the northern Cheviots are green hills of conical and high-arched forms, finely grouped, with the peat-capped Cheviot itself (2676 feet) at their centre, deep steep glens radiating into all parts of their mass, and generally more or less of hollow and enclosed ground separating them from the slopes at their base. The southern Cheviots (south-westwards from Thirlmoor) are the highest part of the county,—moory hills, lower and more confluent, and sometimes curiously equal-topped. On the Cumberland side of the county these watershed heights sink into a monotonous rolling tract, separated only by the river Irthing from the "wastes" of Bewcastle. They again swell up in the south-west towards Killhope Law (2208 feet) and the Pennine range. Few eminences break the general incline, which stretches in a far-spread billowy sea of confluent hills that for six months of the year mingle their browns, russets, and duns in a pattern of Oriental richness, and at all times communicate a fine sense of altitude and expanse. The Simonside Hills (1447 feet) form one not very conspicuous exception. The configuration of much of these uplands has a certain linearity in its details due to groups and ranges of ridges, crags, and terrace-like tiers, picturesquely termed "edges" (escarpments) by the country folk, and generally facing the interior, like broad ends of wedges. The line of pillared crags and prow-like headlands between the North and South Tynes along the verge of which the Romans carried their wall is a fine specimen. Passing eastwards from the uplands we exchange the moors for enclosed grounds, "drystone" walls for hedgerows, rare sprinklings of birch for a sufficiently varied wooding, and towards the south-east we approach the smoke of the coal-field and the roar of the Tyne.

The chief rivers and valleys are the Derwent, the Irthing, the Tyne (with its North and South branches, the Allendales, and Redesdale), the Wansbeck with its twin the Font, the Coquet, the Alne, the Till with its feeders the Breamish, Glen, and College, and the Tweed. The Tyne is the "coaly Tyne" only from Wylam downwards. For 19 miles (its tidal portion) it has been dredged into a small estuary,—"a river of coal, iron, and chemicals." The rivers and streams in general are greatly diversified with numbers of rocky gorges and rich "denes." The deepest glen-scenery is at the head of the Breamish and College burns; and the North Tyne gathers its waters from surrounding moorlands into a vale of surpassing beauty.

The coast is a succession of sands, flat tidal rocks, and low cliffs. Its bays are edged by blown sandhills; its borders are severely wind-swept. Several islands lie over against it. Holy Island, the classic Lindisfarne, 1051 acres in extent, but half "links" and sandbanks, is annexed to the mainland and accessible to conveyances every tide. The Farne Islands are a group of rocky islets farther south, —the scene of many saintly austerities, and of the nobler devotion of Grace Darling.

Geology.—The core of the county, in a geological aspect, is the northern Cheviots from Redesdale head nearly to the Tweed. Its oldest rocks are gritty and slaty beds of Silurian age, about the head of the rivers Rede and Coquet and near the Breamish south of Ingram,—a part of the great Silurian mass of the southern uplands of Scotland. Even before the times of the Old Red Sandstone these rocks had been crushed and folded, upraised into a continental land, and much wasted. The largest hollows in that ancient continent held the great lakes in which the "Old Red" was deposited. Volcanic activity near one of the lake-group (now to be known as Lake Cheviot) resulted in the felspathic porphyrites passing into the syenites and granites that form the mass of the northern Cheviots.

Round this core there now lie relays of Carboniferous strata dipping east and south, much faulted and repeated in places, but passing into Coal-measures and Magnesian Limestone in the south-eastern part of the county. The dawn of the Carboniferous ages saw the volcanic piles of the Cheviots becoming shapeless with waste. Then ensued a general settling down of the land, the gathering of a long series of deposits around its subsiding borders, the burying of Cheviot-land, and the gradual formation of the whole great succession of the Carboniferous system. The builders thereof were three. After every sufficient subsidence the limestone sea that covered Derbyshire sent incursions of marine life northwards; the waste of the land in the north then spread out in sheets of sand and silt; and over the mud-flats thus prepared came slow migrations of dense plant-growth. Limestones, sandstones, shales, and coals were the result; and the whole system now consists of—(1) the Carboniferous Limestone series in three divisions, first detected by the accurate eye of George Tate of Alnwick; (2) the Millstone Grit; and (3) the Coal-measures. Lowest in Northumberland lies Tate's Tuedian group, the first envelope of sinking Cheviot-land. Some reddish shore-like conglomerates lie in places at its base, as at Roddam Dene; its shales are often tinged with distemper greens; its coals are scarçely worthy of the name; its limestones are thin, except near Rothbury; and its marine fossils are few and incursive. The Tuedian group is overlaid by the Carbonaceous group; its shales are carbonaceous-grey, its coals, though mostly small, very numerous, its limestones often plant-limestones, and its calcareous matter much diffused. Upon this lies the Calcareous group; its lime occurs in well-individualized marine beds, cropping up to the surface in green-vested strips; its fossils are found in recurrent cycles, with the limestones and coals forming their extremes. These three groups now range round the northern Cheviots in curved belts broadening southwards, and occupy nearly all the rolling ground between the Tweed and the South Tyne, the sandstones forming the chief eminences. The middle division becomes thinner and more like the Coal-measures in passing northwards, and the upper division, thinning also, loses many of its limestones. The Millstone Grit is a characterless succession of grits and shales. The Coal-measures possess the same zone-like arrangement that prevails in the Limestone series, but are without limestones. They also are divided, very artificially, into three groups. The lowest, from the Brockwell seam downwards, has some traces of Gannister beds, and its coal-seams are but thin. The famous Hutton collection of plants was made chiefly from the roof-shales of two seams,—the Bensham and the Low Main. The unique Atthey collection of fishes and Amphibia comes from the latter. The Coal-measures lie along the coast in a long triangle, of which the base, at the Tyne, is produced westwards on to the moors south of that river, where it is wedged against lower beds on the south by a fault. The strata within the triangle give signs of departing from the easterly dip that has brought them where they are, and along a line between its apex (near Amble) and an easterly point in its base (near Jarrow) they turn up north-eastwards, promising coal-crops under the sea.

The top of the Coal-measures is wanting. After a slight tilting of the strata and the denudation that removed it, the Permian rocks were deposited, consisting of Magnesian Limestone, a thin fish-bed below it, and yellow sands and some Red Sandstone (with plants of Coal-measure species) at the base. These rocks are now all but removed. They form Tynemouth rock, and lie notched-in against the 90-fathom dyke at Cullercoates, and again are touched (the base only) at Seaton Sluice. No higher strata have been preserved. The chief faults of the county extend *across* it. Its igneous rocks, other than the Cheviot porphyrites and a few contemporaneous traps in the lowest Carboniferous, are all intrusive. An irregular sheet of basalt forced between planes of bedding (perhaps at the close of the Carboniferous period) forms the crag-making line of the Great Whinsill, which, with many shifts, breaks, and gaps, extends from Greenhead near Gilsland to the Kyloe Hills. Numbers of basalt dykes cross the county, and were probably connected with the plateau of Miocene volcanic rocks in the Hebrides. Everywhere the Glacial period has left rocks rounded and scored, and rock-fragments from far and near rubbed up into boulder-clay. The glaciers at first held with the valleys, but as the ice-inundation grew they spread out into one sheet,—the Cheviot tops, heavily ice-capped, alone rising above it. Two great currents met in confluence around these hills,—one from across the western watershed, the other skirting the coast from the north. Boulders from Galloway, Criffel, the English lake district, and other places adjacent, and from the Lammermuirs and Berwickshire, lie in their track. Of moraines there are only a few towards the hills. The "great submergence" has left no unequivocal signs of its presence. Glaciated shell-fragments have been detected at Tynemouth. Laminated brick clays occur among the boulder-clays. Sheets and mounds of gravel of the nature of kames exist here and there on the low grounds, and stretch in a chain over the low watershed between Haltwhistle and Gilsland, sparsely dotting also some more upland valleys. An upper boulder-clay, containing flints, skirts the coast.

The older valleys are all pre-Glacial, and may date from the Miocene period. They are much choked up with Glacial deposits, and lie so deep below the surface that, if they were cleared-out arms of the sea, one of them, 140 feet deep at Newcastle, would extend for miles inland. After the departure of the glaciers the streams here and there wandered into new positions, and hence arises a great variety of smooth slope and rocky gorge. In the open country atmospheric waste has hollowed out the shales at their outcrops, leaving the sandstones, &c., as protruding "edges," roughened here and there into crags. In the lower grounds, where this surface-dissection first began, the "edges" have much run together; on the heights, whose turn came last, they are often prominent and crest-like, but have glacier-rounded brows. Many old tarns are now sheeted over with peat. The sloping peat-fields are often the sites of straggling birch-woods, now buried.

Minerals, &c.—The main portion of the great northern coal-field that extends into Northumberland is an uneven triangle, with its base stretching 14 miles inland from the mouth of the Tyne, and its apex on the coast 24 miles northwards. There are eighteen or twenty seams of workable thickness, all of them of varieties known as bituminous or "caking" coal, amounting in the aggregate to nearly 60 feet in thickness. The familiar "Wallsend" was the product of a seam now worked out (the High Main), and its name has sunk into a trade term. The Low Main or Hutton seam ranks first in thickness and value; it runs nearly through the whole length of the northern coal-field, and yields at one point or another the best description of three varieties of coal, viz., household, gas, and steam coals,—in Northumberland chiefly steam coal. The seams below it, including five seams averaging about a yard in thickness, are still unworked at Newcastle. The best coking coals are furnished from the lower seams. Three little coal-basins lie against a fault on the moors south of the Tyne. In the Limestone series there also exist coal-seams of some value, worked here and there, generally singly and for land sale purposes. The Scremerston lower coals, eight of which are workable seams with an aggregate thickness of 23 feet, form a little coal-field in the Carbonaceous group in the north of the county. Numberless little seams are dug into by farmers and shepherds for their own use, chiefly in the same group in the southern half of the county. According to the mineral statistics the output of coal from the 176 collieries worked in Northumberland in 1882 was 14,518,789 tons, as against 36,299,597 tons from the whole coal-field, and 156,499,977 tons from the United Kingdom. The net quantity of coal in Northumberland available for the future was estimated before the Coal Commission in 1870 as 2,576,000,000 tons, besides 403,000,000 tons under the sea within 2 miles of land. About 350 millions of tons have since been realized. The rate of production is increasing annually.

The "lead-measures" in Northumberland chiefly lie in South Tynedale and Allendale, and belong to the Upper Limestone series or Yoredale rocks. From these lead-mines in 1882 there were raised 6817 tons of ore, having a value of £54,719. The product of the ore was 5252 tons of lead and 9547 ounces of silver. The industry has recently suffered from the effects of foreign competition.

The Cleveland ironstone and cheap foreign import have repressed iron-mining in Northumberland. An abundance of nodular calcareous ironstone in the Upper Limestone series awaits future development. For many years a shale bed at Redesdale furnished Sir W. G. Armstrong with some of his best materials, but it was abandoned in 1877.

Among other mineral products are building freestones in profusion; millstone grits, not at all restricted to the strata bearing the name; fireclays, chiefly of value among the Coal-measures; brick clays from glacial beds; and disintegrated shales. The Whinsill yields hard paving-stones and kerbstones; Newcastle grindstones, from a hard sandstone near the town, are as familiar as "Wallsend"; and limekilns are numerous in the broad belt occupied by the upper limestones. The uplands are rich in springs issuing from the sandstones and limestones. Chalybeate springs or "red wells" abound; "sulphur wells" (sulphuretted hydrogen) are by no means rare.

Natural History.—The fauna and flora of the county have been worked out with a care and completeness chiefly due to the Naturalists' Field Clubs of Tyneside and Berwickshire. The catalogue of plants in Northumberland (with Durham) contains 936 species out of the 1425 of the British list, Ireland excluded. The facies of the flora is intermediate between the northern and southern types of the island. Forty-six species enter Northumberland from the south which do not reach Scotland. There is a distinct preponderance of damp-loving kinds. No plants are restricted to the county. Numerous aliens, enumerated as 117 species, grow upon the large ballast-hills beside the Tyne and elsewhere, and there are 87 other "casual introductions." The cloudberry ripens on most of the watershed hills above 1250 feet.

The richness of bird-life in the county is accounted for by the situation of the coast in a frequented track of migration to and from the north, and by the diversity of its own physical features. Of the entire catalogue of British birds, in all about 395 species, two-thirds (267) have been met in Northumberland and Durham, 91 of which are residents, 40 spring and autumn migrants that come to nest, 54 autumn and winter visitants, and 79 casual visitants. Moorfowl abound on the fells, though less numerously than of old.

Among the larger fauna of the county are the half-wild white cattle of Chillingham Park, the representatives, according to the best authorities, of the aboriginal cattle of the British forests, and degenerated descendants of the great Urus, or *Bos primigenius*.

Climate.—The climate is bracing and healthy. In spring east winds prevail over the whole county. The lambing season in the higher uplands is fixed for the latter half of April, and is even then often too early. In summer and autumn west winds are general. The mean temperature in the shade at Alnwick and North Shields in the winter and summer quarters of the year, during four years of observation, was as follows:—Alnwick, summer

52°·9, winter 38°·9; North Shields, summer 55°·1, winter 39°·0. At Greenwich during the same years it stood as—summer 59°·9, winter 39°·4. The rainfall gradually increases as the country rises from the coast. The average rainfall during the six years 1877-82 was:—at Tynemouth (65 feet above the sea), 27·78 inches; in Newcastle (105 feet), 30·28 inches; near Belford (640 feet), 30·41 inches; near Haltwhistle (380 feet), 40·41 inches; near Rothbury (400 feet), 37·50 inches; at Allenheads (1358 feet), 47·65 inches; and at Broadstruther (1672 feet), about five miles north of the Cheviot, 60·93 inches. East winds, in summer, bring rain to the interior. The smell from the coal-field, the lighter grime of which is detected as far as Cumberland, is taken by the shepherd for a sign of wet.

Governmental and Ecclesiastical Divisions.—Northumberland comprises the nine wards (answering to hundreds and wapentakes) of Bamburgh, Glendale, Coquetdale, Morpeth, Tynedale, Castle, Norhamshire, Islandshire, and Bedlingtonshire. The last three formed detached portions of Durham until 1844. It contains 76 mother-parishes and 162 benefices, together forming (with Alston and Nenthead in Cumberland) the diocese of Newcastle, erected in 1882. There are 541 civil parishes in which poor-rate is separately levied. The county has one court of quarter-sessions, is divided into 13 petty and special sessional divisions, and for parliamentary purposes into a northern and a southern division, each of which returns two members. Berwick-upon-Tweed (which has been joined to this county for election purposes) and Newcastle-upon-Tyne have separate courts of quarter-sessions and commissions of the peace, and, together with Morpeth and Tynemouth, the latter of which has also a commission of the peace, are municipal and parliamentary boroughs. Berwick and Newcastle each return two members, and Morpeth and Tynemouth each one.

Population and People.—The population in 1881 numbered 434,086 persons, 215,882 males and 218,204 females,—showing an increase since 1871 of 47,440 persons, and of 256,008 since the first census in 1801. The average number of persons to an acre was 0·34, and of acres to a person 2·97. The number of inhabited houses was 70,682. The population of its chief towns was as follows:—Newcastle-upon-Tyne, 145,359 (or with Gateshead upon the Durham side, 211,162); North Shields and Tynemouth, 44,118; Berwick-on-Tweed, 13,998; Alnwick, 7440; Morpeth, 6946; and Hexham, 5919. The Tyne ports are rapidly becoming one continuous town. Walker had a population of 9522 persons, Wallsend 6515, and Willington Quay 5105. Persons engaged as miners or in mine service numbered 21,607, of whom 20,752 were coal-miners. Persons engaged in agriculture numbered 18,901.

In physique the Northumbrian is stalwart and robust, and seldom corpulent. The people have mostly grey eyes, brown hair, and good complexions. The inhabitants of the fishing villages appear to be Scandinavian; and parts of the county probably contain some admixture of the old Brit-Celt, and a trace of the Gipsy blood of the Faas of Yetholm. The natives have fine characteristics: they are clean, thrifty, and plodding, honest and sincere, shrewd, and very independent. Their virtues lie rather in solidity than in aspiration.

Northumbrian speech is characterized by a "rough vibration of the soft palate" or pharynx in pronouncing the letter *r*, well known as the *burr*, a peculiarity extending to the town and liberties of Berwick, and absent only in a narrow strip along the north-west. Over the southern part of the county there is the same duplication of vowel-sounds, such as "peöl" for "pool," that is met in the English counties adjacent. Many charming Old-English forms of speech strike the ear, such as "to butch a beef," *i.e.*, to kill a bullock, and curious inversions, such as "they not can help." There is the Old-English distinction in the use of "thou" to familiars and "ye" to superiors.

Ownership of Land.—According to the *Owners of Land Returns* 1873, the distribution of land-property in Northumberland was as follows:—there were 22 proprietors of more than 10,000 acres; of 100 and less than 1000, 507; of 10 and less than 100, 771; of 1 and less than 10, 820; and of less than 1, 10,036. The gross estimated rental was £2,144,743. Six proprietors held lands exceeding 20,000 acres. The duke of Northumberland, the largest land-proprietor in England, held 181,616 acres; the earl of Tankerville, Chillingham Park, held 28,930; Sir John Swinburne of Capheaton, 28,057; Walter C. Selby of Biddlestone, 25,327; Sir W. C. Trevelyan (now Sir Charles) of Wallington, 21,342; and the lords of the Admiralty, who held the old Derwentwater estate, 20,642. The mansions and parks attached to these estates are all beautiful or interesting. Biddlestone is uplying, but in some respects is the original of Scott's Osbaldistone Hall.

Agriculture, &c.—More than half of the county is pastoral. South of the river Coquet there is a single broad tract of cultivation towards the coast that sends lessening strips up the valleys into the interior. From the Coquet northwards another breadth of enclosed ground stretches almost continuously along the base of the Cheviot hills. In the basin of the Till it becomes eminently fertile, and towards the Tweed the two breadths unite. In the porphyritic Cheviots the lower hills show a great extent of sound surface and good grass. The average hill-farms support about one sheep to two acres. A coarser pasturage covers the Carboniferous hills, and the proportion of stock to surface is somewhat less. Their highest fells are a rough-and-tumble of bogs, hags, and sandstone scars, with many acres dangerous to sheep and worth less than nothing to the farmer. The lower uplands are a patchwork of coarse grasses (mown by "the muirmen" into "bent-hay") and heather, or, in the popular terms, heather and "white ground," for it is blanched for eight months in the year. Heather is the natural cover of the sandstones (which form most of the eminences) and of the sandy glacier-débris near them. The limestone crops are bright green strips or *gairs*. Sheets of boulder-clay are common on the eastern sides of eminences, in the valleys, and on the low grounds. On the uplands they grow bents; lower down they are apt to be cold and strong, but are much relieved by patches and inworkings of gravel, especially north of the Wansbeck. The prevalent stream-alluvium is sandy loam, with a tincture of peat. The arable regions are very variable. Changes of soil are probably as numerous as fields. Fencing has now reached the watershed tracts; draining is following; but there is room to doubt whether the latter will be altogether an unmixed good. The peat mosses act retentively, like sponges, softening the air, nourishing the early-springing deer-grass and cotton-grass, and preventing precipitation of drainage on the rivers, which are now more liable to floods than formerly.

Northumberland contains 1,290,312 acres. In the *Agricultural Returns* for 1883 the cultivated area of the county stands as 712,615 acres, exclusive of orchards and market gardens, embracing—corn crops, 126,439 acres (wheat 19,980, barley 40,696, and oats 58,989); green crops, 55,202 acres (turnips and swedes 46,066, and potatoes 5384); clover, sanfoins, and grasses under rotation, 84,562 acres; permanent pasture not under rotation, exclusive of heath or mountain land, 431,031 acres. Of orchards there were 184 acres; of market gardens, 659; of nursery gardens, 81; and of woods (in 1881), 39,977. Since 1866 55,626 acres have been reclaimed from mountain land. The corn area has meanwhile diminished by 27,277 acres, and turnip-culture has not increased; but the permanent pastures are more extensive by nearly one-fourth, or 101,207 acres. The turnip-culture of the northern parts of the county takes rank with the best districts in Scotland. A five- or four-course shift is the usual rotation.

By the census of live-stock (1883) the returns are as follows:—horses and ponies, 18,147, including 13,538 used for agricultural purposes; cattle, 93,550, of which 21,930 were in milk or in calf; sheep, 880,230, including 336,702 under one year old; pigs, exclusive of those kept in towns and by cottagers, 14,883. The sheep, which are celebrated, fall into three groups. The half-breds—crosses between the Leicester (or Shropshire) and Cheviot breeds—occupy the lower enclosed grounds, the pure Cheviots are on the uplands, and the hardier blackfaced breeds lie out on the exposed heathery heights. The cattle are chiefly shorthorns and Galloways.

The size of the agricultural holdings was returned in 1875 and 1880. Holdings of 50 acres and under numbered in these years 3070 and 3329 respectively; of 100 to 300 acres, 1313 and 1273; of 1000 acres and upwards, 38 and 36. Leases of fourteen and nineteen years "usually without compensation clauses, and more or less restricted as to cropping," have hitherto been in fashion. In the large part of the county owned by the duke of Northumberland (nearly one-seventh of the whole) there obtains a system of yearly agreements, except in the case of hill-pastures. In the recent uncertain years annual arrangements have been more in favour generally. Large farms have now much absorbed the smaller holdings of earlier times. In Allendale the mining population includes many small occupiers, and the commons are still unbroken. In other parts of the county the commons have mostly been divided. Between 1702 and 1877 commons to the number of 59, and with an aggregate extent of 194,917 acres, are known to have been enclosed. There is no authentic account of the unenclosed remainder.

The management of many Northumbrian farms is excellent, "far in advance of ordinary practice." Wages are high, but "the cost per acre of labour does not exceed and is often much lower than that of districts where wages are from 25 to 40 per cent. lower. This is attributable to (1) the superior quality of the labour, both physical and moral, (2) the extensive use of women-workers (the employment of whom is not found to be demoralizing when properly safe-guarded), and (3) more systematic and economical management" (Coleman, *Report*, *Royal Commission*, 1882).

The practice of paying wages in kind has passed greatly into disuse. Some of the shepherds still receive "stock-wages," being allowed to keep forty or fifty sheep and several cows on their employers' farms in lieu of pay. This arrangement, which makes them really copartners, has probably done much to render them the singularly fine class of men they are.

Manufactures, &c.—The manufactures of this county chiefly come from the Tyne, which is a region of ironworks, blast-furnaces, shipbuilding-yards, ropeworks, coke-ovens, alkali-works, and manufactories of glass, pottery, and fire-bricks, from Newcastle to the sea (see NEWCASTLE). There is great activity in all trades concerned in pit-sinking and mine-working. In the other parts of the county there are a few small cloth-mills, a manufactory of tan-gloves at Hexham, some potteries, and numbers of small brick and tile works.

Fisheries.—The Tyne is the most productive salmon-netting river from a commercial point of view in England and Wales. The richness of its fisheries is mentioned in the time of Henry I. According to Professor Huxley's report, the estimated catch in 1882 was 41,110 salmon and 10,336 salmon-trout. The salmon catch has doubled within the last four years, and is not known to have been exceeded except in three abnormal years, 1871-73. The fish taken by the Berwick Salmon Fishery Company in 1882 were 3808 salmon, 3104 grilse, and 12,390 trout. Bull-trout abound in the Coquet. The sea-fisheries include herrings, whitefish, and some crabs and lobsters. In 1872 the number of boats employed was 1163, chiefly cobles. Beyond Holy Island the boats and fishing are essentially Scotch.

Antiquities, &c.—The pre-Roman antiquities of Northumberland are camps, cairns, standing-stones (both monoliths and fragmentary circles), sculptures on rock, hand-made pottery, and weapons, ornaments, &c., of stone, bronze, iron, jet, glass, and gold. The camps are entrenched enclosures rudely rounded or quadrate, with their main entrances and those of the hut-circles, or foundations of huts, always facing sunrise. They differ from the camps of the Romans in their want of symmetry, and in an absence of plan in distribution, due to the desultory clan-warfare of their inhabitants. The primitive village of Greaves Ash near the Breamish, the strong defensive earthwork at Elsdon, and the camps at Old Bewick, Lordenshaw near Rothbury, and Warden Hill near Hexham are a few instances from among the great numbers that are preserved on the eminences girdling the northern Cheviots and on the lower untilled grounds. Traces of occupation by Romans, Saxons, and marauders of later times sometimes mingle with the remains of the original occupants. The sculptured cups and circles, now familiar to antiquaries, were first brought into observation at Rowtin Linn near Ford in 1852. Numerous instances and varied designs have since been found, both on "fast" rock and on slabs associated with burials. The uplands are dotted with round barrows and cairns containing cists and interments, sometimes cremated, sometimes inhumed, and in some instances both together. The county scarcely affords material as yet for a separation into periods of stone, bronze, and iron. The older interments are associated only with stone, but not necessarily precedent to bronze; in the "late Celtic" or "early iron" ages all three were in use together.

In Roman military antiquities this is the premier county of Britain. For the great wall between the Tyne and the Solway, see HADRIAN'S WALL. The Roman road from London nearly bisects the county, and still goes familiarly under the name of "the Watling Street." It passes numbers of quadrangular camps, three of which were permanent stations. Its eastern branch, the Devil's Causeway, leaves it near the Tyne for Berwick. In the south-west of the county lay the Maiden Way, making for Liddisdale. Coal, iron, and lead appear to have been worked by the Romans. Numerous heaps of heavy iron slag, mingled with charcoal, are the sites of little "bloomeries" on the uplands. They may be of different ages, from that of the Britons downwards.

Of Anglo-Saxon buildings the Danes left almost nothing. The crypt of Wilfrid's abbey of St Andrew at Hexham is one undoubted remnant; portions of several other churches are very doubtfully pre-Norman. Some thousand Saxon *stycas* found buried at Hexham, the "fridstool" there, and an ornate cross now shared between Rothbury and Newcastle are the other principal vestiges of Saxon times. The Black Dyke, a bank and ditch crossing the line of the Roman wall about three miles east of the Irthing, is supposed by some antiquaries to be the continuation of the Catrail at Peel Fell; the latter was the probable boundary-fence between the Saxon Bernicia and the British Strathclyde.

The ecclesiastical architecture of the county suffered greatly at the hands of the Scots. Not a few of the churches were massive structures, tower-like in strength, and fit to defend on occasion. Lindisfarne Priory, the oldest monastic ruin in the county, dates from 1093. Hexham Abbey Church (early 12th century), raised over the crypt of Wilfrid's cathedral, has been termed a "text-book of Early English architecture;" it lacks the nave, destroyed by the Scots under Wallace. Of Brinkburn Priory the church remains, and has been well restored. Hulne Abbey, now surrounded by the sylvan loveliness of the Alnwick demesnes, was the first Carmelite monastery in Britain. Besides these there are fragments of Newminster Abbey (1139), Alnwick Abbey (1147), and others. An exquisitely graceful fragment of Tynemouth church is associated with some remains of the older priory. Among churches ought first to be named St Nicholas's, Newcastle (1350), the prototype of St Giles's, Edinburgh, and now the cathedral-church of the new diocese. There is a massive Norman church at Norham, and other Norman and Early English churches at Mitford, Bamburgh, Warkworth, Alnwick (St Michael's), &c., most of them with square towers. The stone roof of the little church at Bellingham, with its heavy semicircular girders, is said to be now unique.

"It may be said of the houses of the gentry herein," writes old Fuller, "'quot mansiones, tot munitiones,' as being all castles or castle-like." Except a few dwellings of the 16th century in Newcastle, and some mansions built after the Union, the older houses are all castles. A survey of 1460 mentions thirty-seven castles and seventy-eight towers in Northumberland, not probably including all the bastle-houses or small peels of the yeomen. At the Conquest Bamburgh, the seat of the Saxon kings, was the only fortress north of York. Norham Castle was built in 1121. None of the baronial castles are older than the time of Henry I. A grass mound represents Wark Castle. Alnwick Castle is an array of walls and towers covering about five acres. The interior was restored in Italian palace style by the late Duke Algernon. Warkworth, Prudhoe, and Dunstanburgh castles are fine groups of ruins. Dilston Castle has still its romantic memories of the earl of Derwentwater. Belsay, Haughton, Featherstone, and Chipchase castles are joined with modern mansions. The peel-towers of Elsdon, Whitton (Rothbury), and Embleton were used as fortified rectory-houses. Seaton Delaval was the work of Vanbrugh.

The place-names of the county may be viewed as its etymological antiquities. The Danish test-word *by* we find to be absent. Saxon *tons*, *hams*, *cleughs* (clefts or ravines), and various patronymics are met with in great numbers; and the Gaelic *knock* (hill) and Cymric *caer*, *dwr* (water), *cefn* (ridge), *bryn* (brow), &c., mingle with the Saxon. Many curiosities of nomenclature exist, some strange, some expressive, *e.g.*, Blink-bonny, Blaw-wearie, Skirl-naked.

A few gleanings of folk-lore still remain for the discriminating collector. The virtues of certain holy wells in ailments or barrenness and of a south-running stream in sickness, the powers of Irish men and cattle over snakes and snake-bites, and the growing of boulders in the earth like bulbs are still latently believed in by many; and there is a general aversion to burying on the sunless side of the churchyard, which is left to suicides and unchristened infants.

The literary antiquities are the Border ballads. "I never heard the old song of Percy and Douglas, that I found not my heart more moved than with a trumpet" (Sir Philip Sidney).

Bibliography.—See Hodgson's unfinished county *History*, 1820-40, a marvel of minute local fidelity; Hodgson Hinde's *General History*, added thereto, 1858; also Skene's *Celtic Scotland*, Green's *Making of England*, and Freeman's *Norman Conquest*, as more recent authorities. In antiquities: Bruce, *Roman Wall*, 1874, *Wallet Book*, 1863, *Lapidarium*, 1875, and *Descriptive Catalogue of Antiquities at Alnwick Castle*, 1880; Hartshorne, *Feudal and Military Antiq. of Northumberland*, 1858; Wilson, *Churches of Lindisfarne*, 1874; Wallis, *Natural Hist. and Antiq. of Northumberland*, 1769; Greenwell, *British Barrows*, 1877; and the *Archæologia Æliana*, being proceedings of the Antiquarian Society of Newcastle. In natural history: Tate and Baker, "Flora of Northumberland," &c., vol. vi. of *Tyneside Naturalists' Transactions*; Hancock, "Birds of Northumberland," in vol. xii.; "Catalogue of the Mammalia," in vol. vi.; and much valuable matter on antiquities, natural history, &c., both in these and in the *Berwickshire Naturalists' Transactions*; and Storer, *Wild White Cattle of Britain*, 1879. In geology: the maps of the Geological Survey (now completed), and memoirs which will accompany them; G. Tate, careful and clear-sighted, in Tate and Baker's "Flora"; Bruce's *Roman Wall*, 4th ed. In agriculture: Coleman's *Report to the Royal Commission*, 1882; John Gray of Dilston, "Report," *Agricultural Journal*, 1841; Bailey and Culley, 1813. On dialect, &c., Murray, "Northumbrian Speech," *Philological Journal*, 1870-72; Brockett's *Glossary of North Country Words and Phrases*, 1846. *Murray's Handbook* is a very useful but not very accurate companion for the traveller in Northumberland. The library of the Lit. and Phil. Society at Newcastle is one of the best provincial libraries in the kingdom. (H. M.)

NORTHUMBERLAND, KINGDOM OF. The history of Anglo-Saxon England is the history, not of a heptarchy of independent and equal or nearly equal kingdoms united by any kind of federal bond, but of the rise and progress of the kingdom of Northumberland from the end of the 6th to the middle of the 8th century under Ethelfrith and the descendants of Edwin of Deira, the predominance of Mercia during the latter half of the 8th century under Offa, and the gradual union of England under the descendants of Egbert of Wessex between the close of the 8th century and the Norman Conquest. The present article is chiefly concerned with the first of these periods chronologically, and geographically with the portion of Britain which under the Northumbrian kings at the time of their greatest power extended from the Humber to the Forth, and was bounded on the east by the German Ocean and on the west by an irregular and gradually receding line, at times overstepped, of the country more or less mountainous retained by the Celts of Strathclyde and Cumbria between the Clyde and the Mersey (see Plate II., vol. viii.). The first settlements of the Angles in these regions and the foundation of the kingdoms of Bernicia and Deira have been spoken of in vol. viii. p. 270. Bernicia and Deira were Celtic names, Bryneich and Deifr, somewhat modified; the former kingdom corresponded generally with the modern counties of Durham and

Northumberland and the Lothians, the latter with Yorkshire, and when the two became united in one kingdom it received the name of Northumberland.

The history of Bernicia between the establishment of Ida as its king and the reign of his grandson Ethelfrith (592-617), and of Deira prior to the reign of Edwin (616-633), the son of Ælla, is obscure. The skilful piecing together of the notices of Nennius, Bede, and the early English chroniclers by Palgrave, Lappenberg, Skene, and others cannot be regarded as a completely successful reconstruction of the chronology of the Northumbrian kings. The chief difficulty, though only one of many, is that six of twelve sons of Ida are said to have reigned in Bernicia from his death (559) to the accession of Ethelfrith, his grandson (592 or 594), a period of only thirty-three or thirty-five years, which, though not quite incredible, appears short in comparison with the parallel reigns of Ælla of Deira (559-588) and his son Edwin (616-633), while their names and order of succession do not agree in the earliest authorities. Another is that Bebba, the British princess from whom Bamburgh, the chief fortress of Bernicia, was named, was according to the *Saxon Chronicle* wife of Ida, but according to Nennius of Ethelfrith. Whatever may be the truth as to the earlier history, more light dawns with Ethelfrith, in whose reign the attempt to unite Bernicia and Deira commenced. "The most powerful and covetous of glory of kings," as he is called by Bede, Ethelfrith "wasted the race of the Britons more than all the chiefs of the Angles, and made more land than any of them subject to or inhabited by Angles, exterminating or subduing the indigenous tribes" (Bede, i. 34). By one of these victories, that of Catræth ? (596), commemorated in the verse of Aneurin, he overcame the Britons, who were driven back into Cumbria, and by another at Degsastan (?Dawston in Liddisdale) over Aidan, king of the Scots of Dalriada, in 603, he put a stop to incursions of the Scots down to Bede's own day. A third victory at Caerleon (Chester on the Dee) 613?, followed by the slaughter of the monks of Bangor, marks the fact that the Northumbrian Angles were still heathens fighting against Christian Celts. It was these successes that led to the extension of Northumberland to the borders of Cumberland and Westmoreland, and the first permanent inclusion of part at least of the district between the Tweed and the Forth in the kingdom of the northern Angles. Ethelfrith married a sister of Edwin and daughter of Ælla of Deira, and after Ælla's death, during the minority of Edwin, seized Deira, over which he reigned for twelve years. The young Edwin took refuge first amongst the Britons and afterwards with Redwald, king of East Anglia, who restored him to his kingdom by the defeat and death of Ethelfrith at a battle on the Idle, a tributary of the Trent, in 617. This turn of fortune drove Eanfrid, Oswald, and Oswy, the sons of Ethelfrith, into exile amongst the northern Celts, and Edwin, like Ethelfrith, ruled over the whole Angles north of the Humber to the Forth; for, whether Edinburgh was his foundation or a fortress of the Celts (Dunedin), the tradition which linked its modern name with his can scarcely be without meaning. Through his example the Angles were converted to Christianity by Paulinus, a monk sent from Canterbury with letters from Boniface V. to the king and his wife Ethelberga, the daughter of Ethelbert of Kent. The story of the origin of the Northumbrian Church, with its incidents of the destruction of the idols by the heathen archpriest Coifi, the speeches at the council of the witan which decided in favour of the new faith, the host of catechumens eager for baptism in the nearest rivers, the Glen in Bernicia, the Swale in Deira, and the Trent in the country of the Lindissi, the erection of a stone church dedicated to St Peter at York surrounding the wooden oratory in which Edwin had himself been baptized, afterwards itself enclosed in the minster, forms one of the most vivid passages of Bede. As the scene of these incidents was his native country, and their time about half a century before his birth, there is no reason to doubt the substantial truth of a narrative derived at first, or at furthest at second hand.

> "Deda, a priest of Bardney, a man of singular veracity," he mentions in one place, "told me that one of the oldest persons (in the province of the Lindissi, modern Lincoln) had informed him that he himself had been baptized by Paulinus at noon in the presence of Edwin, with a great multitude of the people, in the river Trent . . . he was also wont to describe the personal appearance of Paulinus, tall of stature, a little stooping, his hair black, his visage meagre, his nose very slender and aquiline, his aspect both venerable and majestic."

The same historian testifies to the dignity of Edwin's reign, shown by the "tufa," or standard of feathers on a spear-head, borne before him in war and peace. A woman with a new-born child might walk through his dominion without harm, and cups were provided at the springs on the wayside for travellers. Such a time was fitted for the reception of the new religion of peace, but Edwin's days ended in war, and he perished at Heathfield (Hatfield in Yorkshire) in a battle against the heathen host led by Penda, king of Mercia, and the British King Ceadwalla (633). His death permitted the return of the sons of Ethelfrith. The eldest, Eanfrid, who is supposed to have been in exile amongst the Picts, obtained Bernicia, while Deira fell to Osric, the son of his uncle Alfric. Eanfrid, who relapsed to paganism, held his kingdom only a year; and in 634 Ceadwalla defeated Osric at York, and killed by treachery Eanfrid, who had made overtures of peace. Eanfrid's brother Oswald recovered both Bernicia and Deira by the great victory of Heavenfield near Hexham in 635. "The most Christian king of the Northumbrians," as Bede emphatically calls him, Oswald restored Christianity throughout his whole territory, but under the monastic form he had learnt during his exile in Iona, and with the usages as to Easter and the tonsure which distinguished the Celtic from the Roman Church. At his request Aidan, a monk of Iona, came to instruct the Angles in the Christian faith, and was in 634 or 635 consecrated as bishop of Lindisfarne, the Holy Island, which became the Iona of the eastern coast.

The powerful and wise rule of Oswald not only reunited Bernicia and Deira, but subjected races of all the four languages (for we may be sure Bede's expression "*all* the nations of the four languages" is an hyperbole), the Britons, the Picts, the Scots, and the Angles, to his dominion.

In 642 he fell in a battle against Penda of Mercia at Maserfield, which, whether it be the place of that name now called Winwick in Lancashire or Oswestry (Oswald's tree) in Shropshire, shows that he was still further enlarging his realm. His successor Oswy revenged his death by the defeat and death of Penda at the river Winwaed, now Winmore, near Leeds (655), which resulted in the conversion of Mercia. In his reign Wilfrid, an energetic and ambitious monk, persuaded the Northumbrians at the council of Whitby to conform to the Roman usage as to Easter and the tonsure, and Colman, the third Celtic bishop of Lindisfarne, returned to Iona with the Scottish monks and the relics of Aidan. The successful advocate of the Roman rites became bishop of York, with a diocese including all Northumberland and the Pictish subjects of Oswy, thus completing the scheme of Gregory I. and Augustine for the ecclesiastical organization of England.

On the death of Oswy in 670 the Picts revolted, but his son Egfrid succeeded in quelling the revolt and in extending his father's kingdom both against the Mercians on his southern and the Pictish kings on his northern border. In 684, tempted by his good fortune, he sent his general Berct to ravage Ireland, then, says Bede, a peaceful and friendly country, which implies that his dominions had now touched some parts of the western shores, and next year he himself invaded the territory of the northern Picts, where he was defeated and slain by their king Bredei or Brude at Nechtan's Mere (Dunnichen? in Forfarshire) in 685. The result was that not only the Picts recovered their own land and ceased to pay tribute, but some of the Britons also became independent. The Northumbrian Church under the able leadership of Wilfrid shared in the extension of the kingdom, and it also shared in its repulse. A bishopric established under Trumwine at Abercorn in Linlithgowshire, in the country of the Angles, but close to the arm of the sea dividing the Angles and the Picts (Bede, iv. 26), had to be abandoned. The Forth was destined to be the limit of Northumbrian sovereignty to the north.

Shortly before the close of this reign a dispute between the king and Wilfrid led to the division of the diocese of York into two bishoprics—York, of which Bosa was made bishop, and that of Lindisfarne or Hexham, whose first bishop was Eata. A new bishopric was erected for the district of the Lindissi (Lincoln), who had been conquered by Egfrid. To this or the next reign belong the earliest fragmentary memorials of the Northumbrian or Northern English dialect which have come down to our time—the Runic inscription of the crosses at Ruthwell and perhaps those at Thornhill in Dumfriesshire and at Bewcastle in Cumberland. It was during the same period that CÆDMON (*q.v.*), a monk of Whitby, the earliest English poet, died (680), and BEDE (*q.v.*), the monk of Wearmouth and Yarrow, the earliest English historian, except the anonymous authors of the *A.S. Chronicle*, Aldhelm, and Eddi, the writer of Wilfrid's life, was born (672 or 674). To their influence, and to the learned—which succeeded the warlike—epoch of Northumberland during the next century down to the death of Alcuin of York in 804, may be ascribed the fact that, while Saxon Wessex became the dominant state, the language and the land south of the Forth received from the Angles the name of English and England.

Egfrid was succeeded by his brother Aldfrid, an illegitimate son of Oswy (685-705), who "retrieved," in the words of Bede, "the ruined state of the kingdom, though within narrower bounds." It was in his reign that Cuthbert, a monk of Melrose, which had been founded by Bishop Eata, became bishop of Lindisfarne. His preaching commenced the Christianization of the country between the Forth and the Tweed, and his fame quickly gathering a legendary halo of miracles led to his being adopted as the patron saint of Durham and the north of England, as well as of southern Scotland. While no serious attempt was made to regain the lost territory in the country of the Northern Picts, Egfrid, his son Osred (705-716), and Osred's successors, Coenred (716-718), Osric (718-729), and Ceolwulf (729-737), some of whom were descendants of a different branch of the family of Ida, gradually extended the limits of their kingdom to the west, and, following the coast, established themselves in Galloway and as far as Cunningham (Bede, v. 12), the northern district of modern Ayrshire. Shortly before 731, when Bede concluded his history, an Anglian see had been created at Whithorn (*Candida Casa*) in Galloway, of which Pechthelm was the first bishop, and which lasted till 803.

The last of the important kings of Northumberland, Eadbert (737-758), pushed his arms as far as the Clyde, defeating the Britons in Kyle, and, in alliance with Angus Macfergus, king of the Picts, took Allclyd (Dumbarton), the chief town or fortress of the Strathclyde Britons in 756. These were uncertain conquests.

The epoch of Northumbrian greatness closes with Oswy. It is significant that two of the last-named kings, Ceolwulf and Eadbert, resigned the crown for the tonsure. External circumstances combined with the enervation of the royal race to produce the decline of Northumberland. Its southern neighbour, Mercia, was ruled by two powerful kings,—Ethelbald, who ravaged Northumberland in 737, and after his death the great Offa (757-796), the contemporary of Charlemagne; while a series of Northumbrian kings, of whom we know little save the names and the dates of their mostly violent deaths—Oswulf (758), Ethelwald (765), Alchred (774), Ethelred (779), Alfwold (788), Osred (792), another Ethelred (796), whose wife, Ethelfreda, was a daughter of Offa—wasted in intestine struggles the kingdom of their predecessors.

On its northern boundary a vigorous line of Pictish kings, beginning with Angus Macfergus (731-761), the ally of Eadbert against the Britons of Strathclyde, whose chief seat was Scone, threatened, and there is no doubt often passed, the boundary of the Forth, but the Angles retained Lothian during the 8th and the first half of the 9th century, and it was not till a century after the union of the Scots and Picts under Kenneth Macalpine (844), in the reign of Indulph (954-962), that Edinburgh became Scottish instead of Northumbrian ground. In 793 the heathen Northmen signalized the commencement of the attacks which were for several centuries to vex the coast of Britain by the sack of Lindisfarne, and in the following year of Yarrow. Though this descent was repelled, the Danish vikings with increased numbers renewed their raids in the following century. Before its close the southern half of Northumberland had received a large infusion of Danish population. Their distant kinship in race and not so distant likeness of language favoured their settlement in the territory of the Angles. With the close of the 8th century the history of the kingdom of Northumberland practically ends, though a few names of kings of pure Anglian race are recorded in the 9th century.

It may be convenient to trace the subsequent fate of this kingdom and its parts. In 827 Eadred, king of Northumberland, submitted to Egbert, the founder of the greatness of Wessex, and agreed to pay tribute in order to stay the progress of that kingdom at the Humber.

In 875 the Danish host, now too large for and weary of mere raids, divided itself between Guthorm, who led his division against southern England, where its final repulse by Alfred made him the hero of his race, while Healfdene, with no Alfred amongst the Angles to oppose him, conquered Northumberland and settled his followers on the east coast, throughout the whole of ancient Deira, the southern part of ancient Bernicia, and as far west as the central districts of Anglian Cumberland. Wherever the "by" replaced the older name or gave a new name to the settlement, wherever the "t" still lingers instead of "the" as the article, linguistic scholars see certain marks of Danish occupation. This occupation retarded the northern advance of the Wessex kings, the descendants of Alfred, and a century elapsed before Edward the Elder in 924 received again at Bakewell in Derbyshire the homage of the Northumbrians, as Egbert in 827 is said to have done almost at the same point, whose position on the extreme southern border of Northumberland is significant. This homage is recorded in the contested passage of the *A.S. Chronicle*: "And then chose him for father and lord the king of the Scots and the whole nation of the Scots and Regnwald and the sons of Eadulf and all those who dwell in Northumbria, as well Angles as Danes, Northmen, and others." But the dispute as to the precise nature and extent of the submission does not concern the present subject so much as the evidence it affords of the mixed population of Northumberland, and of the absence of any prominent sovereign of the whole country whose name could be mentioned by the Chronicle. In the reign of Athelstan, the son of Edward the Elder, the great victory of Brunanburgh (937), by which he defeated the united forces of Olaf Cuaran, the son of Sitric, the Danish king or earl, his father-in-law Constantine, king of the Scots, another Olaf, the son of Godfry, king of the Irish Danes, and the British prince of Cumbria, made the conquest of Northumberland south of the Solway and the Tweed more of a reality. Norse mercenaries under Egil, the hero of the Icelandic saga, fought in the army of Athelstan, and a few years later the aid of Eric Blood-Axe, son of Harold the Fairhaired, had to be purchased by giving him the rule over Northumberland, which he was intended, but was unable, to hold as a barrier against the Scots and Danes. The conquest of the Northumbrian Danes was only completed in 954, when Eadred, the third son of Edward the Elder, who was king of Wessex, was able to substitute Oswulf, an earl of his own choice, for their last king, Eric, who is called by the English chroniclers simply "the son of Harold," and is supposed by Adam of Bremen to have been the son of Harold (Blue-tooth) king of Denmark, but by the best modern writers to be Eric Blood-Axe, who had returned to Northumberland and was slain at Stanemoor (954).[1] Eadgar (959-975), the successor of Eadred, divided Northumberland into two earldoms, which answered roughly to the ancient Deira and Bernicia, but probably more nearly to the modern county of York, of which Oslac was earl, and modern Northumberland and Durham, which Oswulf retained. The dismemberment of the ancient kingdom had commenced in the earlier reign of Edmund, who in 945 ceded Cumbria to Malcolm I. of Scotland on condition that he should be "his fellow-worker both by land and sea," a remarkable expression in the A.S. Chronicle, indicating alliance rather than homage.

Lothian was either ceded between 970 and 975 by Eadgar to Kenneth, the son of Malcolm I., upon condition that it should retain its Anglian speech and customs, which is the account given by John of Wallingford, or conquered by the defeat of Eadulf Cudel, its ruler in the time of Canute, by Malcolm II. at the battle of Carham in 1018, as is stated by Simeon of Durham. It seems not impossible that both statements may be true, and that an earlier almost compulsory union was followed by a more complete annexation. For England was already threatened by the last and most formidable invasion of the Danes, which was to end in its conquest by Canute (1017). This conquest for a brief space included not only Northumberland but Scotland (1031-35). In the confused period between the Danish and the Norman conquests of England, the succession of the Northumbrian earls appears to have been this. The two earldoms of Oslac and Oswulf had been united under Waltheof (975), who was deposed by Æthelred in favour of Waltheof's son Uhtred (1000). Uhtred defeated the Scots near Durham, and received the hand of Ælgifa, Æthelred's daughter. He submitted to Canute, but was slain soon after his submission by a private enemy, and Eric, the husband of Canute's sister Gytha, became earl, though the northern portion of his earldom was left to the charge of Eadulf Cudel, a brother of Uhtred, whose signal defeat at Carham, we have seen, finally united Lothian to Scotland. Two obscure sons of Eadulf, Ealred and a second Eadulf, afterwards appear as earls in Bernicia in the time of Hardicanute. Both were assassinated, the latter by Siward the Strong, a Danish follower of Canute, who married a daughter of Ealred, and in 1041 reigned over all Northumberland. He was the famous earl in the narrative of whose exploits it is difficult to separate legend from history, but to the latter apparently belongs his alliance with Malcolm Canmore, and the aid he gave in recovering his father's kingdom from Macbeth, the representative of the Celtic party in Scotland. On his death in 1055, Edward the Confessor appointed Tostig, one of the sons of Godwin, earl of Northumberland, including the detached shires of Northampton and Huntingdon. Deposed by the Northumbrians, he took refuge with his brother-in-law, the Flemish Baldwin, at Bruges. After taking part in the early designs of William the Conqueror against England, he joined in the expedition of Harold Hardrada against his brother Harold, and was slain at Stamfordbridge (25th September 1066). After the Conquest Yorkshire was incorporated in England. Morkere the son of Ælfgar earl of Mercia, and Copsige, a thane who had acted as deputy of Tostig, still retained the northern districts, and, though they submitted to William, the subjugation was almost nominal. Northumberland, Cumberland, Westmoreland, and Durham were not sufficiently subdued to be included in the Domesday survey, though some parts of southern Westmoreland and Cumberland are contained in the description of the West Riding of Yorkshire, and parts of Lancashire in that of Cheshire. Frequent risings and constant changes of its earls prove the difficulty which the Norman kings experienced in governing the unruly northern province: Robert of Comines was slain at Durham in 1069; Cospatric was deprived for rebellion in 1070; Waltheof, who also rebelled, was executed in 1076; Walcher, who held it along with the bishopric of Durham, was murdered in 1080; Alberic resigned the dignity in 1085, and was succeeded by Robert de Moubray, after whose forfeiture in 1095 Northumberland was united by Rufus to the crown. In the reign of Henry II. the earldom was conferred on Henry, earl of Huntingdon, the son of David I. of Scotland; after his death it was surrendered in 1154 by Malcolm IV., but its possession was always coveted and sometimes almost obtained by the Scottish kings, until the final result of the wars of the Plantagenets was to leave Scotland independent, but to fix its boundaries north of the Tweed, the Cheviots, and the Solway. Richard II. in 1377 regranted the earldom to Henry Percy, and the memory of its former independence probably prompted the ambition of the earls of this powerful house, which played so great a part in English history in the 15th and 16th centuries (see Percy).

To sum up the results of a somewhat complex and here necessarily compressed history. The ancient kingdom of Northumberland, formed by the union of all the north-eastern part of Britain between the Humber and the Forth under the Anglian kings, and the more or less complete conquest of the British or Cymric western part between the Mersey and the Clyde, was ruled by the Anglian kings from the middle of the 6th to the 9th century. A great portion of it was resettled by the Danes towards the close of that century. It was conquered by the West-Saxon kings in the 10th century, but they had to allow its Danish earls to remain its real governors until shortly before the Norman Conquest, and before its close, or in the beginning of the 11th century, to cede the northern part of Cumbria and the northern part of Bernicia beyond the Tweed to the Scottish kings. Of their dominions the former, Galloway (the shires of Wigtown, Kirkcudbright, and part of Dumfries), became for a time an outlying district, but after David I. an integral part, though it retained for some time longer its Celtic speech and customs, while the latter, Lothian, preserving its Anglian speech and customs, became the seat of the court and the source of the civilization of Scotland. The portion of the Northumbrian kingdom which remained English was divided into the shire of York, the earldom or county of Northumberland in the modern sense, and the later counties of Cumberland, Westmoreland, and part of Lancashire. The preponderating influence in government as in language passed during the Middle Ages, and still continues to belong, to southern England, which possesses the capital London, its greatest river the Thames, and its most fertile lands. The discovery of the coal and ironstone, the sinews of manufactures, in the North, and the later development of the Mersey, the Clyde, the Humber, the Tyne, and the Forth, as the channels of commerce in modern times, have revived the importance of the districts comprised within the ancient kingdom of Northumberland. Whatever may be its future, its earliest history forms a memorable chapter in that of Great Britain.

Of original authorities the *Anglo-Saxon Chronicle* and Bede are the most important, but the former was written in Wessex, and magnifies the West-Saxon kings. After Bede, Simeon of Durham is the most trustworthy English chronicler of northern affairs. Eddi's *Life of Wilfrid* and Bede's *Life of Cuthbert* are of value for the history of the church. The *Chronicles of the Picts and Scots*, edited by Mr Skene for the record series of the Lord Clerk Register, Adamnan's *Life of Columba*, and the *Scottish Chronicles* of Fordun and Wynton, supplement, unfortunately in a fragmentary manner, the English writers. Some additional information may be anticipated from the edition of the passages in the Norse sagas bearing upon English history to be published in the English series of chronicles and memorials. The best modern writers to consult for Northumbrian history are Lappenberg, *History of the Anglo-Saxons* (1880); Skene, *History of Celtic Scotland*, vol. i. (1876); Robertson, *Scotland under her Early Kings*; Freeman, *History of the Norman Conquest*, and *Old English History for Children* (1869); and J. R. Green's *The Making of England*. (Æ. M.)

NORTH-WESTERN PROVINCES, The, a lieutenant-governorship of British India, lying between 23° 51′ and 31° 5′ N. lat. and between 77° 3′ and 84° 43′ E. long., is bounded on the N. by Tibet, on the N.E. by Nepál and Oudh, on the S. by the Chutiá Nágpur districts of Bengal, Rewah, the Bundelkhand states, and the Central Provinces, and on the W. by Gwalior, Rájputána, and the Punjab, with an area under British administration of 81,858 square miles. The administrative headquarters and seat of the lieutenant-governor are at Allahábád.

Physical Aspects.—The North-Western Provinces occupy, roughly speaking, the upper basin of the Ganges and the Jumna. The province of Oudh (*q.v.*) has since 1877 been under the administrative charge of the lieutenant-governor at Allahábád, but in respect of its land and courts it still remains a distinct chief-commissionership. With this exception, the North-Western Provinces include the whole upper portion of the Gangetic basin from the Himálayas and the Punjab plain to the Vindhyán plateau and the low-lying rice-fields of Bengal. Taken as a whole, the lieutenant-governorship consists of the richest wheat-bearing country in India. It contains many of the most famous cities of Indian history and is studded with thriving villages, interspersed at distances with large commercial towns. Except during the hot months, when the crops are off the fields, the general aspect is that of a verdant and well-tilled but monotonous plain, merging into hilly or mountainous country at the extreme northern and southern edges of the basin.

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[1] See Munch, *Chronicle of Man*, p. 39; and Vigfusson, *Corpus Poeticum Boreale*, i. p. 259, ii. p. 494 (Oxford, 1883).

The extreme north-western or Himálayan region comprises the native state of Garhwál, with the British districts of Dehra Dún, Garhwál, and Kumáun. The economic value of this mountainous tract is confined to the growth of tea in Kumáun and the export of forest produce. South of the Himálayas, from which it is separated by valleys or *dúns*, is the Siwálik range, which slopes down to the fruitful plain of the Doáb (two waters), a large irregular horn-shaped tongue of land enclosed between the Ganges and Jumna. The great boundary rivers flow through low-lying valleys fertilized by their overflow or percolation, while a high bank leads up to the central upland, which, though naturally dry and unproductive except where irrigated by wells, has been transformed into an almost unbroken sheet of cultivation by various canals and their distributaries. This favoured inter-fluvial region may be fitly regarded as the granary of upper India. North of the Ganges, and enclosed between that river and the Himálayas and Oudh, lies the triangular plain of Rohilkhand. This tract presents the same general features as the Gangetic valley, varied by the damp and pestilential submontane region of the Tarái on the north-east, at the foot of the Kumáun hills. South of the Jumna is the poor and backward region of Bundelkhand, comprising the districts of Jaláun, Jhánsi, Lálitpur, Hamírpur, and Bánda, besides several petty native states under the administrative control of the Government of India. The soil is generally rocky and unfertile, and the population impoverished, scanty, and ignorant. The southernmost portion of Bundelkhand is much cut up by spurs of sandstone and granite hills, running down from the Vindhyán system; but the northern half near the Jumna has a somewhat richer soil, and comes nearer in character to the plain of the Doáb. Below the junction of the Ganges and the Jumna at Allahábád the country begins to assume the appearance of the Bengal plains, and also once more expands northwards to the foot of the Nepál Himálayas. This tract consists of three portions, separated by the Ganges and the Gogra. The division south of the Ganges comprises portions of Allahábád, Benares, and Gházípur, together with the whole of Mírzápur, and in general features somewhat resembles Bundelkhand, but the lowlands along the river bank are more fertile. The triangular tract between the Ganges and the Gogra and the boundary of Oudh is the most fertile corner of the Gangetic plain, and contains the densest population. It comprises part of Allahábád, Jaunpur, parts of Benares and Gházípur, and the whole of Azamgarh. The trans-Gogra region, comprising Basti and Gorakhpur districts, presents a wilder, submontane appearance. But even here cultivation has widely extended, and the general aspect is that of a well-tilled and verdant plain.

Besides the three great rivers—the Ganges, Jumna, and Gogra—there are the following secondary streams, each with numerous minor tributaries:—the East and West Káli and the Hindan flow through the Doáb; the Chambal intersects the trans-Jumna tract; in Bundelkhand the principal streams are the Betwá and the Ken; the Rámgangá, rising in Garhwál, pursues a very tortuous course through Rohilkhand; the Gumti enters the Provinces from Oudh, and flows past Jaunpur to join the Ganges; the trans-Gogra region is divided into two nearly equal parts by the Rápti. All the drainage of the country falls directly or indirectly into the Ganges.

Climate, &c.—The climate of the North-Western Provinces as a whole may be classed as hot and dry. The Himálayan districts are, of course, cool, and have a much greater rainfall than the plains. They are succeeded by a broad submontane belt, the Tarái, which is rendered moist by the mountain torrents, and is covered by forest from end to end. This region bears a singularly bad reputation as the most unhealthy in all India, and in many parts only the acclimatized aborigines can withstand its deadly malaria. The plain country is generally warm and dry, the heat becoming more oppressive as the general level of the country sinks towards Allahábád and Benares, or among the hills of Bundelkhand. The monthly temperature of twelve stations in 1881-82 was as follows:—maximum, 112° Fahr.; minimum, 40°·1 Fahr.; general mean, 77°·8 Fahr. The maximum was 82° at Chakráta in Dehra Dún, 109° in Meerut, 114° in Allahábád, and 116° in Jhánsi; the minimum was 28° at Chakráta, 35° at Meerut, 41° at Allahábád, and 44° at Jhánsi. The general mean was 57°·7 at Chakráta, 76°·8 at Meerut, 78°·4 at Allahábád, 78°·8 at Benares, and 79°·1 at Jhánsi. The total rainfall during the same year amounted to 54·03 inches at Chakráta, 97·49 at Dehra, 29·68 at Meerut, 35·48 at Bareli, 34·01 at Allahábád, 33·77 at Benares, and 52·62 at Jhánsi. The chief disease is fever, to which a large proportion of deaths are due.

Population.—The North-Western Provinces contain a denser population than any country of Europe, excepting Belgium and England. The census of 1881 returned the population of the British districts at 32,720,128 (males 17,060,901, females 15,659,227), distributed among 81,274 villages and towns. Including the two attached native states of Garhwál and Rámpur, the area amounted to 86,983 square miles, and the population to 33,461,878. The following table exhibits the area (in square miles) and population of each district and state separately (exclusive of Oudh).

Division.	District.	Area.	Population.	Division.	District.	Area.	Population.
Meerut	Dehra Dún	1193	144,070	Jhánsi ..	Jaláun ..	1469	418,142
	Saháranpur	2221	979,544		Jhánsi ..	1567	333,227
	Muzaffarnagar	1656	758,444		Lálitpur ..	1947	249,088
	Meerut ..	2379	1,313,137	Allahábád	Cawnpur	2370	1,181,396
	Bulandshahr	1915	924,822		Fatehpur	1639	683,745
	Alígarh ..	1955	1,021,187		Bánda ...	3061	698,608
Rohilkhand	Bijnaur ..	1868	721,450		Allahábád	2833	1,474,106
	Murádábád	2282	1,155,173		Hamírpur	2288	507,337
	Budáun ..	2002	906,451	Benares	Jaunpur ..	1554	1,209,663
	Bareli	1614	1,030,936		Azamgarh	2147	1,604,654
	Sháhjahánpur	1746	856,946		Mírzápur	5224	1,136,796
	Pilíbhít ..	1372	451,601		Benares ..	998	892,684
Agra	Muttra ..	1453	671,690		Gházípur	1473	1,014,099
	Agra ...	1850	974,656		Gorakhpur	4598	2,617,120
	Farrukhábád	1719	907,608		Basti	2753	1,630,612
	Máinpuri	1697	801,216		Ballia	1144	924,763
	Etáwah ..	1694	722,371	Kumáun	Almora ..	6000	493,641
	Etah	1739	756,523		Garhwál ..	5500	345,629
					Tarái	938	206,993
				Garhwál or Tehri (native state)		4180	199,836
				Rámpur (native state)		945	541,914

Mohammedans muster strongest in the northern divisions of Meerut and Rohilkhand, where they number 2,327,620. In Benares, Allahábád, Agra, and Kumáun divisions they form a percentage respectively of 10·7, 9·5, 8·7, and 8·4 of the population. Many of the descendants of converts forced to embrace Islám at the sword's point retain several Hindu customs and adhere to purely Hindu observances and ceremonies.

Most of the people are gathered into small villages. There are, however, no fewer than 238 towns with a population exceeding 5000, and containing an aggregate of 3,513,107 inhabitants. No other part of India contains so large a proportion of celebrated cities, though recent changes have made over Delhi, the most famous of all, to the adjacent province of the Punjab. Thirteen towns contained in 1872 a population exceeding 50,000—namely, (1) Benares, 199,700; (2) Agra, 160,203; (3) Cawnpur, 155,444; (4) Allahábád, 148,547; (5) Bareli (Bareilly), 113,417; (6) Meerut, 99,565; (7) Sháhjahánpur, 74,830; (8) Murádábád, 67,387; (9) Farrukhábád, 62,437; (10) Koil (Alígarh), 61,730; (11) Saháranpur, 59,194; (12) Gorakhpur, 57,922; and (13) Mírzápur, 56,378. Eighteen towns contain a population of between 20,000 and 50,000. The other places of interest in the provinces are—the hill sanataria of Náini Tál, Masúri (Mussooree), and Landaur, the sacred town of Hardwár, the ruined sites of Kanauj and Hastinapur, the deserted Mughal capital of Fatehpur Síkri, and the ancient temples and fortresses of Mahobá and Kálinjar. Most of the great towns lie along the banks of the Ganges and the Jumna.

Agriculture.—Of a total area of 81,858 square miles, 38,169 were returned as under cultivation in 1881-82. Eleven great canal irrigation works have been undertaken by Government:—(1) Ganges Canal, (2) Eastern Jumna Canal, (3) Agra Canal, (4) Dún Canals, (5) Rohilkhand Canals, (6) Bijnaur Canals, (7) Bundelkhand Lakes, (8) Lower Ganges Canal, (9) Bundelkhand survey, (10) Sardah Canal survey, and (11) Betwá Canal. The total area irrigated in 1881-82 by Government works amounted to 1,395,217 acres. There are two principal harvests, in autumn and spring. The great agricultural staple is wheat. The chief commercial crops include indigo, cotton, sugar, oil-seeds, and opium. The cultivation of tea is confined to the submontane districts of Kumáun, Garhwál, and Dehra Dún. The produce is chiefly manufactured into green tea, which finds a ready sale across the frontier in Central Asia, and is also exported to England. Rice and sugar-cane grow chiefly in the river valleys or in irrigated fields; wheat is raised on the uplands by the aid of canals and wells; millets and cotton grow on the drier soils, while tobacco, vegetables, and other richer crops occupy manured plots in the neighbourhood of villages. The three principal recognized tenures are—(1) *zamíndári*, in which the whole land is held and managed in common, the rents and profits of the entire estate being thrown into a common stock and divided among the shareholders; (2) *pattidári*, in which the lands are held severally by the different proprietors, all of whom are jointly responsible for the Government revenue; (3) *bháyáchára*, in which portions of the soil are held severally, while other portions may be held in common, with joint responsibility for the Government demand. In the hill tracts the peasantry are well off and independent; in the more favoured plain districts they are in fairly comfortable circumstances; but in Bundelkhand they still suffer from the effects of former misrule and from the effects of recent famines.

Commerce and Trade; Communication, &c.—The exports of the North-Western Provinces are principally confined to its raw agricultural produce—wheat, oil-seeds, cotton, indigo, sugar, molasses, timber and forest produce, dye-stuffs, *ghí*, opium, and tobacco. The imports consist mainly of Manchester piece-goods, metal-work, manufactured wares, salt, and European goods. The principal manufactures are sugar, indigo, and coarse cotton cloth. Ornamental metal-work is made at Benares. The only factories on the English model are the Elgin and Muir cotton mills at Cawnpur, the Sháhjahánpur rum distillery, and breweries at Masúri and Náini Tál. The largest and most valuable portion of the trade of the Provinces is now conducted by rail direct with Calcutta, but the great waterways of the Ganges and Jumna still carry a large part of the heavy traffic. The Gogra forms the main channel for the grain and cotton of Gorakhpur, Basti, and Azamgarh, and for the forest produce of Nepál. The lines of railway are the East Indian, which enters the North-Western Provinces from Bengal, and has its terminus at Delhi; the Sind, Punjab, and Delhi line; the Oudh and Rohilkhand Railway; and the Rájputána State Railway, connecting Agra with Bhartpur. The great trunk road traverses the heart of the Provinces.

Administration.—The North-Western Provinces are under the administrative charge of a lieutenant-governor, who resides at Allahábád. The total revenue (including that of Oudh) in 1881-82 amounted to £9,075,727, and the expenditure to £4,362,274. The chief item of receipt is the land-tax, which produced during the same year £5,751,104. Education is making steady progress throughout the central Gangetic plain, though still very backward in the Himálayan districts, in Bundelkhand, and in the remoter parts of Rohilkhand and the trans-Gogra tract. The total number of colleges and schools in the North-Western Provinces in 1881-82 was 5068, with a roll of 170,966 pupils, of whom 142,190 were Hindus and 24,437 Mohammedans. The principal institutions for higher English education are the Muir Central College at Allahábád, and the Government and Church Missionary Society's Colleges at Agra. The Benares College gives high Sanskrit education, while Delhi College, just beyond the borders, gives instruction in Arabic and Persian. Primary education is afforded by a complete system of village schools, the Provinces being divided into three circles of inspection, and elementary instruction is now brought within easy reach of all who choose to avail themselves of it.

History.—The traditions of the *Mahábhárata* cluster round the city of Hastinapur in Meerut district, which, with Indraprastha, whose shapeless ruins are still to be seen near Delhi, formed the respective capitals of the Pandavas and Kauravas. The earliest empire in this part of India, however, of which any certain monuments remain was that of the Buddhist dynasty of Magadha, which attained its greatest development under Asoka (see vol. xii. p. 784 *sq.*).

Continuous history begins with the Mohammedan invasion of Mahmúd of Ghazni, who sacked the sacred cities of Kanauj and Muttra in 1017 A.D. Mohammed Ghorí, however, was the real founder of the Moslem power in Hindustán. In 1193 the seat of the Moslem empire was fixed at Delhi, where it remained, with few intermissions, till the British conquest.

The British first came into connexion with the North-Western Provinces as they advanced along the valley of the Ganges from Bengal. In 1763 the nawáb wazír of Oudh, with the phantom emperor Sháh Alam, invaded Bengal. They received a crushing defeat at Baxar, and the emperor, with Balwant Sinh, rájá of Benares, joined the British camp. In 1775 the nawáb of Oudh, Asaf-ud-daulá, ceded Benares, Jaunpur, and Gházípur to the British, retaining Allahábád and Korah, which had been taken from the emperor in the previous year, when the British sold them to Oudh. The nawáb wazír, having agreed to pay a subsidy for the English troops maintained for his aid, and being always in arrear, signed in 1801 the treaty of Lucknow, by which he made over to the British the whole of his Oudh dominions in the Doáb, together with Rohilkhand. For Lord Lake's campaign in 1803 against Sindhia, which brought the whole remaining portion of the North-Western Provinces under British rule, see vol. xii. p. 804. The Himálayan districts of Kumáun and Garhwál were not acquired until after the Gúrkha war of 1814-15, while the Delhi territory remained the personal apanage of the Mughal royal family until 1832, when it passed to the direct government of the East India Company.

The first half-century of the British occupation was a period of peaceful progress. The Doáb especially rose into a great agricultural and commercial tract, filled with new and growing cities, such as Cawnpur, Meerut, Alígarh, Rúrki (Roorkee), and Sahásanpur. This peaceful period was interrupted by the mutiny of 1857, which first broke out in the North-Western Provinces, and produced more disastrous effects in this tract than in any other part of India. Since the repression of the rebellion the principal event of importance in the Provinces has been the rapid development of the railway system, which is revolutionizing the commercial condition of the country and throwing open fresh outlets for its agricultural wealth. The outlying chief-commissionership of Oudh was placed under the administration of the lieutenant-governor of the North-Western Provinces from January 1877. (W. W. H.)

NORTH-WEST TERRITORY was at first the vague general designation of all that portion of British North America which lay to the north-west of the provinces of the St Lawrence basin. In the British North America Act of 1867 provision was made for the eventual admission into the Dominion of Canada of Rupert's Land and the North-Western Territory. When, in 1869-70, the territories of the Hudson's Bay Company (Rupert's Land, &c.) were incorporated with Canada, the province of Manitoba was formed out of the district lying between 49° and 50° 30 N. lat. and between 96° and 99° W. long., and "any portion of Rupert's Land and the North-West Territory outside" of those limits was to be governed by the lieutenant-governor of Manitoba under the name of the North-West Territories. In 1876 the district of Keewatin (or Kewatin) was constituted; in 1881 the limits of Manitoba were shifted north to 52° 30′ and west to 101° 20′; and in 1882 the four new districts of Assiniboia, Saskatchewan, Alberta, and Athabasca were organized. (1) Keewatin (395,000 square miles) lies due north of Manitoba, and extends as far as Boothia on the Arctic Ocean. (2) Assiniboia (about 95,000 square miles) lies west of Manitoba between 101° 20′ W. long. and the line dividing the 10th and 11th ranges of townships of the Lands System Survey, and is bounded northward by the 9th correction line (near 52° N. lat.). It contains Fort Pelly, Fort Ellice, Qu'Appelle, and Regina (on the Canadian Pacific Railroad), the last of which has been chosen as the future capital of the province. (3) Saskatchewan (about 114,000 square miles) lies north of Assiniboia and extends north to the 18th correction line (about 54° N. lat.) and east to the Nelson river and Lake Winnipeg. It contains Battleford, Carleton. Prince Albert. (4) Alberta (100,000 square miles) is all the country due west of Assiniboia and Saskatchewan as far as the boundary of British Columbia. (5) Athabasca (122,000 square miles) is the country due north of Alberta as far as the 32d correction line (about 60° N. lat.). The term North-West Territories is now used to indicate, not only the unorganized region to the north-west, but all the unorganized region of British North America, inclusive even of Labrador.

NORTHWICH, a market town of Cheshire, England, is situated at the confluence of the rivers Weaver and Dane, near the Trent and Mersey Canal, and near the main line of the London and North-Western Railway in the Chester branch of the Cheshire lines, 18 miles north-east of Chester and 22 south-west from Manchester. The streets are narrow and irregular, and many of the houses are screwed and bolted together to keep them secure from subsidences arising from the dissolving of the salt strata (180 feet in thickness), caused by the pumping of brine for the purpose of evaporation. Among the public buildings are the market-house, the drill-hall, and the Victoria club. Salt springs in Northwich were known to the Romans. By the Britons it was called the Black Salt Town. The substratum of rock-salt upon which the town rests was first discovered in 1670. It consists of two beds, a lower and an upper, which lie horizontally, the lower about 330 feet from the surface. In the lower stratum there exist several mines in the neighbourhood of the town. From two of these, each 40 acres in extent, the rock-salt is produced. The average quantity of salt exported from the town annually amounts to over 500,000 tons. Many of the inhabitants are engaged in building flat boats to convey the salt to Liverpool; and shipbuilding, rope and sail making, brick making, iron and brass founding, and tanning are also carried on. One mile from the town the river Weaver trustees have constructed an hydraulic lift to connect their navigation with the Trent and Mersey Canal on the higher level. By the river vessels of 500 tons burden can approach the town. The population of the urban sanitary district (area 1920 acres) in 1881 was 12,246.

At the time of the Norman survey Northwich constituted part of the demesne of the earls of Chester. In the reign of Richard III. it passed to the crown, and afterwards was granted to the Derby family, who sold it a century ago; in recent years the manor was acquired by the local board by purchase. The town in 1643 was fortified by the Parliament, was taken by the Royalists, but was retaken by the Parliamentarians.

NORTON, Hon. Mrs Caroline Elizabeth (1808-1877), afterwards Lady Stirling-Maxwell, ranks high among the women of letters of the 19th century. She was born in 1808. One of the three beautiful granddaughters of Sheridan, daughters of his son Thomas, "three Graces" of London society in the reign of George IV., she showed literary ambition and faculty before she was out of her teens. Her first publication, made at the age of seventeen, was a merry satire, *The Dandies' Rout*, illustrated by herself, full of girlish high spirits and wit. The preference shown for mournful and tender themes in her subsequent writings is in strange contrast with this opening *jeu d'esprit*. Her first essay in serious verse was made in 1829 with *The Sorrows of Rosalie*, the next in 1831 with *The Undying One*, a version of the legend of the Wandering Jew. Fluent melody of versification, richness and felicity of language, great tenderness of sentiment, and rhetorical luxuriance of illustration showed that she had inherited no small portion of her grandfather's genius, and brought her at once into fame. Her portrait appeared in *Fraser's Magazine* in 1831 as that of "the leader of the female band." Curiously enough, the author of the accompanying notice describes her as "happy in all the appliances of wealth and fame," and asks, "Of a life like hers what can be told?" at the very time when, according to her own subsequent account, she was "learning the law respecting women, piecemeal, by suffering from every one of its defects of protection." She had made an unfortunate marriage in 1827 with the Hon. George Norton, brother of Lord Grantley; then, after three years of protests on her part and good promises on his, she had taken the decisive step of leaving his house for her sister's, had "condoned" on further good promises, and had returned, to find matters worse. The husband's unmanly persecutions culminated in 1836 in an action brought against Lord Melbourne for seduction of his wife, which the jury decided against Mr Norton's claims without leaving the box. Mrs Norton made her own unhappy experience a plea for addressing to the queen in 1855 an eloquent letter on the law concerning divorce, and her writings had considerable influence in ripening opinion for recent changes in the legal status of married women. During the reign of William IV., Mrs Norton was at the height of her literary reputation, contributing many criticisms, sketches, tales, and songs to various periodicals and annuals, and using pencil as well as pen. She was not a mere writer of elegant trifles; she was one of the priestesses of the "reforming" spirit; she appeared at her best in such works as *A Voice from the Factories* (1836), a most eloquent and rousing condemnation of child labour. In a similar vein of warm sympathy with the unfortunate, she addressed a poem in 1845 to the prince of Wales, exhorting this *Child of the Islands* to use his power for social reforms. *Aunt Carry's Ballads*, dedicated to her nephews and nieces, are written with playful tenderness and grace of the most charming kind. Later in life she produced three novels, *Stuart of Dunleath* (1851), *Lost and Saved* (1863), and *Old Sir Douglas* (1868). All three are written with great power and freshness of style, enthusiastic facility in the exposure of social impostures and in the exhibition of ideals of generous conduct. Her heroines are too painfully tried by calamitous misunderstandings and injuries, especially Eleanor Raymond, the heroine of the first, whose long series of misfortunes finds hardly any relief from childhood till death. This may have been due to the writer's moral purpose, originating in her own bitter experience, of championing the wrongs of her sex; but it is a singular fact pointing to temperament as the cause, that Johnson made the same complaint about the novel of her great-grandmother, Frances Sheridan. Mrs Norton's last poem was the *Lady of La Garaye* (1861), her last publication the half humorous, half heroic story of *The Rose of Jericho* in 1870. She died on the 14th of June 1877. Mr Norton died in 1875; and Mrs. Norton in the last year of her life was married to Sir W. Stirling-Maxwell.

NORWALK, a township of the United States, in Fairfield county, Connecticut, on Long Island Sound, 43 miles north-east of New York, at the terminus of the Danbury and Norwalk Railroad. It contains the borough of Norwalk, dating from 1836, and the city of South Norwalk, incorporated in 1870, the population of township, borough, and city in 1880 being respectively 13,956, 5308, and 3726. Vessels drawing 6 feet of water ascend the Norwalk river at low tide, and there is regular steamboat communication with New York. The shallow waters of the bay at the mouth of the river form a good locality for oyster-culture, and about three hundred families in South Norwalk are engaged in this industry. Locks, knobs (of New Jersey clay), and iron bolts and screws are manufactured in the township on a very extensive scale; and there are also iron-foundries, shipyards, flour-mills, planing-mills, felt factories, hat factories, carriage-works, shoe factories, &c. Norwalk was settled about 1640 and incorporated as a town in 1653. The settlement was burned by Governor Tryon's Hessians in 1779.

NORWALK, a post-village of the United States, capital of Huron county, Ohio, 58 miles east of Toledo by the Lake Shore and Michigan Southern Railway and also on the Wheeling and Lake Erie Railroad, is a flourishing little place of 5704 inhabitants (1880), containing planing-mills, grist-mills, manufactories of sewing-machines, organs, carpet-sweepers, and shoes, and breweries.

NORWAY

Part I.—Geography.

NORWAY comprises the western and northern divisions of the Scandinavian peninsula. It is bounded N. by the Arctic Ocean, W. by the Norwegian Sea and the North Sea, S. by the Skagerrak, and E. by Sweden, Finland, and Russia. It lies between 57° 59′ (Lindesnæs, or The Naze) and 71° 11′ (Knivskjærodden, close to the North Cape) N. lat. and 4° 30′·5 (Utvær, off Sogne Fjord) and 31° 12′·5 (Renö, adjacent to Vardö) E. long. The length of the coast-line, exclusive of fjords, bays, and islands, is 3018 miles, and the area 122,780 square miles. The country, which has its greatest breadth, 280 miles, at the 61st parallel of latitude, is comparatively narrow, measuring only 70 miles across between the 64th and the 68th parallels.

The Scandinavian peninsula constitutes for the most part a rocky region, of which the loftiest tracts lie on the Norwegian side. The interior of Finmark, the most northerly district of Norway, has no considerable heights; but the frontier between Sweden and Norway, from Tromsö stift (69° N. lat.) to the southern part of Throndhjem stift (63° N. lat.), is marked by a continuous mountain range, called Kjölen (the keel), which, geologically, extends in lower levels still farther south as the frontier between the two countries. In this range are specially conspicuous the alpine regions occupying the interior of Tromsö stift, with peaks reaching a maximum altitude of 5475 feet,—the ice-clad tract of Sulitjelma east of Salten Fjord (6178 feet), the heights east of Throndhjem Fjord (4560 feet), and those east of Röros (4680 feet). From this region the loftiest line of the rocky mass takes a direction bearing west-south-west, under the name of the Dovre Fjeld, commencing with a plateau only 2000 feet high, but rising farther west into mountainous tracts like those of Snæhætten, whose summit (7566 feet) was long regarded as the highest in Norway, Rundane (6930 feet), the Jotun Fjelde, where the loftiest peak of Norway, or indeed of northern Europe, occurs (Galdhöpiggen, 8400 feet), and terminating at its western extremity, north of Sogne Fjord, in the snow-field known as Justedalsbræ, where Lodalskaupen reaches the height of 6790 feet. From the Jotun Fjelde the ridge extends southwards, under the name of the Lang Fjelde, comprising the Fille Fjeld (Suletind, 5807 feet; Jökuleggen, 6247 feet), the Hemsedal Fjeld, Hallingskarvet (6430 feet), Hallingjökelen (6539 feet), Hardangervidden (Haarteigen, 6063 feet), and is gradually lost in more moderate elevations towards the extreme south of the country. Thus a glance at the map will show that the ridge of highest points which traverses the Scandinavian peninsula runs almost parallel to the west coast of Norway, and that the lines retain on the whole this relative position in their various deviations. The narrower part of the mountain mass occurs on the side of the ridge facing the Norwegian Sea, the broader part on that facing the Baltic and its arms. In the latter direction, *i.e.*, eastward, the surface of the country presents a comparatively uniform slope, alike in Sweden and in the part of Norway lying south of the Dovre Fjeld and east of the Lang Fjelde. West of the ridge, on the other hand, the rocky mass maintains on the whole a higher elevation, sinking comparatively slowly and here and there in ledges towards the sea, so that in various localities its final descent to the ocean is exceedingly abrupt, or it terminates in lofty precipitous islands.

In Norway the mountainous region constitutes chiefly a vast plateau extending well-nigh over the whole country, the general outline of which has been noted above. From this tableland rise the summits of the mountains, and the rocky mass itself is intersected by wide fissures, forming valleys, lakes, and fjords. The roads across the mountain ridge traverse the valleys, and hence can afford no standard by which to measure its height. Its elevation is estimated at from 2000 to 4000 feet in different localities. From the position of this mountain ridge it naturally follows that the longest valleys and the longest rivers are found in the "east country," *i.e.*, the part of Norway lying to the east of the Lang Fjelde and south of the Dovre Fjeld, whereas on the west coast the valleys are invariably short, and many of the fissures are occupied by deep fjords penetrating far into the interior. Such parts of the country as may justly be entitled plains (as, for instance, Romerike in east Norway, and Lister and Jæderen on the south-west coast) are exceedingly limited as to both number and extent. Hence the rivers are navigable only for short distances, and even then only exceptionally by large vessels. It is only in those comparatively frequent cases where the rivers expand into lakes that they can, strictly speaking, be navigated by ships. On the other hand, the waterfalls in Norway are exceedingly numerous, and many of them remarkable for their height, body of water, and great beauty. The most important rivers are enumerated below.

(1) The Klar Elv flows from Fæmundsö into Sweden. (2) The Tista (7 miles) flows through Femsö and thence into the sea at Frederikshald. (3) The Glommen, the largest river in the Scandinavian peninsula (350 miles), rises in Söndre (South) Throndhjem amt, north of Röros, flows through Österdal, and disembogues by two arms into the Skagerrak at Frederikstad. It is navigable for large ships 7 miles from its mouth up to Sarpsborg, where it forms the celebrated Sarpfos (69 feet). The Glommen has numerous tributaries, of which the most considerable is the Vormen, flowing out of Lake Mjösen. (4) The Gudbrand Laagen (50 miles), rising in Lesjeskogen Vand (a lake with two outlets) on the Dovre Fjeld and flowing through Gudbrandsdal, forms Lake Losna and falls into Lake Mjösen at Lillehammer. (5) The Drams Elv (168 miles, reckoned from the source of the Bægna), the outlet of Lake Tyrifjord, falls at Drammen into Drammen Fjord, an arm of Christiania Fjord. The chief tributaries of the Drams Elv are the Rands Elv, which flows through Rands Fjord; the Bægna (87 miles), which rises in the Fille Fjeld and passes through Valders; and the Hallingdal Elv (113 miles), which has its source in Hallingskarvet and flows through Hallingdal and Lake Kröderen. The two first of these tributary streams unite at Hönefos, at the northern extremity of Lake Tyrifjord. (6) The Nummedal Laagen (143 miles) rises in the mountain lake Normands Laagen on Hardangervidden (Waste of Hardanger), flows through Nummedal, passes the mining town of Kongsberg, and falls into the Skagerrak at Laurvik. (7) The Skien Elv (126 miles) receives the drainage of eastern Thelemark and falls at Skien into Skien Fjord. (8) The Nisser Elv (112 miles), from Nisser Vand, falls into the sea at Arendal. (9) The Topdal Elv (84 miles) rises in western Thelemark and disembogues at Christiansand. (10) The Otteren (140 miles) flows through Sætersdal, where it expands into several lakes, and falls at Christiansand into the Skagerrak. (11) The Mandal Elv (85 miles) reaches the Skagerrak at Mandal. (12) The Sire-aa (84 miles) traverses Siredal, forms Siredal Vand, and disembogues into the North Sea. (13) The Bjoreia (22 miles) rises on Hardangervidden, forms the celebrated Vöringfos (474 feet high), and discharges itself into Hardanger Fjord. (14) The Rauma (86 miles), from Lesjeskogen Vand, flows through Romsdal and has its outlet at Veblungsnæs into Romsdal Fjord. (15) The Driva (70 miles), from Snæhætten on the north side of the Dovre Fjeld, flows through Drivdal and disembogues into Sundal Fjord. (16) The Orkla (98 miles), flowing from Opdal through Orkedal, discharges itself into Throndhjem Fjord. (17) The Gula (78 miles) rises in close proximity to the springs of the Glommen and flows through Guldal to Throndhjem Fjord near the embouchure of the Orkla. (18) The Nea (70 miles), from Selbusjö, the river on which Throndhjem is situated, forms the Lerfos. (19) The Namsen Elv (85 miles) flows through Namdal and enters Namsen Fjord at Namsos. (20) The Rös Elv (16 miles), the outlet of Rös Vand, falls into Ranen Fjord. (21) The Ranen Elv (42 miles), from the frontier range, disem-

bogues into Ranen Fjord. (22) The Salten Elv (43 miles) falls into Salten Fjord. (23) The Maals Elv (74 miles) flows into Malangen Fjord. (24) The Skibotten Elv (43 miles) falls into Lyngen Fjord. (25) The Reisen Elv (70 miles), from the Swedish-Norwegian frontier, disembogues into Reisen Fjord. (26) The Alten Elv (98 miles), from the Finmark plateau, flows past Kautokeino and falls into Alten Fjord; it is navigable with boats for a considerable distance. (27) The Tana Elv (175 miles), which constitutes throughout a great part of its course the frontier between Norway and Finland, disembogues into Tana Fjord; it also is navigable with boats for a considerable distance. (28) The Neiden Elv (50 miles) is in south Varanger. (29) The Pasvik Elv (77 miles), which for part of its course constitutes the Russian frontier, drains the great Enare Lake and flows into Kloster Fjord, an arm of Varanger Fjord. (30) The Jakobs Elv (15 miles), the last frontier river bordering on Russia, disembogues close to King Oscar II.'s Chapel.

The fresh-water lakes of Norway must, as already stated, be generally regarded as mere river expansions. Hence they are, as a rule, long and narrow, and, to judge from the soundings hitherto made, exceedingly deep.

The most important are;—Fæmundsö in Österdal, 35 miles long, 2300 feet above the sea; Öieren (Glommen); Mjösen, the largest inland lake of Norway, 57 miles long, with a surface-area of 200 square miles, 400 feet above the sea, and 1483 feet in depth, the bottom being 1083 feet beneath the level of the North Sea; Randsfjord, 43 miles long; Tyrifjord, comparatively quadrangular in form; Kröderen (the Hallingdal Elv), Nordsjö, Hiterdal Vand, Tinsjö, Siljord Vand, Bandak Vand, Nisser Vand, in Thelemark; Bygdin, Gjende, 3314 feet above the sea; Vinster Vandene (Jotun Fjelde), Hornindal Vand (in Nordfjord), Selbusjö (Throndhjem), Rös Vand, possibly the largest inland lake of Norway next to Mjösen, and by comparison of a somewhat more quadrangular form, in Helgeland; and Alte Vand (Tromsö stift). A map of Norway on a large scale shows a prodigious number of smaller sheets of water, more particularly in Christiansand stift. The total surface-area of all the fresh-water lakes of Norway is estimated at 2930 square miles, or 2·38 per cent. of the area of the land.

The numerous and in many cases very extensive fjords, as well as the height and contour of the country, give to the different parts of the coast of Norway a remarkably varied character. For long distances the mainland does not come into direct contact with the sea, girdled as it is by a belt of islands, holms, and skerries, more or less thickly set, which forms the so-called "skjærgaard" (fence of skerries) or outer coast. Between this wall of islets and the mainland, accordingly, extends a connected series of sounds—"leder" (roads), as they are called—of the greatest importance for coastal navigation, since they admit of the employment of smaller and weaker vessels. The whole of the coast from Svinesund, the terminal point of the southern frontier towards Sweden, as far as Lister, is comparatively low. Of its most noteworthy fjords the first in order is that of Christiania, 90 miles long from south to north, or from the Færder lighthouse to Christiania. Here, at its head, it forms Bunde Fjord, extending north to south; and some distance down Drammen Fjord. Farther west comes Langesund Fjord, which enters Skien Fjord in a northerly direction. The remaining fjords on this tract of the coast are of minor importance. Of islands must be mentioned those in close proximity to Christiania:—Jelöen, in the vicinity of Moss; the Hvalöer, off the eastern shore of Christiania Fjord; Nötterö and Tjomö, off the western shore; Jomfruland, in the vicinity of Kragerö; and Tromöen, near Arendal. The navigable roads or sounds on this part of the coast are not strictly connected, though comparatively considerable in extent. Open tracts, unprotected by a belt of islets and skerries, occur at the mouth of Langesund Fjord, and along the coast westwards from Lindesnæs. At Lister the coast begins to rise, and continues to do so as far as the flats of Jæderen, where the land has a gentle slope towards the interior of the country. This tract, with the sole exception of Egeröen, has no girdle of skerries, nor is it anywhere intersected by any considerable fjords.

From Bukken Fjord, however, which lies fully exposed to the sea, the "skjærgaard," in a stricter sense, commences, to continue almost uninterruptedly along the whole west coast. Bukken Fjord sends off several arms, the principal of which are Stavanger Fjord and Lyse Fjord, the latter noted for its great narrowness and its lofty precipitous walls. The roads or navigable sounds between Bukken Fjord and Bergen are open to the sea at the mouths of the larger fjords only. Of such the most noteworthy is Hardanger Fjord, which, beginning at Bömmelen and piercing the country for 80 miles in a north-easterly direction, sends off several arms. That nearest the head is the picturesque Sör Fjord, lying north and south. From Bergen northwards to Cape Stad there is, if the mouths of the fjords be excepted, a well-protected "led" or road. At the 61st parallel of latitude we have the longest fjord of Norway, Sogne Fjord, which penetrates 100 miles into the country, everywhere shut in by high and precipitous rocky walls. Northwards, its chief arms are Fjærland Fjord, Sogndal Fjord, and Lyster Fjord; eastwards, Aardal Fjord and Leirdal Fjord; southwards, Aurland Fjord, together with Nerö Fjord, the grandest of them all. Off the north shore of Sogne Fjord we have the most westerly islands of Norway, viz., Utvær, and farther north the lofty islands of Alden, Kinn, Batalden, and Skorpen. Here Dals Fjord and Förde Fjord, and farther north Nord Fjord, of very considerable extent, penetrate into the country. Off Nord Fjord lies the island of Bremangerland, with a mountain summit, the Hornelen, rising to the height of 2940 feet. The land at Stad projects into the sea without any belt of islets; the protecting fence, however, soon recommences farther towards the north-east. On this part of the coast, that of Romsdal, several large fjords penetrate deep into the country, such as Stor Fjord in Söndmöre, with numerous arms, the most important being Hjörund Fjord and Sunelv Fjord, Romsdal Fjord, Sundal Fjord, and Surendal Fjord. To an exposed tract of coast, Hustadviken, south of Christiansund, succeeds Throndhjem Led (Throndhjem Road), shut off from the sea by the large low islands of Smölen and Hiteren, the latter of which is the largest island in southern Norway. From Throndhjem Led the broad and extensive Throndhjem Fjord stretches in several directions, first south-eastwards, then eastwards, and finally north-eastwards, for about 80 miles into the country, as far as Stenkjær on Beitstad Fjord.

North of Throndhjem Fjord an outer coast with a navigable "road" extends almost unbroken to the North Cape. Among other fjords in Nordre Throndhjem amt Folden Fjord and Namsen Fjord must be mentioned; off the latter, the low-lying group of islands bearing the name of Vigten project far into the sea, surrounded, as in the case of Smölen and Hiteren, by an extremely shoaly "skjærgaard," which stretches right up to Vest Fjord, and renders an approach to land very difficult and dangerous. The coast of Nordland is distinguished by a chain of lofty picturesque islands, as Torghatten, with its natural tunnel, 400 feet above the sea, which runs from south-west to north-east for a length of 520 feet, Vægö, Dönnesö, Lovunden, Trænan, Hestmandö, Lurö, Fuglö, and Landegode. The mainland, too, exhibits magnificent mountain summits, viz., the Seven Sisters on Alstenöen, Strandtinderne, and the snow-field Svartisen. The fjords, though not so long as in southern Norway, are still of very considerable size, as, for example, Bindal Fjord, Vel Fjord, Vefsen Fjord, Ranen Fjord, Salten Fjord, Folden Fjord, Tys Fjord, and Ofoten Fjord. Off Salten are the well-known Lofoten Islands, skirting westerly the broad arm of the sea called Vest Fjord, which terminates in Ofoten Fjord. The Lofotens consist of a chain of islands separated from each other by broader and narrower channels. The mountains on the outermost group are not particularly high—indeed the principal island, Röst, is remarkably low; but otherwise the islands exhibit a chain of granite peaks to be counted in hundreds, strangely characteristic with their jagged, fantastic outlines, and towering to a height of from 2000 to 3500 feet above the level of the sea. This truly alpine scenery is rendered the more imposing in character by the fact of its rising directly from the sea. The Lofotens are connected on the north with the group of islands called Vesteraalen, which, in their southern parts, fully equal the Lofotens in grandeur. Within these groups of islands lies the largest island in Norway, Hindöen (area, 865 square miles), with the lofty peak, Mösadlen. From the innermost creek of Ofoten Fjord the distance to the Swedish frontier is only 6 miles. North of Hindöen, in Tromsö amt, there is also a chain of large islands, as Senjen, Kvalö, Ringvasö, and others. Of large fjords may be mentioned Malangen Fjord, Bals Fjord, Ulfs Fjord, Lyngen Fjord, as also Kvænang Fjord, with the grand scenery of the Kvænang peaks. In Finmark, the large coast islands Sörö, Stjernö, Seiland, Kvalö, Ingö, Magerö extend to the North Cape; but here the "skjærgaard," or outer coast, comes abruptly to an end. The coast of east Finmark presents a totally different character: flat mountain wastes descend precipitously to the ocean without any islands beyond, save Vardö, with two low islets at the farthest eastern extremity of Norway. The fjords of Finmark are broad and long, as Alten Fjord, Porsanger Fjord, Laxe Fjord, Tana Fjord, all extending southwards, and Varanger Fjord, which takes a westerly direction. The farther east one proceeds the lower does the country become; the sharp peaks disappear and give way to a low-lying, monotonous landscape on the north side of Varanger Fjord; the south side, however, exhibits a more varied aspect, especially where, between the tributary fjords, several islands occur. The total area of the islands of Norway amounts to 8460 square miles.

The form of the sea-bed off the shores of Norway has been investigated, partly by the Coast Survey and partly by the Norwegian North Atlantic Expedition, 1876-78. (See NORTH SEA and NORWEGIAN SEA.) The hundred-fathom line of the North Sea extends west of the British Islands, and north of Shetland towards Norway, off Cape Stad. But the bank bounded by this line does not fully reach the Norwegian coast. From off Stad (62° N. lat.) a depression in the sea-bed, called the Norwegian Channel, stretches along the west and south coasts of Norway, southward and eastward, almost to Christiania Fjord and the Cattegat. The deepest part of this channel, upwards of 400 fathoms, extends through the Skagerrak between Arendal in Norway and the Scaw. Off Lister the depth is 200 fathoms, and off Bömmelen, the shallowest part, 120 fathoms. Thence it increases in a northerly direction, reaching 200 fathoms off Sogne Fjord, after which the channel finds an outlet into the deep basin of the Norwegian Sea. The breadth of the Norwegian Channel, computing by the hundred-fathom line, is from 50 to 70 miles; it is narrowest in the southernmost part, off Lindesnæs. Its walls shelve gradually down on either side, and the bottom is comparatively wide and flat. The bank extending between the coast and the inner slope of the channel is exceedingly narrow, being only from 7 to 10 miles broad. The Norwegian Channel thus constitutes a definite boundary between the plateau of the North Sea, with the countries rising from it, and the land of Norway. North of Stad occurs an expansion of the Norwegian coastal bank. Its outer slope rapidly descends towards the deep basin of the Norwegian Sea. While the hundred-fathom line keeps comparatively close to the Norwegian coast as far as the Russian frontier—off the Lofotens only does it extend a little more than 40 miles from land – the two-hundred-fathom line, which, off Romsdal, at Storeggen, runs at a distance of 40 miles from the shore, takes a northward direction, the coast, on the other hand, deflecting towards the north-east and north-north-east. Accordingly the distance between them continues to increase till, off the coast of Helgeland, it reaches 130 miles. Off the Lofotens and Vesteraalen it again approaches the land, at its nearest point—off Andenæs in Vesteraalen—being scarcely 10 miles distant. North of Vesteraalen, the two-hundred-fathom line, or the edge of the coastal bank, makes another bend towards the north, and draws off from the coast of Norway. The Barents Sea, which bounds Norway on the north, is a comparatively shallow ocean tract, the greater part of its bed ranging between 100 and 200 fathoms below the surface. Norway is thus encompassed by a series of rampart-like coastal banks, in the strictest sense continuous, being nowhere broken by channels through which ice-cold water from the depth of the Polar Sea would otherwise find a passage to the "sejlled" or navigable roads along the coast, and to the deep fjords that penetrate so far into the country. The Norwegian fjords have as a rule the remarkable characteristic that the bottom for great distances lies deeper, and in some cases very considerably deeper, than the surface of the coastal banks; thus, for example, the Norwegian Channel is upwards of 400 fathoms deep in the Skagerrak, Stavanger Fjord has a depth of 380 fathoms, Hardanger Fjord 355, Sogne Fjord 670, Nord Fjord 340, Throndhjem Fjord 300, Ranen Fjord 235, Vest Fjord 340, Alten Fjord 225, and Varanger Fjord 230. These maximum depths occur in many cases at a great distance from the sea.

For our knowledge of the geology of Norway we are chiefly indebted to the results brought to light by the Royal Norwegian Geological Survey, under the direction of Professor Kjerulf. To the geologist Norway presents a region of the highest interest, alike from the structure of the country itself and from the fact of the rock-surface almost everywhere lying bare and being intersected by natural profiles of valleys and ravines. Extensive tracts consist of the Archæan formation, with its strata of gneiss, hornblende schist, and quartz,—the first of these forming the lower, the last the upper section, both of great depth. The beds are generally folded, and in part vertical. This formation occurs particularly in Romsdal, in the vicinity of Arendal, east of Christiania Fjord (gneiss), in Thelemark, Hallingdal, Nordfjord (quartz), along the shores of Sogne Fjord, throughout the inner tracts of east Finmark. Above this formation is the Sparagmite, chiefly consisting of fragmentary rocks in thick strata, with felspar embedded. The lowest beds are grey and red Sparagmite, partly accompanied by deep masses of conglomerate. To this formation belongs the blue quartz, widely distributed throughout central Norway, as also subordinate green and black clay schist and black limestones. In the latter, which constitute the upper part of the formation, the Primordial Zone, we meet with the first traces of animal life—the oldest trilobites. The Sparagmite formation extends throughout a great part of central Norway, Österdal, Gudbrandsdal, Land. In other parts the Primordial Zone is met with immediately above the Archæan rocks. Then succeeds the Silurian system, also of wide extent, occurring in a series of beds distinctly marked off by their fossils. Characteristic strata in this system are the orthoceratite limestone with graptolithic schist (Lower Silurian), next lime sandstone, pentamerous limestone, coral limestone, along with other strata, such as red clay schist, limestones, and marl slate (Upper Silurian). The Silurian beds are almost everywhere greatly bent, compressed, and dislocated; the strike is in the great majority of cases from south-west to north-east. At and around Christiania, in the tracts bordering on Lake Mjösen and Skien Fjord, the Silurian beds occur without being metamorphosed, except locally at their contact with eruptive rocks. In the environs of Bergen, the outer part of Hardanger Fjord, the Hardanger Waste, in Söndre Throndhjem amt we meet with regionally metamorphic schists and limestones containing Silurian fossils. In the medial of the three sections of the Throndhjem schists occur Upper Silurian fossils. The Silurian system in Norway extends in the direction of south-west to north-east, straight across the southern part of the country, from Hardanger Fjord to some distance east of Throndhjem Fjord, as also from Skien Fjord to Lake Mjösen. Above the Silurian system is found, in various localities, more particularly west of Christiania Fjord, a sandstone formation, to some extent along with conglomerates, of which the geological age remains uncertain, no fossils having as yet been found in it. With this formation the series of stratified rocks in southern Norway may be said to terminate, since the next fossil-bearing strata are diluvian, containing Pleistocene animal remains.

In various parts of the country we meet with extensive and highly-remarkable beds, geologically established with special local designations, and which, on the discovery of fossils indicating the sections, will, no doubt, at some later period be classed under the names given to the great and generally accepted formations with more precision than is possible at present. Such are, farthest north, the Gaisa series and the Raipas series in Finmark; in the Throndhjem region, the older of the Throndhjem schists, conglomerate and the sandstone series, and the Gula schists; in central Norway, environing the Jotun Fjelde, the alpine quartz. Of Mesozoic beds (Oxford clay) a few only still remain on the island of Andö in Vesteraalen; they consist of sandstone, coal, and oil-shale, with embedded Jurassic fossils.

The eruptive rocks—granite, syenite, porphyry, gabbro, norite, serpentine, greenstone, &c.—have broken through the beds of the various formations in a variety of ways, at one time as vast masses in continuous streams, at another time as isolated dome-like summits or simply cutting upwards as dykes. Old granite occurs in Christiansand stift, Thelemark, the Hardanger Waste, where it extends over extensive tracts and at its boundaries is seen to break through the Archæan formation, sending off multitudinous coarse-grained dykes, as also on the east side of the mouth of Christiania Fjord, in Aadal and in Hedal, south of Valders, and in Österdal. Very extensive tracts of granite are met with along the coast of Romsdal and in Nordre Throndhjem amt, where the coast, called Fosen, exhibits its characteristic rounded forms. Up through Nordland we pass numerous granite tracts of considerable extent. The whole of the Lofotens and Vesteraalen, together with all the outermost islets, holms, and skerries along the coast of Nordland, consist exclusively of granite. The interior of Finmark also has very large granite tracts. Extensive masses of post-Silurian granite and syenite, as also of porphyry in sheets, occur to the west and north of Christiania Fjord; it is at the borders of these masses that the Silurian system here becomes prominent. The largest tract of gabbro is that of the Jotun Fjelde; this rock is also met with extensively in Throndhjem stift and in Tromsö stift. Norite occurs chiefly near Sogne Fjord and at Egersund. Serpentine, in tracts of very considerable extent, is met with principally throughout Throndhjem stift. Dykes of post-Silurian porphyry, but more especially of greenstone, pierce in large numbers the Silurian system of eastern Norway; similar dykes, however, are also seen here and there throughout the country traversing both schist and granite.

Notwithstanding its great abundance of rocks, Norway cannot be said to be rich in valuable ores or minerals. Thus, for example, true coal does not occur; Jurassic has been found on Andöen, but only in seams extremely limited in extent. Gold is met with very sparingly in veins of quartz at Eidsvold, in the rivers of Finmark, and along with silver in the Kongsberg mines. The latter metal is found as native silver in veins of calcareous spar at Kongsberg, where the state owns a silver mine of considerable value. Copper occurs in numerous localities, as Thelemark, Röros in the Throndhjem district, many parts of the west coast, more especially at Vigsnæs on Karmöen, and in northern Norway at Kaafjord in Alten. Nickel is produced in some parts from sulphuretted iron ore, particularly on the island of Senjen in Tromsö amt. Iron ores are met with in southern Norway, particularly along the coast near Arendal. According to the geological survey, the presence of ore is intimately connected with the eruptive rocks, at the limits of which they are accordingly to be looked for, both in the Archæan and in the later formations; thus on the confines of the oldest granite we find alike iron and copper ore; on those of gabbro, sulphuretted iron ore containing nickel and apatite.

Volcanoes, in a strict sense, and their subsequent results, such as hot springs, have not been met with in Norway.

The portion of the earth's crust now visible in Norway has obviously in the lapse of time undergone very great changes with respect to the position of its parts, their level, and their surface. Both the oldest formation and the later systems are almost everywhere greatly bent, compressed, and distorted,—and also denuded, and their parts forcibly dislocated, alike as regards situation and relative height. Formations that in the interior lie at a height of several thousand feet are on the coast found level with the surface of the sea. Strata resting on the summits bordering a lake or the shores of a fjord are again seen on islands in such lakes or fjords, and level with the surface of the latter. One side of a valley exhibits a profile which, in regard to the height of the various strata, differs materially from the profile of the opposite side. The whole rocky sheet is cut up in various directions, and the several laminæ are now sunk beneath, now raised above, those adjoining them. These dislocations have been occasioned by fissures, which in many places can be pointed out, and the number of such provable faults of dislocation increases almost every year. The direction of the fissures is manifestly of the greatest assistance in indicating the form exhibited by the surface of the country. The subsidence between two fissures produces a valley, a fjord, its rise on the other hand a height, a promontory. Professor Kjerulf has succeeded in showing that the entire system embracing the valleys and fjords of southern Norway may be easily referred to four principal directions, corresponding very nearly to the four quarters of the globe, round which the principal directions of the valleys and fjords are found grouped with predominant frequency. The same applies to northern Norway, and can also be shown to distinguish the fjords of Spitzbergen, Iceland, and Greenland; the same directions are again met with in the lines of the Icelandic volcanoes, springs, lava-dykes, and volcanic eruptions.

Vestiges left by the ice age are very conspicuous and varied throughout Norway. The rock-surface exhibits almost everywhere, and more especially when sheltered by loose superincumbent layers, a ground, polished, and striated aspect; up to a height of 4000 to 5000 feet the striation runs in the direction of the valleys, or from the lofty inland tracts, towards the sea. Boulders of foreign origin are found scattered over the mountains, in the fields, and in the loose layers covering the surface; their origin can often be determined with certainty. Old moraines, consisting of gravel-walls lying transversely to the direction of the striæ, indicate by their position the fronts of the ancient glaciers, and by their numerous serial lines an equal number of breaks in the retreat of the ice into the country. Layers of clay and banks of mussel-shells, in which are embedded the remains of arctic marine animals, indicate the sedimentary deposit of the material carried down by the rivers of the ancient glaciers to the sea.

At the present day perpetual snow is found in Norway only in elevated localities. The most celebrated masses are the following—(1) the Justedalsbræ, between Sogne Fjord and Nord Fjord. It occupies an area of 580 square miles, reaches an altitude of 5000 feet, descends with its snow-cap to between 4000 and 4500 feet, and sends off numerous glaciers on either side; several of these extend very nearly down to the sea, as the Boiumbræ in Fjærland, in Sogn, 426 feet above the sea; the largest of the Justedal glaciers is the Nigardsbræ. (2) The Folgefon, between Hardanger Fjord (Sör Fjord) and Aakre Fjord, with an area of 108 square miles and an altitude of 5270 feet. It sends off only three glaciers. (3) Hallingskarvet. (4) The snow-fields of the Jotun Fjelde, east of Sogne Fjord. (5) The snow-fields of Snæhætten. (6) The Store Börge Fjeld in Helgeland. (7) Svartisen, the largest snow-field but one in Norway, between Ranen Fjord and Salten Fjord in Nordland. It sends off a number of glaciers, some of which reach almost to the sea-level at the heads of the fjords. (8) The Sulitjelma snow-field, east of Salten Fjord, on the Swedish frontier. (9) The Jökul Fjeld, between Kvænang Fjord and Öx Fjord, on the boundary of Finmark. It sends off magnificent glaciers towards the sea. One of these, in Jökel Fjord, a branch of Kvænang Fjord, extends down to the water's edge, so that fragments of its ice fall into the fjord and float as small icebergs on the surface, the sole instance of the kind in Norway. (10) Seiland snow-field, on the island of Seiland, near Hammerfest, the most northerly névé in Europe. The limit of perpetual snow in Norway is estimated at 3080 feet on the island of Seiland, 5150 feet on the Dovre Fjeld, from 4100 to 4900 feet on the Jotun Fjelde, from 3100 to 4100 feet on the Justedal snow-fields, and from 3100 to 4100 feet on the Folgefon.

Traces of relative changes of level between land and sea are observed in numerous localities. The highest marine terraces (in which the remains of marine animals have been found) are met with in the east part of the country and near Throndhjem at 600 feet above the sea-level; at the heads of the fjords on the west coast they lie lower. This obviously proves these districts, at the termination of the ice age, while the glaciers were still in process of melting, to have been relatively lower than at present. And we have further indication of the fact that the interior lay higher during the ice age in the "giant kettles" occurring near the level of the sea, since these are believed to have been formed at the foot of cataracts in the glaciers, the substratum of which must, of course, have been above the level of the sea. Along the whole coast, in numerous localities, from Söndhordland (between Stavanger Fjord and Hardanger Fjord) nearly to the North Cape, and along the fjords, are found ancient beach-lines cut out in the solid rock. Their real significance as sea-level marks is shown by their perfectly horizontal direction, by their extending in several localities on the same level as the most elevated of the marine terraces (*e.g.*, that of Throndhjem), by the circumstance that in other places they run in a line continuous with the surface of adjoining terraces, and finally by the sea-wrought caverns found on the same level. It is in northern Norway especially that beach-lines largely occur. In several localities there are two parallel lines, the one above the other. Throughout extensive tracts these lines can be referred to particular levels, thus indicating a pause in the rise of the land that afforded sufficient time for the action of the sea, or pointing to the presence of certain climatic influences favourable to this production periodically alternating with unfavourable intervals. No change of level in the Norwegian coast within recent years can be scientifically shown. Earthquakes are of rare occurrence in Norway.

The following is a summary of the results arrived at by the Norwegian Meteorological Institute (1867-83). The number of stations is from forty to fifty. The coldest parts of Norway, where the mean annual temperature is below 32° Fahr., are the highest regions of the country and the interior of Finmark (Karasjok, 26°·4); on the sea-shore it is only at Varanger Fjord that it falls below 32°. The highest mean annual temperature (44°·6) is that of Skudesnæs; and the outer coastal margin from the mouth of Sogne Fjord to Lindesnæs has a mean annual temperature of 44°. The interior of southern Norway and that of Finmark have the longest winter (200 days with a mean annual temperature of under 32°) and the lowest winter temperature, the mean temperature of the coldest day being under 14°. From the interior districts towards the coast the climate becomes everywhere milder in winter. From Lindesnæs an exceedingly narrow strip of land stretches along the west coast northwards right to the mouth of Throndhjem Fjord where the lowest mean temperature of any day exceeds 32°. Röst, the outermost of the Lofoten Islands, belongs to this strip of coast (32°·9 in January). The January isotherm for 32° reaches beyond Tromsö up to the 70th parallel of latitude; on the one side it extends down to the southern coast of Iceland, on the other to the alpine districts of Norway. In January the interior of Finmark has a temperature of 2°·5, central Norway, at an altitude of 1600 feet, 11°·3. The winter isotherms follow the contours of the coast and lie very close together. The summer is hottest in south-eastern Norway (Christiania, July, 61°·9); next come Hardanger (July, 58°·3) and Sogn (Sogndal, July, 60°·3). Karasjok has in July a mean temperature of 57°·2. On the coast the summer is colder than some distance inland; it is coldest on the Finmark coast (Vardö, July, 47°·7) and in the lofty inland tracts (Röros, 52°, 2000 feet above the sea). The interior of Finmark has a higher temperature (upwards of 57°) than any part of the outermost coastal margin as far south as Jæderen (59° N. lat.). The temperature in July (50°·2) at the North Cape (71° N. lat.) is the same as in the southern part of Iceland (63° to 64° N. lat.). The isotherm for 52° passes through the Lofotens (68° N. lat.) and the Shetland Isles (62° N. lat.); that for 56° extends from Jæderen straight across the North Sea to the northern part of Scotland. On reducing the temperature to the sea-level we get for the south-eastern part of Norway a maximum of heat exceeding 60°. The interior having a warm summer and a cold winter, and the coast a cool summer and a mild winter, the annual range of temperature is greatest throughout the inland regions (55° in Finmark, 45° in central Norway) and least on the coast—from Lindesnæs to Vardö. In Österdal and the interior of Finmark the mercury sometimes freezes (−40°). Along the outermost line of coast, from Romsdal to Jæderen, the mercury never sinks below 12°. At Karasjok a temperature of −58° has been observed. The highest known readings are those observed at Christiania (90°) and in Finmark (96° in the vicinity of Varanger Fjord). Throughout a tract extending straight across the country near the 65th parallel of latitude the maximum temperature does not reach that observed in the south-east and in Finmark. Along the coast the highest temperature is from 77° to 79°, and on the outermost skerries it hardly reaches 75°. The diurnal range of the temperature of the air is greatest in the south-east (Christiania, 15° in July, 3° in January), least on the coast (only 5° in July). In Finmark it is inappreciable during the dark season, when the sun is below the horizon throughout the twenty-four hours. At Vardö it is 5° in July. In spring the heat everywhere makes its way from the coast towards the interior of the country (in Finmark from north to south); in autumn the cold passes from the interior towards the sea (in Finmark from south to north). The thermic anomaly is in Norway during the winter months always positive; along the west coast it reaches as much as 36° in January, and off the Lofotens amounts to even 43°, the highest value it anywhere attains on the globe; even in central Norway it is +11° in January. In July it is greatest in Lapland, viz., +9°. Along a narrow strip of the south-western coast of Norway it is negative in the month of July, though hardly −2°; hence this strip of coast is comprised in the negative thermic anomaly of the North Atlantic during summer.

The tension of vapour is at all seasons of the year greatest on the coast and least in the interior of the country. The relative humidity is greatest on the coast of Finmark (82 per cent. per annum). Leirdal in Sogn, which lies under the lee of the Justedalsbræ, has an annual relative humidity of only 65 per cent. In winter it is greatest in the cold tracts of the interior (85 per cent.) and least on the west coast (70 per cent.); in summer it is greatest on the coast (upwards of 80 per cent.) and least in the interior (Christiania, 60 per cent.). On the driest days it can sink as low as 20 or even 12 per cent.

Just as the isotherms exhibit a tendency to follow the contours of the coast, so likewise do the isobars. In the mean for the year there is a maximum of pressure (reduced to the level of the sea and to the gravity at 45° lat.) in south-eastern Norway comprised within the isobar for 29·88 inches. The isobar for 29·84 inches extends from the north of Scotland over Bergen, Dovre, Throndhjem, and parallel with the coast of Nordland to Lapland. The isobar for 29·80 inches passes across Shetland and the coasts of Romsdal, Nordland, and Finmark to the south side of Varanger Fjord. The isobar for 29·76 inches passes a little to the north of the Faroe Islands, across the Lofotens, and along the Finmark coast to Vardö. Out in the Norwegian Sea there is a minimum pressure of air (29·72 inches), with its longitudinal axis stretching from south-west to north-east, between Iceland and Norway; it extends into the Barents Sea, between Beeren Eiland, Novaya Zemlya, and Finmark. In January the normal isobars take approximately the same course. Central Norway has a maximum of 29·97 inches. The isobar for 29·80 inches extends from the north coast of Ireland across Scotland to Stad and Lapland; that for 29·60 inches passes from the Faroe Islands towards the north-east, off the coast of Norway. The least pressure of air in January is at the North Cape (29·64 inches). A minimum occurs east of Iceland (29·45 inches, a still lower

(29·37 inches) west of Iceland, and another not quite so low in the Barents Sea to the north-east of the North Cape (29·56 inches). In July there is a minimum of pressure (29·80 inches) over central Norway (61° N. lat.). Along the part of the country adjoining the coastal region we have a maximum zone with a pressure of 29·85. In the sea between Iceland and Norway a trifling minimum (29·76 inches) occurs. It is obvious that the distribution of pressure must be regulated by that of temperature,—a maximum pressure of air over the colder, a minimum over the warmer localities.

As a consequence of this normal distribution of the pressure of the air the prevailing winds in winter blow from the land to the sea, with a deviation to the right. These are accordingly north-easterly along the Skagerrak, southerly along the west coast, south-westerly in northern Norway. They are for the most part cold winds, and cool down the surface of the sea throughout the nearest tracts. In summer sea-winds prevail; they blow along the land with the land to the left, more especially in southern Norway, where the coast of the Skagerrak has south-westerly, Lindesnæs westerly, and the west coast northerly winds. In northern Norway the prevailing summer winds are northerly. The winds blowing along the coast, in one direction or another, up or down, are twice as numerous as those blowing across it, from the land or the sea. In accordance with the greater value of the normal gradient in winter than in summer, the force of the wind on the coast is greatest in winter; during that season it rarely ceases to blow on the coast; but the number of calm days is very considerable in the interior of the country in and around the locality of the maximum barometric pressure. In summer calm weather is comparatively frequent on the coast (maximum zone of pressure), but not to the same extent in the interior. Upon the whole, the force of the wind on the coast is at all seasons of the year much greater than in the inland tracts. Storms are frequent on the coast (30 stormy days a year), rare in the interior (4 stormy days a year). Their most frequent direction is the same as that of the prevailing winds, viz., for the whole country on an average from the south-west, then from the west and the north-west. They are most frequent in winter, particularly during December and January (4 a month), rarest in summer (hardly 1 a month).

The amount of cloud in Norway is on the whole considerable. The coast of Finmark has the largest proportion (upwards of 3 cloudy days to 1 clear day). In the interior of the country the amount of cloud approximates 50 per cent. The summer months are somewhat clearer than those of winter.

Fog is most frequent on the west coast and the coast of Finmark in summer, rarest in winter. In the south-east part of the country the reverse is the case. In winter a frosty fog hangs over the inner extremities of the fjords when the cold is severe and the wind blows out from the land over the open water of the fjord.

The number of days with rain or snow is upon the whole greatest on the coast, from Jæderen to Vardö, least in the south-east part of the country. At the North Cape, in the Lofotens, along the west coast between Stad and Sogne Fjord, precipitation occurs on as many as 200 days of the year. On the Dovre Fjeld and on the coast bordering the Skagerrak the number of rainy days amounts to about 100 a year. The number of days with snow is least at Lister, increasing from 20 a year in that locality to 50 on the coast of Nordland in the vicinity of Throndhjem Fjord, on the Dovre Fjeld, and in Christiania, to 90 at Andenæs and Vardö, and to 100 at the North Cape. From Vardö to Andenæs, on the Dovre chain, and in the high mountain tracts snow occurs more frequently than rain. Snow can fall on the coast in all months of the year from the North Cape to the Lofotens. The amount of precipitation is greatest on the coast, between Sogne Fjord and Stad, where it amounts to 77 inches. West of a line from the coast of Romsdal to Christiansand it is above 40 inches. In the Lofotens it reaches 45 inches. Throughout the south-east and in Finmark it falls as low as 12 inches. In the former region, however, exceptions occur; thus, for example, a short distance north of Christiania the annual rainfall is 40 inches, whereas in the city itself it amounts to only 26 inches. In the south-east the amount of precipitation is greatest during the months of July and August, on the west coast late in autumn or in the beginning of winter. The amount of precipitation is least in spring.

Thunderstorms are not very frequent in Norway. They occur chiefly in summer, either during rainy weather and with southerly to south-westerly winds or (especially throughout the interior) on very hot days. In winter the heavy gales from the west and south-west on the west coast are often accompanied with thunder and lightning of an exceedingly dangerous character, the clouds hanging very low. Not less than a hundred churches in Norway have been struck and destroyed by lightning during the last 150 years, and of these not less than forty on the coast, in the winter thunderstorms, as far north as the Lofotens. At the North Cape, too, thunderstorms occur in winter.

The mild climate Norway enjoys must be chiefly ascribed to the high temperature of the water that laves her shores. (See NORWEGIAN SEA.) The fjords are filled with the heated water of the Atlantic, which in their deepest parts exhibits a constant temperature as high as, in the north even higher than, the mean annual temperature of the air, representing an amount of heat which during the coldest of winters can be reduced only to a slight extent. Thus in the depths of the Skagerrak channel the temperature is 42°, that of Sogne Fjord is 43°·7, of Throndhjem Fjord 42°·8, of Ranen Fjord 40°·6, of Salten Fjord 38°·1, of Vest Fjord 42°·8, of Alten Fjord 39°·2, and of Varanger Fjord 37°·6. Where the temperature at a depth of 100 to 200 fathoms is above 32° the water does not freeze; hence the open coasts and fjords of Norway. It is only in the innermost and more continentally situated arms of fjords into which rivers disembogue, as also along shallow stretches of coast—the coast of Lister, for example—that the sea is found to freeze in winters of exceptional severity. The cold prevailing land-winds in winter cool the surface of the sea on the coasts; therefore the surface-temperature increases outwards towards a thermal axis extending off the coast of Norway, and the isotherms of the sea-surface assume the same linguiform shape as those of the air. In winter the surface of the sea on the coast has a higher temperature than the air. The surplus heat is in January 4° at the Skagerrak, 10° at the North Cape. In summer the surface of the sea is in part very slightly colder than the air. Thus upon the whole the sea exerts a direct influence in raising the temperature of the air; and the prevailing direction of the wind from the south-west tends to diffuse this heated air over the nearest inland tracts, in particular those of the west coast. In summer Norway is indebted, as regards climate, to the long days which, by reason of her high northern latitude, she enjoys. The heated water on the banks and in the fjords having during winter rendered impossible the formation of ice on the coast, and thus provided against any waste during summer of solar energy in a melting process, the sun can freely exert his beneficent influence, working, so to speak, well-nigh—in Finmark actually—without intermission throughout the short period of vegetation.

The current sets as a rule along the Norwegian coast from the mouth of Christiania Fjord, passing round Lindesnæs and thence on to the North Cape and the Russian frontier. In the Skagerrak the water is much less salt than on the west coast, being mixed with fresh water from the great rivers in the south-east part of the country, and those emptying into the Baltic. The tidal water is scarcely appreciable east of Lindesnæs; its height increases, however, rapidly northwards (Lindesnæs 1 foot, Stavanger 3 feet, Bergen 4 feet, Throndhjem 8 feet, Hammerfest and Vardö 9 feet). In narrow sounds the tidal current is often exceedingly strong; the following are examples—the Moskenström or Malström in the Lofotens, the Saltström at Bodö, the Ryström at Tromsö.

The forest growth of Norway consists chiefly of pine and fir, which clothe the slopes of the mountain valleys, especially in southern Norway (as those of the Glommen and its tributaries, those of the Drammen, Laurvik, Skien, Arendal, and Christiansand districts, and those drained by the rivers disemboguing at Frederikshald). Extensive forests of Coniferous trees are also found in Throndhjem stift and the amt of Nordland. The Coniferous woods of Bergen and Tromsö stifts consist—with a solitary exception—of fir alone. The extreme limit of the fir belt in southern Norway is from 2200 to 3000 feet above the sea; throughout the Throndhjem region, from 1600 to 2000 feet; at Talvik in Alten (70° N. lat.) it does not exceed 700 feet. With the sole exception of the birch, none of the foliferous trees indigenous to the country form woods of great extent. The birch, reaching higher up the mountain sides than do any of the Coniferæ, forms a belt above them, which is, however, exceedingly narrow in southern Norway. Next come the dwarf birch (*Betula nana*) and various species of willows, and, last of all, between this and the snow-limit, the lichen belt. But the line of demarcation between this region and the willow belt is not distinctly traceable, the dwarf birch and some few of the willows—more especially the creeping rotundifolious varieties (*Salix herbacea* or *polaris*)—extending occasionally to the very edge of the snow-fields. Other plants also, such as the snow ranunculus, the Alpine heather, and numerous mountain plants, many of them distinguished by their beautiful flowers, grow abundantly here. The region of the Dovre is especially noteworthy, as the tract in which the alpine flora of Northern Europe is found in greatest variety, and within comparatively narrow limits. In the fertile and less elevated districts of Norway the forest growth, apart from Coniferæ, includes the ash, elm, lime, oak, beech, and black alder. The aspen, white alder, mountain ash, and bird cherry thrive at a considerable elevation, and are occasionally found even in the birch zone. The oak still grows abundantly on the south-eastern coast, from Jarlsberg-Laurvik amt to Christiansand, but is nowhere found in extensive forests. The only locality in which the beech can be said to thrive is Jarlsberg-Laurvik amt.

The vast fir and pine forests are still the haunts of the largest of European carnivora—the bear, the lynx, and the wolf. The numbers of the last-mentioned, however, have, in southern Norway, been steadily and one may almost say unaccountably decreasing during the last twenty years; and the wolf may be now regarded as the most rare of all Norwegian beasts of prey. In Finmark it still abounds, constituting the worst enemy to the herds of reindeer. The bear also is less frequently met with, a fact to be accounted for by the immense quantities of timber felled of late throughout the country. The animal is most numerous now in Throndhjem, Nordland, and Romsdal amts; it occurs with comparative frequency in the amts of Bratsberg, Nedenæs, Buskerud, Hedemark, and Christian, and is not absolutely rare in Nordre Bergenhus amt. About 150 are annually killed throughout Norway; in 1849 the number was twice as great. The lynx does not appear to have suffered any diminution within the last twenty years; as many as 120 are annually killed. Nordre Throndhjem amt would appear to be its northern limit. This animal is most destructive to hares and all kinds of feathered game. In the great forests—especially where the soil is marshy, and there is a mingled growth of ash, mountain ash, and willow (*Salix caprea*)—the elk occurs, and indeed appears to be increasing in numbers in some places, notwithstanding the vast quantities of timber felled, a fact chiefly attributable doubtless to the rapid decrease of its worst enemies, the wolf and the bear. It is most numerous in Hedemark and Buskerud, and in some parts of Akershus and Smaalenene, though considerable numbers have been met with of late throughout Nordre Throndhjem amt; in a westerly direction it has penetrated as far as Nedenæs amt. The elk is not found in the west of Norway, but its place is partially taken by the red deer, which selects as its haunts the largest of the wooded islands on the coast and the numerous semi-insular projections of the mainland. It is most abundant on the island of Hiteren, at the mouth of Throndhjem Fjord. The wild desolate wastes of the fjelds are the home of the glutton and the reindeer, the lemming and the polar fox. Large herds of reindeer still roam throughout the alpine region of the fjelds between eastern and western Norway, and on the Dovre mountains, the Rundane, and the highlands between Gudbrandsdal and Österdal, and Gudbrandsdal and Valders; but this noble animal has become scarcer of late years, owing chiefly to the numbers killed by peasant hunters, who fire their rifles into the midst of the herd, sometimes maiming at a shot half-a-dozen animals, which they cannot hope to secure, and which afterwards become the prey of the glutton. In some years, and in certain localities, the lemming makes its appearance in countless multitudes, to be attacked by its numerous enemies, particularly birds of prey, among which are the snowy and the short-eared owl; the common kestrel too, and the rough-legged buzzard, are seen in large numbers at such times, sweeping over the wastes of the fjelds. The lemming has an enemy among ruminants even, the reindeer crushing it with a stroke of his cloven hoof for the sake of the vegetable matter it contains. Hares are found all over the country up to the snow-limit. In Finmark occur several species of small mammals of Russian origin.

The sea that washes the shores of Norway abounds in fish; and hence the coast, with its numberless islands, holms, and skerries, is a favourite haunt for such birds and mammals as prey upon fishes and other marine animals. When the herring approaches the coast to spawn, it is hotly pursued by the whale; and in Finmark when shoals of capelan make for the coast in spring, accompanied by cod, which gorge themselves with this their favourite food, the fin-whale (*Balænoptera musculus*) and the blue-whale (*Balænoptera sibbaldi*) are also exceedingly numerous, and their presence has given rise to a most important branch of the fishing industry. The waters of the fjords, and the holms and islets of the coast, abound in the spotted seal (*Phoca vitulina*), and the *Phoca barbata* is not uncommon in some localities on the outermost skerries.

Feathered game—capercally, black-cock, hazel grouse—is still abundant in the forests, though less plentiful now than formerly, owing to the reckless manner in which they have been destroyed by amateur sportsmen. The woodcock is distributed pretty equally over the whole country; besides the lynx, it has enemies in the marten, fox, and weasel, the birds of prey most destructive to it being the sparrow-hawk and the great eagle owl. The finest ptarmigan are found in the birch region of the fjelds; but in southern Norway they often prefer the more elevated tracts of the willow zone during summer, though even then they are most abundant in the birch zone. The "rype" must be regarded as the most important of Norwegian game birds, on account of its numbers no less than of its flavour. It is extensively snared in winter, and of late years dogs have been used to hunt it. On the numerous islands lying off the northern coast, where the vegetation is strikingly similar to that of the birch belt and willow region of the fjelds, ptarmigan are plentiful. The treeless island of Smolen, in the bailiwick of Nordmöre, where they occur in great numbers, is the most southerly of the insular localities they frequent. The marshy tracts of the fjelds are the breeding-grounds of numerous varieties of fen-fowl, the lapwing (*Charadrius apricarius*) and the dotterel plover (*Charadrius morinellus*) occurring in great numbers. The double snipe and the teal, which also breed in the willow belt, are frequently shot by sportsmen when in pursuit of ptarmigan. In the numerous mountain tarns various species of divers are met with, for instance the *Fuligula marila* and the *Fuligula clangula*. The partridge, which has strayed across from Sweden, is now pretty evenly distributed throughout the amts of Akershus, Buskerud, Hedemark, and Christian; but in severe winters, when the fall of snow is exceptionally heavy, nearly every bird perishes, and several years elapse before the stock is recruited by immigration from the neighbouring kingdom. Almost every species of sea-fowl occurring in northern Europe that prey upon fish is found along the coasts, some of them breeding together in countless thousands in certain localities. The coast north of Stad is their chief haunt. The so-called "fugleberge" (bird cliffs) are chiefly frequented by the *Mormon fratercula*, the flesh, eggs, and feathers of which provide the owners of these preserves with some of the chief necessaries of life. The great black-banded loom occurs in tarns and mountain-lakes all over the country.

Of the various species of freshwater fish the *Salmonidæ* are beyond comparison the most important to the inhabitants. In the more extensive of the lakes, which are generally of great depth, trout attain almost the size of salmon, weighing up to 30 lb. In some lakes the red charr attains a weight of 12 lb, as does also the Finmark variety of this fish, which, in common with the sea-trout, remains during most of the year in deep sea-water, ascending the rivers in the spawning season only. Mountain-trout are found to thrive best in certain lakes and tarns within the birch and willow belts; but, owing to the abundance of food they can obtain, do not readily take the fly, hence they must be fished for with live bait or netted. As a rule, however, the great mountain-lakes yield excellent sport to the angler. The Mjösen abounds in grayling and charr; there is good grayling fishing too in the Tyrifjord and Randsfjord. Next to these species the perch, pike, bream, and eel are found in greatest numbers; but the eel is met with almost exclusively in a few rivers of southern Norway. Norway, notwithstanding the great number of its rivers which empty their waters into the sea, will not, owing to their inaccessible character, bear comparison with Great Britain or Ireland as a salmon-producing country. The most destructive enemies of freshwater fish in Norway are the otter, the loom, the duck, and the osprey.

The sea being very deep, both in the fjords and off the coast, such fishes and marine animals as affect great depths are there abundant. Some species are of great economic importance. On the banks off the coast of Finmark, at a depth of 150 to 200 fathoms, large numbers of the Greenland shark (*Scymnus glacialis*) are annually captured, their livers yielding a large quantity of oil. During the first half of the present century the sun fish, or basking shark (*Selache maxima*), abounded on the coast, its capture forming an important branch of the fishing industry. It is now but rarely met with; and the fishery has been discontinued. No species of fish can compare in point of importance with the herring and the cod, which, taken in immense quantities on the western coast, constitute one of the chief sources of national wealth.

PART II.—STATISTICS.

The population of Norway on the 31st of December 1882 was 1,918,000, of whom 1,509,000 were living in the country districts, and 404,000 in the towns. Subjoined are the figures for each of the eighteen counties (amter) into which the kingdom is divided:—

Smaalenene	114,000	Stavanger	118,000
Akershus	100,000	Söndre Bergenhus	121,000
Buskerud	104,000	Nordre Bergenhus	88,000
Jarlsberg and Laurvik	92,000	Romsdal	125,000
Bratsberg	87,000	Söndre Throndhjem	123,000
Hedemark	123,000	Nordre Throndhjem	84,000
Christian	113,000	Nordland	116,000
Nedenæs	79,000	Tromsö	60,000
Lister and Mandal	77,000	Finmark	27,000

Of the towns the following seven had the largest population (Christiania and Bergen being each a separate amt):—Christiania, 119,407; Bergen, 43,026; Throndhjem (1875), 22,152; Stavanger (1879), 23,500; Drammen, 19,582; Christiansand, 12,282; and Christiansund, 9025.

Norway is the most sparsely-populated country in Europe, having an average of about eighteen persons to the square mile. The distribution is very unequal: the greatest density is in Christiania stift, which contains about seven-twentieths of the whole population in seven-hundredths of the total area of the country. The density is relatively great along the coast. The districts which lie more than 600 to 700 feet above the sea are comparatively sparsely peopled. Notwithstanding the great emigration to America and Australia which has taken place in recent years, the population of the country has steadily advanced. About 1660 it numbered only 300,000, while at the beginning of the present century it was 800,000.

According to the returns completed in 1875, the owners of real property in the rural districts numbered 173,183, the total value of their properties being stated at £42,390,000. 24,718 English square miles of the southern stifts are estimated to be under wood, while the whole arable land of the country in 1875 amounted to 738 square miles, with a production valued at £2,794,000. At the same date the live stock included 151,903 horses, 1,016,617 cattle, 1,686,306 sheep, 322,861 goats, 101,020 pigs, and 96,567 reindeer.

The fisheries form one of the most important sources of the national wealth. In 1881 they employed upwards of 120,000 men, and the aggregate profits were estimated at about £1,111,000. The principal are the cod fisheries, along the inner coasts of the Lofoten Islands, where, in 1881, 26,850 men on 6153 boats caught 28,400,000 fish, valued at £313,400. In the same year the cod fishery in Finmark yielded about 18,000,000 fish, at a value of £131,000; those on the coast of Söndmöre produced only one-fourth of this amount. Next come the herring fisheries, which in 1881 yielded 2,412,630 bushels, valued at about £277,800. 6,165,000 mackerel (£42,700) were also taken. The summer fisheries of coal-fish, ling, salmon, trout, lobsters, and oysters at the same time gave a total of £222,200.

Manufacturing establishments in 1878 numbered 2628, employing an aggregate of 41,391 hands. The leading place here is taken by the saw-mills, of which there were 112 driven by steam (3402 hands) and 630 by water (4274 hands). Next come 551 cotton-mills (2037 workmen), 199 brick-works (3540 workmen), 123 cod-liver-oil works (598 workmen), 112 shipbuilding yards (2388 workmen), and 27 wood-fibre factories (805 workmen).

Mines are a considerable source of wealth to the country, their production in 1879 being estimated at £202,200. To this sum must be added £11,310 for apatite, £6150 for felspar, and £24,360 as the value of hewn stone exported in that year. The most important mines are:—the silver mines at Kongsberg, which in 1879 produced 9415 lb of silver, and a surplus of £3750; the copper works at Roros, producing 6880 tons, valued at £17,800; the copper pyrite mines at Vigsnæs, with a production of 39,898 tons, and a value of £69,440; the nickel-works at Senjen in Nordland, which yielded 3828 tons, valued at £5000; the iron-works of Næs and Egeland, which produced 2400 tons, at a value of £1050; and the iron-works of Holden, with 5660 tons, worth £2500. It must, however, be mentioned that the production of the mines since 1879 has been diminishing.

The foreign trade of Norway is steadily increasing. Its aggregate value in 1882 was estimated at £15,724,500 (imports, £8,916,700; exports, £6,807,800). The principal imports were:—corn, 1,100,000 quarters, £1,836,650; beef and pork, £202,660; butter, £310,570; colonial wares, £894,950; and manufactured goods, £1,305,560. Among the exports the leading place is taken by timber (£2,549,450), of which the greater part was sent to England. The fishery products sent abroad were valued at £1,444,450, and the metals at £117,450. The port of Christiania has the largest trade, the imports in 1882 having been worth £4,082,800, and the exports £1,409,200; next to Christiania come Bergen and Throndhjem. The mercantile marine of Norway some years ago passed through a period of stagnation, but revived somewhat in 1880 and 1881. At the close of the latter year it consisted of 7977 vessels (7618 sailing vessels and 359 steamers), with an aggregate tonnage of 1,520,407. The gross freight earned was £5,021,200, of which not less than £3,969,500 were derived from the carrying trade. The largest shipping ports are those of Stavanger (669 vessels, 120,017 tons), Arendal (412 vessels, 171,858 tons), Bergen (348 vessels, 84,870 tons), Christiania (318 vessels, 105,193 tons), and Drammen (281 vessels, 85,028 tons).

The Norwegian railways have a total length of 978 English miles. (1) From Christiania along the eastern coast of Christiania Fjord to the Swedish frontier (Smaalensbanen), including the inner or eastern line between the station of Ski and the town of Sarpsborg, 156 miles. (2) The Trunk Railway (Hovedbanen), between Christiania and Eidsvold by Lake Mjösen, 42 miles. (3) From Lilleström on the Trunk Railway to the Swedish frontier (Kongsvingerbanen), 71 miles. (4) From Eidsvold to Hamar (Hedemarksbanen), 36 miles. (5) From Hamar to Throndhjem (Rörosbanen), consisting of four administratively separate sections—Hamar to Grundset, 24 miles; Grundset to Rena, 16 miles; Rena to Stören, 199 miles; and Stören to Throndhjem, 31 miles. (6) From Throndhjem to the Swedish frontier (Merakerbanen), 63 miles. (7) From Christiania to Drammen, 33 miles. (8) From Drammen along the western coast of Christiania Fjord to Skien (Grevskabsbanen), with a branch line from Skopum, 98 miles. (9) From Drammen to Randsfjord Lake (including branch lines from Hougsund to Kongsberg and from Vikersund to Lake Kröderen), 89 miles. (10) From Stavanger to Egersund (Jæderbanen), 47 miles. (11) From Bergen to Vossevangen, 67 miles. The first three are commonly called the eastern railways (Östbanerne), (5) and (6) the northern (Nordbanerne), and the last three the western (Vestbanerne).

With improved means of communication the Norwegian post-office has made corresponding advances. In 1882 there were forwarded a total of 13,990,100 letters, of which 11,749,600 were inland, and 2,240,400 were sent abroad; 2,728,800 letters were in the same period received from foreign countries. The Government telegraphs had at the close of 1882 a line length of 47,065 miles, with a wire length of 85,485 miles. The telegrams transmitted in that year reached a total of 880,876.

As regards primary education Norway takes a leading place among the states of Europe. In the country districts 207,922 children were instructed in 6408 schools by 3374 teachers and 108 preceptresses in 1878; in the same year 40,826 children in the towns were instructed by 372 teachers and 367 preceptresses in 144 schools. There are, besides, 147 citizen-schools, middle-schools, and higher-schools, with a staff in 1878 of 824 teachers and 466 preceptresses; the scholars numbered 16,800 (9150 boys and 7650 girls). The university, that of Christiania, has 50 professors and 1000 students.

Service in the army or navy, without the right of providing a substitute, is obligatory on all males who have completed their twenty-third year; the only exemptions are in favour of ecclesiastical functionaries, pilots, and the inhabitants of Finmark. To the navy are drafted all conscripts who have made a voyage to foreign parts of at least twelve months, all conscripts from Nordland and Tromsö, and a certain number of those from southern Norway who are accustomed to the sea. The army is made up of the troops of the line, the landværn, and the landstorm; the term of service is seven years in the line, and three in the landværn. The landstorm consists of every man capable of bearing arms, under fifty years of age, who does not belong to the line or the landværn. The troops of the line in continuous service number 1850 non-commissioned officers and men, and consist partly of volunteers; the other troops of the line in time of peace are called out for drill only in summer. For infantry recruits the minimum period of drill is forty-two days, for cavalry and artillery ninety days; for those who have passed out of that category it is only twenty-four days. The military schools are at Christiania. The average annual conscription is 6300 men. The total establishment of the army on 30th June 1878 was 68,809 men, viz., infantry 60,672 (48,275 combatants), cavalry 2735 (1343 combatants), artillery 5150 (2867 combatants). The commissioned officers numbered 703. The numbers on a peace footing were:—for the line 15,878 (war complement 3203), for the reserve 17,089, for the landværn 12,846. There were also 532 musicians.

The navy is manned in part by volunteers. The term of service is from the age of twenty-two to that of thirty-five. The schools for naval instruction are at Horton, where also is the chief royal dockyard. The fleet consists of two wooden steam frigates, two wooden steam corvettes, four monitors, two first-class gunboats, several second and third class gunboats, two training ships, and some transports. There is also a torpedo service.

The constitution of Norway primarily rests on the "fundamental law," or *grundlov*, which was promulgated at Eidsvold on the 17th of May 1814, and afterwards, on the union with Sweden, agreed to, with slight modifications, in Christiania on the 4th of November in the same year. To this must be added the Swedish succession ordinance of the 26th of September 1810, accepted by Norway in November 1814, and the *rigsact*, or charter of union, of 1815. By the first-mentioned Norway is a free, independent, indivisible kingdom, united with Sweden under the same king. The form of government is a limited monarchy, and the throne is hereditary in the male line. Evangelical Lutheranism is the established religion. In their foreign relations the two kingdoms are regarded as one. The one cannot make war without the other, and there is a common diplomatic corps, which is controlled by the ministry of foreign affairs in Stockholm. In all other respects each kingdom is regarded as sovereign and independent. The executive is vested in the king, who comes of age when he is eighteen. His person is inviolable, and all responsibility for his official acts rests with the council of state. This body consists of two ministers, and at least seven (at present nine) councillors, chosen by the king from among the citizens, of at least thirty years of age. One minister and two councillors must always be with the king when he is not in Norway. The others form, under the presidency of the remaining minister, or of the viceroy if there be one, the Government in Christiania; its authority is decisive, except in cases reserved for the king, when it only advises. As viceroy in Norway the king can nominate only the crown prince. Formerly the Government in Christiania was presided over by a governor, but this office was never filled after 1855, and in 1873 it was abolished (on the accession of Oscar II.). Each of the seven councillors has charge of one of the seven state departments (finance, justice, home affairs, church, war, navy and post-office, and audit). The king can declare war and conclude peace, make alliances and treaties, and has the supreme command of army and navy; but for offensive war the consent of parliament is necessary. The king appoints to all public offices, and can dismiss at pleasure his council of state and other Government functionaries, the highest officials of church and state, the heads of the army, and the commandants of fortresses. He can also issue provisional ordinances relating to trade, taxation, industry, and legal procedure, provided they are not contrary to the fundamental law of the country and the laws agreed upon by parliament; these ordinances are in force till next meeting of parliament.

While the king has thus the executive power, the right of legislation and taxation is exercised by the people through their representatives in the parliament or *storthing*, which statedly meets in Christiania in the beginning of February every year. The king can, however, when circumstances require it, summon an extraordinary storthing. The elections are for a period of three years. The number of members is, by a law passed in 1878, fixed at 114,—38 from the towns and 76 from the country. The members are not chosen directly, but by electors nominated by the voters. Several little towns are grouped into one electoral district. In the country there is an elector for every hundred voters in the parish (*herred*). The electors afterwards meet in each county, and choose the number of members fixed by law. Only citizens who have the right to vote are eligible, and they must, moreover, be at least thirty years of age and have been ten years settled in the country. Every Norwegian citizen, not being a criminal or in foreign service, is entitled to vote, if he has passed his twenty-fifth year, has been settled in the country five years, and has certain property qualifications—a public appointment, ownership or tenancy of land, or, in towns, ownership of property worth at least 600 crowns (about £33).

Immediately after the opening of parliament one-fourth of its members are elected to constitute the "upper house" or *lagthing*; the remaining three-fourths form the lower house or *odelsthing*. In practice this means a division between the legislative and the controlling powers of parliament. Every bill or proposed enactment must be introduced either by a member or by Government through a councillor in the odelsthing. If it passes it is sent to the upper house, and if carried there also the royal assent gives it the force of law. If rejected by the upper house it goes back, with or without remark, to the lower house, where it is again discussed. If again carried it is sent once more to the upper house, and if it fails to obtain the requisite majority of votes the whole parliament now meets, and two-thirds decide the motion. To give legal sanction to a resolution of parliament thus carried the royal assent is still required.

The royal veto in ordinary questions is not absolute; a resolution passed unchanged by three successive regular parliaments becomes law *ipso facto*; but it is otherwise where alterations in the fundamental law are involved. Parliament also fixes taxation, its enactments with regard to which continue in force only until the 1st of July of the year in which the next ordinary parliament meets. Parliament alone has control of the members of the council, of the supreme court of justice, and of its own members; for crimes in their public capacity these can be put on their trial at the instance of the lower house before the supreme court of the kingdom (*rigsretten*), which is composed of the supreme court of justice and the upper house of parliament. The proceedings of parliament and of its divisions are carried on, when not otherwise determined by special vote, with open doors, and published. The members of the council are not allowed to take part in the proceedings. By the fundamental law Norwegians only, with a few exceptions, are eligible for public appointments.

Administratively Norway is divided into six dioceses (*stifter*), with a bishop at the head of each, and into eighteen counties (*amter*) under the civil administration of an *amtmand* or governor.[1] The towns of Christiania and Bergen form counties by themselves. The dioceses are Christiania, Hamar, Christiansand, Bergen, Throndhjem, and Tromsö. Christiania stift embraces the counties of Smaalenene, Akershus, Buskerud, part of Bratsberg, Jarlsberg and Laurvik; Hamar those of Hedemark and Christian; Christiansand those of Bratsberg (part of), Nedenæs, Lister and Mandal, Stavanger; Bergen, besides Sondre and Nordre Bergenhus, takes in part of Romsdal; Throndhjem the rest of Romsdal, with Sondre and Nordre Throndhjem; Tromsö the three northern counties. Each diocese is divided into deaneries (*provstier*), each under a dean, who is elected by the clergy of the district concerned; each amt is divided into bailiwicks (*fogderier*), each presided over by a sheriff or *foged*, appointed by the king to watch over the maintenance of the law, carry out judgments, and collect taxes and customs. In each town similar functions are assigned to the *byfoged* or town sheriff, who, however, has a more extended authority. The sheriff in the country has generally in each parish a substitute or *lensmand*. In the larger towns there are additional officers charged with municipal and police affairs. As regards courts of justice, only the supreme court and the rigsret, already spoken of, are fixed by the constitution. Courts of first instance are held in the towns by the sheriff and in the country by district judges, who travel on circuit twice or thrice a year. From the inferior courts cases are in second instance carried on appeal to the superior diocesan courts, of which there are four—one at Christiania (in two divisions), one at Christiansand, one at Bergen, and one at Throndhjem. From these courts cases relating to values of more than 400 crowns (about £22) and criminal cases proceed to the supreme court of the kingdom, which, according to the fundamental law, is composed of a president (*justitiarius*) and at least six assessors. The municipal court of Christiania consists of a president and seven assessors; from this court there is direct appeal to the supreme court of the kingdom.

The kingdom of Norway has its own national flag, red, divided by a dark-blue, white-bordered cross into four parts. In the upper square, next to the staff, the union mark is placed. The Norwegian escutcheon is a crowned golden lion on a red field, armed with the battle-axe of the tutelary saint, St Olaf.

(H. MO.—H. RA.—O. A. Ö.)

PART III.—HISTORY.

The early history of Norway is exceedingly obscure. The scanty allusions to Scandinavia and its inhabitants which we find in the classical writers refer to the inhabitants of Denmark and of the south of Sweden. The first mention of names which can be identified with any certainty as those of known Norwegian tribes is found in Jordanes, a writer of the 6th century. The traditions of the earlier times which are preserved in Norse literature can scarcely be said to afford any sure ground for history, for whatever truth may be in them seems to be almost hopelessly concealed beneath an overgrowth of mythological and genealogical legend. It is, however, certain that the first settlers after the nomad tribes of Lapps or Finns, whose traces are still found far south of their present limits, were the ancestors of the present inhabitants,—Germanic tribes closely akin to the Danes, Swedes, and Goths. The time of their immigration is unknown, but is conjectured with probability to have been at the latest not long after the commencement of the present era. The way by which they came has been the subject of a lengthened controversy. Munch and his school held that the first proper Norwegian settlements took place in the north, and spread thence down the western coast and the centre of the country. Later historians incline to the more probable theory that the country was settled by immigration from the south. To some extent the theory of a northern immigration derived its vitality from a view of early Norwegian history which is now generally rejected. Until recently the collection of old Norse poetry which passed under the name of the *Eddas* was regarded not merely as the peculiar inheritance of the Norse branch of the Scandinavian family but as the oldest and most primitive relic of Germanic mythology and legend. It fell in naturally with this view to regard the Norse people as leaving their primitive home at a later time, and as travelling by a different route from the rest of their kin. And plausible arguments could also be drawn from archæology. There is a well-marked distinction between the older and younger iron ages in Scandinavia. The older age, which is more fully developed in Denmark and the southern part of the Scandinavian peninsula, is marked by greater refinement of workmanship, and is more under the influence of southern art. The younger age, which is best marked in Norway and in Sweden proper, is rougher, and has more the appearance of an independent growth. It seemed natural, therefore, to regard the comparatively sudden transition to the more recent archæological period as evidence that the land had been occupied by a new people, closely akin indeed to the earlier inhabitants of the south, but which had come fresh from the common home and had not been subjected to the same influences. For various reasons, however, this more recent period cannot well be put farther back than the end of the 7th century, a date which brings the supposed northern immigration so near historic times that if it had taken place it must have been distinctly commemorated in tradition; and, at the same time, it is now generally admitted that even the oldest of the Eddic poems must be referred to a period close to or within the limits of authentic history. In all probability, therefore, we may regard the change of custom and the rise of the earliest poetry as marking a period of development and expansion which affected all the Scandinavian peoples, but which, we may well suppose, presented peculiarly individual characteristics in the isolated districts of Norway.

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[1] This territorial division is the only one which has been known in Norway since that into "fylkis," which had become antiquated even in the days of Harold Haarfager. These fylkis were more numerous than the present amter.

Towards the end of the 8th century we first hear of that phase of history which made the Scandinavian peoples well known during the next two hundred years to the nations of north-western Europe. In 787, if we may trust a record of later date, the ships of the Northern sea rovers first appeared on the English coast, and in 793 and 794 they plundered Lindisfarne and Monkwearmouth. Thenceforward we find them in continually increasing numbers on the coasts of Scotland and Ireland, in England and France, and on the southern coasts of the North Sea, isolated expeditions going as far as Spain and the Mediterranean. It is not easy to determine the share taken by the Danes and Norwegians respectively in these earlier expeditions, for the contemporary chroniclers confounded them under common names. But the geographical relations of the two peoples naturally led them into different tracks. The coasts which lay nearest to the Danes were those of the southern shores of the North Sea and the English Channel; but the nearest way for the Norsemen of western Norway lay straight across to the Shetlands and Orkneys and thence south along the Scottish coasts. It seems probable, therefore, that the first expeditions which ravaged the coast of Northumberland, and which swept down by the Hebrides to Ireland, and thence in some instances to the more southern coasts of France, before Flanders and the northern coasts of France began to suffer, started from the western coasts of Norway. Some years later, when the Danish expeditions become numerous and powerful, they fall with heaviest force on Flanders, England, and France. Of course, when the rovers increased in number and their excursions became wider, we find these kindred peoples in the same countries and joining in common expeditions. At an early period they come into collision in Ireland. Northumberland seems for a while to have been almost common ground, and Rollo, the chief who completed the permanent settlement in Normandy, is generally admitted to have been a Norseman, although the point is contested by Danish writers. But on the whole it was in the north and west that the Norse vikings had their chief haunts and formed their settlements. At first even the largest viking expedition had no further aim than plunder: they simply devastated the coasts on which they landed and returned with their booty to their native country, or sold it in foreign parts; but after a time we find them making permanent settlements, either attracted by the richer countries or driven from their own by the pressure of population or by political reverses. In the middle of the 9th century the Norse kingdom of Dublin was founded. In the latter half of the century the Danes, with a possible admixture of Norsemen, had obtained a permanent footing in England. Towards the end of the century the Scottish islands, which had hitherto formed a temporary refuge and starting-point for vikings, were occupied by permanent Norse settlers, and the colonization of Iceland was commenced.

Before the end of the 9th century we know comparatively little of the internal condition of Norway. The land is divided into *fylkis*, which in point of relative size answer roughly to the English shire. The word is connected etymologically with "folk," and seems to indicate that the fylki was originally a district peopled by a subdivision of the race. In the case of many of the fylkis this is borne out by the formation of the individual name, while in others the name seems to have applied directly to the district itself. There seems to have been an early union between some of these fylkis, having laws and customs of their own. The *Egil's Saga* tells us that Gula-thing was originally constituted from Horda-fylki, Sygna-fylki, and Firda-fylki; and this seems confirmed by the three twelves which form so conspicuous an element in the Icelandic law courts. In this case Horda-fylki may give us the name of the race by which that part of the country was originally settled, while the others are simply names of districts subsequently occupied by the same tribe. At a later time the whole country was divided into great districts, each with a common thing and a body of law of its own. These law districts, which corresponded to natural divisions of Norway of considerable importance in its history, were the district of the Frosta-thing, which comprehended the northern fylkis as far south as Sogne Fjord; that of the Gula-thing, which comprehended the south-western fylkis; and that of the Uplands and Vik, which included all the country south and east of the central mountain chain, and which had in old times its only common meeting-place in the Eidsifia-thing, but from which at a later time the Vik district with its Borgar-thing was separated. Within the fylki we find a minor subdivision called the *herad*, at the head of which stood the *hersir*, who held his office by hereditary right, and who, like the Icelandic godi, presided over the civil and religious affairs of the district. At the head of each fylki stood as a rule the king, though occasionally we find more than one king in a fylki, or more than one fylki under the rule of a king. In at least one district of the country, also, the chief power is in the hands of a race of jarls, a title which in later times was conferred by the kings, but which at this early period, although inferior to that of king, does not appear to be necessarily subordinate. It is difficult to define precisely the position of these petty kings. They seem to have represented the fylki in external affairs and to have been its leaders in war, but their power depended greatly on their personal qualities and the extent of their private possessions. That they had no very deep hold is clear from the readiness with which they disappear after the union of the kingdom. But both in fylki and herad every matter of importance was determined at the thing, the meeting of the free people. In some respects the condition of the people in Norway differed materially from that of other Germanic peoples at a similar stage of development. Owing probably to the nature of the country, we find no trace of the village community which has played so important a part in kindred races. As far back as we can go the ground was owned by individual proprietors, who partly held it in their own use and partly let it out to men who were practically their dependents. These proprietors, with the hersir families at their head, formed something closely resembling a landed aristocracy. The most powerful members of the class, distinguished by their descent, possessions, and personal qualities, scarcely acknowledged a superior. They were surrounded by a band of dependents trained to arms, and were accustomed to foreign expeditions, which increased their wealth, power, and warlike habits. Nor did the law of equal succession which at all times prevailed in Norway at all break up the power of these great families. The more common practice seems to have been, not to divide the lands, but to give the younger and more restless members their share of the inheritance in movable goods and let them seek a settlement for themselves. After the lands were settled such a practice must eminently have tended to increase the readiness to undertake foreign expeditions, while at the same time the wealth and power acquired in these expeditions fostered the increase of powerful families at home.

About the end of the 9th century Norway first became a united kingdom, and from that time we have a comparatively full and authentic record of its history. On the west side of the Vik, the present Christiania Fjord, lay a small district called Vestfjold, ruled over by a race of kings descended, according to a not very trustworthy legend, from the Swedish Upsala kings. The whole country round the Vik stood, as might be expected from its situation, in closer relation to Denmark and Sweden than the rest of Norway did. According to one version of history the Vestfjold kings occupied for a short time the Danish throne, while according to another they were tributaries of Denmark. There was a well-known trading-place within their territory; and probably at an early time they shared extensively in the traffic of the neighbouring seas and in the expeditions of the Danes. The first clearly discernible figure amongst these Vestfjold kings is Halfdan the Black, who, partly by family connexions and partly by conquest, included within his kingdom the country around the head of the Vik, and thence inland to Lake Mjösen. Halfdan died at a comparatively early age, leaving a son, Harold, who afterwards bore the famous name of Harold Fairhair, and who, according to the commonly received story, succeeded his father in 860, being then ten years of age. Mr Vigfusson contends, however, with considerable probability, that Harold's reign, as well as the colonization of Iceland, has been antedated by nearly thirty years, and it seems, to say the least, improbable that the events during the first ten years of his accession could have taken place in his early youth. But, setting aside the question of chronology, the story of Harold's reign, as given in Norse history, appears to be substantially trustworthy. After obtaining a firm hold on his father's dominions, he went north through Gudbrandsdal and descended upon the country of Throndhjem, which he speedily brought to subjection; and in the three or four subsequent years he had subdued the whole country as far south as Sogne Fjord. He appears to have received material assistance from two great chiefs, Earl Hakon, whose descendants are conspicuous in subsequent history as the Hlada jarls, and Earl Rognwald of Mœri, the ancestor of the dukes of Normandy and the Orkney earls. The country south of Sogne Fjord was still unsubdued, nor was its conquest apparently attempted for some years later. It was the most warlike part of Norway, and from it probably issued the greater part of the Norwegian viking expeditions, which were now in their fullest vigour. The western chiefs appear at length to have taken the initiative, and to have gathered together a great force, summoning aid apparently even from their kinsmen beyond the western sea. Harold sailed south to meet them, and a fierce battle took place at Hafrs Fjord, near Stavanger, in which he gained a complete victory; the hostile force was entirely broken, and from this time his rule over all Norway appears to have been undisputed. Every man was forced to own him as master; new taxes and obligations were imposed; the fylkis were put under the rule of earls, and the hersirs became or were replaced by the king's *lendermenn*,—a title which becomes familiar in subsequent history. These lendermenn, however, must not be mistaken for an official nobility deriving their main strength from the king. They became the king's men, bound to support him and to follow him in war, and they received lands from him in return, from which they derived their name; but they were still for a long time merely the old hersirs under another name, powerful local chiefs who were ready at any moment, if the occasion seemed to require it, to lead against the king their dependents and the free proprietors by whom they were surrounded. But many of the leading men refused to live in Norway upon these terms. They sailed with their families and dependents, some of them to Iceland, but many more to the Scottish islands, which had long been a favourite resort of the western Norwegians; and thence for years they kept up a series of raids upon Norway. Harold for a while endeavoured to encounter them on the Norway coast, but finding this interminable he at last crossed the sea with a great force and fell upon the vikings from the northern islands as far south as Man. Orkney, and probably the Hebrides, were placed under Norwegian earls, and from this time we hear comparatively little of marauding expeditions from these islands to Norway. Many of those driven out in this western expedition settled ultimately in Iceland, the colonization of which was completed during Harold's reign (see ICELAND). Harold in his later years divided his kingdom among his sons, giving a predominance among them to his favourite Erik Blood-axe. He died at an advanced age *c.* 933 A.D.

On Harold's death Erik attempted to make himself sole king of Norway, and defeated and slew two of his brothers to whom vassal kingdoms had been assigned by their father; but his tyrannical and unpopular character fostered the reaction which naturally set in against the strong rule of Harold. Hakon, a younger son of Harold, who was brought up at the English court, and was afterwards known as Athelstan's foster-son, was sent for from England. He was presented by Earl Sigurd, the son of Earl Hakon (Harold's early supporter), at a great thing at Throndhjem, and there, after promising that he would restore the old rights which his father had taken away, he was accepted as king. In the words of the saga, the tidings flew through the land like fire in dry grass that the Throndhjem people had taken to themselves a king like in all things to Harold Fairhair, except that Harold had enslaved and oppressed all the people in the land, while this Hakon wished good to every one and offered back the odal rights which Harold had taken away. The people flocked to him from all sides, and Erik soon found himself compelled to leave the country, and sailed west to the Orkneys. Hakon's reign was true to the promise of its commencement. In the Uplands and in Vik he left his kinsmen in possession of the vassal kingdoms; Earl Sigurd ruled under him in the north, and the rest of the kingdom he took into his own hand. The landowners were freed from the burdens and vassalage of Harold's days, although some of the least oppressive taxes appear to have been continued, and the Gula-thing and

Frosta-thing were reorganised, with probably several amendments on their respective laws, and were extended to their later boundaries. In one respect Hakon was not in accord with his subjects. He had been brought up as a Christian at Athelstan's court, and attempted to introduce Christianity into the land; but in this attempt he signally failed, and at one time seems nearly to have broken with his people in consequence. On the whole, however, Norway enjoyed under Hakon internal peace. The troubles which beset his reign, more especially towards its close, arose from Denmark and the sons of Erik Blood-axe.

It is not easy to trace Erik's career after he fled to the Orkneys. According to the Norse sources, he received Northumberland from Athelstan as a vassal kingdom not long after leaving Norway. In the English sources we find him represented as holding Northumberland not under but in opposition to the English king. It is probable enough that he may have held it in both relations; but, however that may be, he certainly ruled for a time at York, and fell in England *c.* 952. At the time of his death his wife Gunhild went to the Orkneys with her children and thence to Denmark. She was a famous character in the history of the time, and to her the Norse tradition attributes much of the evil that appears in the career of her husband and children. According to one account she was the sister of Harold Bluetooth, but it is scarcely credible that the relationship between two such well-known figures in the 10th century should be unknown to the principal Norse writers. The favourable reception which she and her children met with in Denmark is sufficiently accounted for by Erik's own Danish descent, and the relations which then existed between Denmark and Norway. Shortly after their arrival in Denmark Erik's sons commenced a series of expeditions against Norway which lasted during the rest of Hakon's reign; at last, after gaining many victories over the invaders, Hakon was taken by surprise and slain *c.* 961.

On Hakon's death the sons of Erik, with Harold, afterwards called Greyfell, at their head, got possession of the western part of Norway, but Vik and the Uplands remained under their former kings, and Earl Sigurd still kept firm hold of the Throndhjem country. Earl Sigurd was treacherously slain, and was succeeded by his son, Earl Hakon the Great; and for many years afterwards the history of the country is a series of struggles between the sons of Erik and Hakon, mixed up with occasional interferences from Denmark. At length Harold Greyfell was slain in Denmark, and Hakon succeeded with the help of the Danes in driving the sons of Erik out of the country. For a time he remained in nominal dependence on Denmark, but this was soon shaken off, and in the latter part of his life Hakon, though he never assumed the title of king, ruled in entire independence over the whole north and west of Norway. Latterly he excited animosity by some reckless outrages on the feelings of the people; a rising took place against him in the Throndhjem country, in which he was slain *c.* 995, and at the very time of the rising Olaf Tryggvason landed in Norway.

Olaf was a great-grandson of Harold Fairhair. His father, Tryggve, had been treacherously slain by the sons of Erik, and his mother had with difficulty escaped with him. After some strange adventures the boy was received and brought up at the court at Novgorod, and then in his early youth took to a viking life. He soon became a famous leader, and plundered far and wide. In 991 we hear of him in England as one of the chiefs who fought the battle of Maldon, and he appears there again in 994. He sailed on his Norwegian expedition from Ireland, and found the whole country well disposed to receive him as king. Olaf's short reign of five years was chiefly occupied with his efforts to Christianize the country. He had been baptized some time during his English expedition, and had taken up Christianity in a more serious manner than was generally the case with the Northern converts of his class, who as a rule submitted to baptism as a convenient or necessary transaction. Olaf's Christianity does not appear to have been of a very deep or enlightened type, but he was thoroughly in earnest about it, and set himself to enforce its supremacy with the whole energy of his character. And in an incredibly short time, if he had not exactly succeeded in making his subjects Christian, he had at least made it very unsafe for them to be anything else. By force, or gifts, or persuasion, or even by torture if necessary—for his anger was sometimes cruel enough—he had soon scarcely left a man of note unbaptized in Norway. Even Iceland was persuaded to accept the faith by his energetic handling of the Icelanders at his court. Of course this wholesale conversion was of a very nominal character, and even Olaf himself always appears to be little more than a loyal and devoted heathen vassal of the new faith. Perhaps the strangest thing is not merely that he attained his end so rapidly, but that he did so without rousing and alienating the people. His splendid personal appearance, his wonderful strength and skill in arms, his inexhaustible courage and energy, and the frank chivalrous nature—bright and joyous when in quiet, but capable of terrible passion when enraged—seem to have overawed and attracted every one at the time, and have made him since the favourite hero of Norse history. In the fifth year of his reign (*c.* 1001) Olaf undertook an expedition to the Baltic, and a league was formed against him by the kings of Denmark and Sweden, and by Earl Erik, the son of Hakon, who had fled into Sweden after his father's death. Olaf went with a powerful fleet, he himself commanding his great ship the "Long Serpent," the largest and best manned that had ever sailed from Norway. His foes lay in wait for him on his return under Swöld, an island off the German coast which cannot now be identified, and there took place the most famous and picturesque battle in Norse history. Olaf's ships were induced by treachery to pass by the island behind which the forces of his enemies lay, while the hostile chiefs watched them as they sailed by. At last when all were gone on their way to Norway but the few ships which with Olaf himself brought up the rear, the enemy rowed out and fell upon them. Olaf bound his ships together with the "Long Serpent" in the centre, and his foes surrounded him on all sides. One after another the ships were taken and cleared of men, and at last the crew of the "Long Serpent" were left alone, under a shower of spears and arrows, with the whole enemy around them and with fresh men continually attempting their decks. The saga tells us that Olaf's men grew so mad with rage that they leaped at the ships that surrounded them, not seeing that they were often so far off, so that they fell into the sea and perished. At length almost none were left, and Olaf leaped overboard in his armour. His people at home could scarce believe that he could have perished, and for many years stories were circulated that he had been seen in foreign countries; but, however that may be, says the chronicler, Olaf Tryggvason came back no more to his kingdom in Norway.

The two kings and Earl Erik divided Norway among them, but in reality the greater part of the country was held by Earl Erik and his brother Earl Svend, under a little more than nominal vassalage. In the south some of the districts were more directly dependent on Denmark and Sweden. Fourteen years afterwards another descendant of Harold Fairhair appeared in the country. Olaf, son of Harold Gränske, had, like most of his race, spent his early youth in foreign expeditions. When about nineteen he came back to Norway with a small band of well-tried men, and went first to his kinsmen in the Uplands, where some of the small kings of Harold's race still remained in a not very close dependence on Denmark. Erik was by this time dead; Olaf succeeded in driving Svend out of the land, and became in a short time more thoroughly king of all Norway than any one had been since Harold Fairhair. He rebuilt Nidaros (the modern Throndhjem), which had been founded by Olaf Tryggvason, and which may be called henceforward the capital of Norway. Like Olaf Tryggvason, he was a zealous adherent of Christianity, and, as soon as he was firmly settled, proceeded to enforce it on his subjects. The previous conversion of the land had been superficial, so that, except in the parts of the country which came most into relations with foreign countries, the old religion had still a strong hold, and in some districts was predominant. Under Olaf heathen worship was suppressed with the utmost severity, and Christianity may be said to have become the professed religion of the land. Olaf's rule was firm and powerful. Equal justice was dealt out, as far as practicable, to every one, often in a summary fashion. The great families had flourished under the earls, and seem to have been almost wholly independent within their own districts, but, as they one after the other came into collision with the king, they had to yield. Olaf was in many ways a greater man than Olaf Tryggvason: his aims were higher, and he understood them more thoroughly; but he lacked some of the gifts of his brilliant predecessor. Olaf Tryggvason was the very incarnation of the old popular ideal, and, had the times been favourable, might well enough have passed into tradition, Christianity and all, as one of the Æsir who had come back again to earth. But the other Olaf was in some ways a new force in Norway. He was aiming at a united Christian kingdom under a strong central power, and these ideas, in so far as they were intelligible, were repugnant to the Norse chiefs. And, besides, his character was somewhat still and reserved, not always destitute even of traits of cunning, so that altogether, though every one was forced to respect his courage and ability, and his own followers were devotedly attached to him, most of the Norwegian chiefs never wholly understood or trusted him. In one way or another he incurred the enmity of many of the most powerful men in the west and north, and he had a dangerous foreign enemy. Canute was at the height of his power, had claims, he thought, upon Norway, and was, moreover, deeply irritated by an expedition which Olaf had made upon Denmark along with the king of Sweden. He had connexions with many of the chiefs, which he fostered as much as possible, and in 1028 he came with a great force to Norway; Olaf could make no head against him, and was compelled to fly to Russia. But after a while Olaf heard that there was for a time no ruler in Norway, and resolved to attempt to win back his kingdom. He obtained assistance in Sweden, gathered his friends from Norway, and then went over the mountains into the Throndhjem country. The chiefs who were most bitterly opposed to him drew together a great force and met him at Stikklestad, and there, when only thirty-five years old, he was defeated and slain in August 1030. There is a singular change to be observed in the narrative of this latter part of Olaf's life. He seems to have become more devoted to Christianity, and in every way more thoughtful and gentle. The stories about him look as if his adversities had forced him to take a retrospect of his life and prepare for a new career; and if he had been the victor at Stikklestad it is hard to say what influence he might not have exercised upon subsequent history.

A short experience of Danish rule under Svend, the son of Canute, made Norway bitterly regret the loss of Olaf. The resentments which had been awakened by his stern, just rule passed out of sight, and men only remembered his great qualities, and that in his time the land was free from foreign interference. His devoted adherence to Christianity, especially in his later days, gave a definite direction to these reminiscences; he was regarded as a martyr and saint, and miracles were reported to have been wrought by him even under the very nose of his Danish successor. Olaf was rightly regarded as the patron saint of the new Christian monarchy. It was he who not only had Christianized the land, but had for the first time thoroughly united the kingdom. His reign had given rise to a feeling of unitedness and independent existence which the country never had before and never afterwards wholly lost. For nearly a century afterwards Norway was ruled in internal peace by the kings of his race. The church was organized and became powerful. The private viking expeditions gradually ceased, for it began to be considered a scandal to plunder in Christian lands; and possibly also the practice grew more dangerous. Swein Asleifson, in the middle of the 12th century, is the last recorded viking of the old type, and he dwelt in the Orkneys. At the same time several of the kings made greater foreign expeditions, which probably afforded a sufficient vent for their more restless subjects. The central authority of the king grew stronger and more stable. His court and personal following were better organized. The lendermenn, although still remaining chiefs of the landed aristocracy, ceased to exercise the same semi-independent power in their own districts and came into closer relations with the king and court.

In 1035 Magnus, Olaf's son, who had remained in Russia, was sent for by some of the leading men, and was readily accepted as king. Magnus, or rather the chiefs in his name, for he was still very young at the time, had settled the quarrel with Denmark by coming to an agreement with Hardicanute, that when one died the other should succeed to his crown. In 1042 Hardicanute died, and Magnus peacefully took possession of his kingdom. But troubles soon arose from Svend Estridsen, nephew of Canute the Great, who attempted to seize Denmark, and who had entered into terms with a formidable Norse ally. Harold, Sigurd's son, known sometimes as Hardrada (hard counsel), the half-brother of Olaf, was one of the last and most famous of the great viking chiefs. His father was a small Upland king of Harold Fairhair's race; he had fought when a boy at Stikklestad, had gone to the East and taken service with the Greek emperor, and was now come back to the North with great wealth and fame. For a short time he entered into league with Svend, but an arrangement was soon brought about by which he and Magnus were made friends, and Harold became joint king of Norway. Magnus died in the following year (1047), leaving Denmark to Svend and Norway to Harold; Harold was not, however, inclined to relinquish Denmark, and wasted it year after year by terrible incursions; at last he undertook a more formidable task, and fell in England in 1066 with the very flower of Norway at the battle of Stamford Bridge.

Harold's son, Olaf Kyrre (the quiet), ruled Norway in peace for twenty-seven years, a peace which may in some respects have been due to the way in which the country had been drained of its hottest blood by Harold's expeditions. During this reign the country attained considerable prosperity, trade increased, and, among other merchant towns, Bergen, which soon attained the first place, was founded. But Olaf's son Magnus (known sometimes as Magnus Barefoot), who succeeded his father in 1093, reigned in a manner more like his grandfather. He was continually occupied in foreign expeditions, and at last fell in Ireland in 1103.

The three sons of Magnus succeeded to the kingdom at his death. One of them died in youth, but Sigurd and Eystein reigned long together, Eystein being a king like Olaf Kyrre, while Sigurd inherited to the full the warlike qualities of his family. The great external event of the reign is Sigurd's expedition to the East, from which he gained the name of Jorsalafari (the traveller to Jerusalem). The account given by the saga of the origin of that expedition is characteristic and probably enough true. Many men had already been to Jerusalem and to Constantinople, and there they had got renown, and had all kinds of news to tell when they came home, and those who had taken service at Constantinople had the best luck in the way of gain; so the people bade one of the kings undertake the expedition. Sigurd went with a great force, fought many battles by the way, gained much plunder in heathen lands, and visited Jerusalem and Constantinople. Sigurd survived Eystein, and died in 1130. In his last year he showed traces of insanity. He was the last true representative of Harold Fairhair's great race, and with him the classical period of Norwegian history may almost be said to come to an end.

With the death of Sigurd commences a long period of internal strife. His son Magnus was forced to share the sovereignty with a colleague, Harold Gilchrist, who professed to be a natural son of Magnus Barefoot, and who in a short time succeeded in deposing his colleague. Harold was slain in 1136 by another pretender. Parties had formed themselves amongst the lendermenn aristocracy, who took as their nominal heads the sons and grandsons of Harold Gilchrist, often mere children; the church hierarchy, now growing powerful, interfered in the struggle, and the whole land was divided by bitter feuds. The disorganization of the country was shown by the appearance of bands of armed disorderly men, generally at first on the Swedish frontier. Unity at last seemed likely to be secured by an innovation in the succession. A powerful chief named Erling Skakke managed to get his son Magnus, who by his mother's side was a grandson of Sigurd Jorsalafari, accepted as king, first by the leading party and then practically by the whole country. He came to terms with the hierarchy; an agreement was entered into in 1164, by which various privileges were secured to the church, and a definite rule of succession was adopted. The kingdom was to be held as a fief of St Olaf, and the church dignitaries were to have a powerful voice in the succession. In return for these concessions Magnus was solemnly crowned by the archbishop of Throndhjem, and his defective claim was thus strengthened by a new form of legitimation.

There seemed every reason to suppose that the kingdom would now rest firmly on the united support of the aristocracy and the church, but in reality the basis proved to be an insecure one. The aristocracy stood no longer as formerly in close connexion with the mass of the free people, and they had not yet become welded together in a separate organized order. One of the troops of adventurers which had appeared in the previous state of confusion, and had been the followers of one of the various claimants to the throne, was known as the Birkebeinar. They were on the verge of extinction when they secured a leader of no common type. Sverri was a Faroe Islander. He seems to have been well enough aware himself that he had no claims to royal birth, but he gave himself out as the son of Sigurd, the son of Harold Gilchrist, and as such was accepted by the Birkebeinar. In a little while it became clear that his talents for command were of the first order, and the little troop of disorderly men became in his hands a disciplined military force. A fierce struggle ensued with Magnus, who in the end was defeated and slain in 1184 at Fimreite on Nord Fjord. Sverri became king, and represented himself as maintaining the old law of succession and the old order of things as against the arrangement of 1164. But in reality his reign was the commencement of a new phase. The older kings were within very narrow limits absolute, and claimed the kingdom as an odal right; but they were confronted and controlled by the mass of free landowners under their local aristocratic chiefs. A change had gradually taken place, and it seemed as if a separate aristocracy were to detach themselves from the people, and, with the help of the church, take the administration into their own hands. Sverri struck the hardest blows at both. He effectually prevented the formation of a powerful nobility, and he wholly repudiated the domination of the church. He had hammered out for himself a theory of church and state not unlike that of Henry VIII., and held that the king derived his title from God, and was entitled to an equal supremacy over both. The church retaliated by excommunication, for which, however, Sverri and his followers cared nothing, and by which their position does not seem to have been in the least affected. New officials appear in the administration of local affairs who were appointed and directly controlled by the king, and if his plans had been fully carried out it seems likely that the whole power would have been centralized under his hands. He had to fight, however, for his kingdom to the very end, and at his death in 1202 it seemed doubtful what turn affairs would take.

The party strife continued with scarcely an intermission until long after Sverri's death. The party of the Birkebeinar, however, kept well together and were on the whole the stronger. Their rivals had their chief seat in the south, and were closely connected with Denmark. At last Hakon, a grandson of Sverri, was placed on the throne in 1217, and in 1240 the last of the rival claimants to the throne fell, and the whole country was once more at peace under one king. The stormy times of Norway's history appear suddenly to pass away, and the stillness that ensues is likened by one of its historians to "the stillness on a battlefield after the battle." Hakon died in 1263. There are only two external events of note in his long reign. The one is the acquisition of Iceland, which, like the parent country, had been thoroughly worn out by the struggles of its chiefs. The other is Hakon's Scotch expedition in 1261, which was put an end to by a storm and by the not very important battle of Largs, and which showed conclusively how much the seamanship and fighting power of Norway had declined. Hakon's son Magnus surrendered the Hebrides to Scotland by the treaty of Perth in 1268. There is some dispute whether or not this was done under condition of a tribute, but there seems to be no doubt that the tribute, if due, was at all events never paid. Magnus was known by the surname of Lagabœtr (law reformer), a designation which indicates the chief work of his reign. The great changes that had taken place during the long period of the civil wars must have rendered some alteration of the old law imperatively necessary; and, while something had been done in Hakon's reign, the work was completed under Magnus. In place of the old provincial laws a new law book was prepared for the whole kingdom, compiled from the older laws with the changes that seemed necessary. Many of these changes relate to customs and rights which had their origin in heathen times. Others show the altered relation of classes. A conspicuous feature is the new importance of the king's officials and the increased power and position of the king himself. Magnus died in 1280 and was succeeded by his son Erik, whose only child, the Maid of Norway, perished at sea when on her way to Scotland. In 1299 Erik died and was succeeded by his brother Hakon, who died in 1319, and whose only daughter carried the Norwegian crown into the Swedish line. During the reign of Hakon the lendermenn, who had so long been conspicuous in Norse history, finally disappeared. Hakon abolished them by a decree, without apparently even consulting his council, and without encountering the slightest resistance. They do not even reappear in the minority which followed, and which must have afforded them a very favourable opportunity of recovering their power. They occupied, in truth, an anomalous and untenable position. They had long ceased, as we have seen, to be the chiefs and representatives of the free landowners, and they had failed to assert themselves as a separate power by the side of the king. Under Magnus Lagabøtr they had acquired the title of barons, but even under long minorities they never got any real hold of power. The king was too strong for them after they had lost their old position, and he preferred ruling through officers of his own who were wholly dependent on him. Neither was there any room for the growth of a nobility of another type. On the one hand the position of the king was too absolute, and on the other hand the people were too firmly rooted in their old traditional independence. The mass of the small landowners, among whom the greater families, by the partition of their domains, gradually sank back, were ready to obey the king and his officers; but they were not the material on which an intermediate power could be rested. They admitted that the king had an odal right to his kingdom and a definite claim for services and payments, but in the same way they themselves had an immemorial odal right to their lands. The situation of Norway during the Middle Ages might be shortly described as an absolute monarchy resting almost directly on one of the most democratic states of society in Europe. Titles appear, but they represent little or nothing. The ruling officials or deputies of the king are occasionally oppressive, but there is no permanent subjection to them.

From the time of the union with the Swedish crown the history of Norway is bound up with that of the other Scandinavian countries. With Sweden she entered the Calmar union in 1397, but when that union was broken in the beginning of the 16th century she remained with Denmark, and during the whole time of union can scarcely be said to have had a history of her own. The Danish kings were accepted in Norway with only an occasional show of dissent and resistance. One of her oldest and most famous colonies, the Orkney and Shetland Islands, was in 1468 given in pledge, never to be redeemed, to the Scottish king by Christian I. The commercial towns fell under the iron rule of the Hanseatic League and all the old enterprise seemed to have perished. Intellectual life appeared to fall as low as commercial prosperity. The vigorous Norse-Icelandic literature was supplanted after the time of Hakon Magnusson by versions of foreign legends and history, but even that disappeared, and, as the manuscript copies grew scarcer, it appears as if for a while the Norwegians had ceased to read as well as to write. The Reformation spread more slowly into Norway than into the other Scandinavian countries, and had to be encouraged by the Danish kings by methods not altogether dissimilar to those by which Christianity had at first been introduced. But better times began to dawn during last century. Restrictions were removed from lands and the administration was improved. The material prosperity of the country rapidly increased and a new life began to appear.

By the terms of the peace of Kiel (14th January 1814) Norway was to be transferred from Denmark to Sweden. The Norwegians were at first inclined to resist this, but their means of resistance were small and the Swedes offered liberal terms. In the same year the constitution was solemnly ratified, and Charles XIII. was taken as king. Since then the country has been peaceful and prosperous. The only serious political troubles have been those arising from the question whether the king has an absolute veto upon alteration of the fundamental law of the kingdom.

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PART IV.—LITERATURE.

The literature of Norway bears something of the same relation to that of Denmark that American literature bears to English. In each case the development and separation of a dependency have produced a desire on the part of persons speaking the mother-tongue for a literature that shall express the local emotions and conditions of the new nation. Two notable events led to the foundation of Norwegian literature: the one was the creation of the university of Christiania in 1811, and the other was the separation of Norway from Denmark in 1814. These events were the signals for intellectual and political independence. Before this time Norwegian writers had been content, as a rule, to publish their works at Copenhagen, which was the metropolis of the realm; they had now a capital of their own in Christiania. The great distinction, however, between Norway and America was that the former was sufficiently ancient and sufficiently neighbouring to contribute to the glory of Denmark a great many young men who quitted the colonial and narrow circle into which they were born, and became to all intents and purposes Danish writers. The first name on the annals of Danish literature, Peder Claussön, is that of a Norwegian; and if all Norse writers were removed from that roll, the list would be poorer by some of its most illustrious names, by Holberg, Tullin, Wessel, Treschow, Steffens, and Hauch.

We must first examine what was done in Norway itself during the colonial period. The first book printed in the country was an almanac, brought out in Christiania in 1643 by a wandering printer named Tyge Nielsen, who brought his types from Copenhagen. But the first press set up definitely in Norway was that of Valentin Kuhn, brought over from Germany in 1650 by the theologian Christian Stephensen Bang (1580-1678) to help in the circulation of his numerous tracts. Bang's *Christianiæ Stads Beskrifuelse*, 1651, is the first book published in Norway. The name which next detains us is that of Christen Jensen (d. 1653), a priest who collected a small glossary or *glosebog* of the local dialects, and which was published in 1656. Gerhard Milzow (1629-1688), the author of a *Presbyterologia Norwegica*, 1679, was also a Norse priest. The earliest Norwegian writer of any original merit was Dorthe Engelbrechtsdatter (1634-1716), afterwards the wife of the pastor Ambrosius Hardenbech (see vol. viii. p. 214). She is the author of several volumes of religious poetry, of a very lacrymose and lamentable order, which have enjoyed great popularity down to the present day. The hymn-writer Johan Brunsmann (1637-1707), though a Norseman by birth, belongs by education and temper entirely to Denmark. Not so Peder Dass (1647-1708) (see vol. vi. p. 831), the most original writer whom Norway produced and retained at home during the colonial period. Another priest, Jonas Ramus (1649-1718), wrote two important posthumous works in prose, *Norriges Kongers Historie* (History of the Norse Kings) in 1719, and *Norriges Beskrivelse*, 1735. The celebrated missionary to Greenland, Hans Egede (1686-1758), wrote several works on his experiences in that country. Peder Hersleb (1689-1757) was the compiler of some popular treatises of Lutheran theology. Frederik Nannestad, bishop of Throndhjem (1693-1774), deserves mention as the founder of the periodical press in Norway, having started a weekly gazette in 1760. The missionary Knud Leem (1697-1774) published a number of philological and topographical works regarding the Lapps of Finmark, one at least of which, his *Beskrivelse over Finmarkens Lapper*, 1767, still possesses considerable interest. The famous Erik Pontoppidan (1698-1764) cannot be regarded as a Norwegian, for he did not leave Denmark until he was made bishop of Bergen, at the age of forty-nine. On the other hand the far more famous Baron Ludvig Holberg (1684-1754), the chief of Danish writers, belongs to Denmark by everything but birth, having left Norway in childhood.

A few Norsemen of the beginning of the 18th century distinguished themselves, chiefly in science. Of these Johan Ernst Gunnerus (1718-1773), bishop of Throndhjem, was the most eminent; he was the first man who gave close attention to the Norwegian flora. He founded the Norwegian Royal Society of Sciences in 1760, in unison with his friends Gerhard Schöning (1722-1780) the historian and Hans Ström (1726-1797) the zoologist. Of these three friends Schöning deserves the greatest prominence in this place, because he wrote more in Danish and less in Latin than the other two. In belles-lettres Norway began to show vitality only when the century had reached its half-way point. Peder Christofer Stenersen (1723-1776), a writer of occasional verses, merely led the way for Christian Braumann Tullin (1728-1765), a lyrical poet of exquisite genius, whose talent is claimed by Denmark as one of the jewels in the crown of her literature, but who must be mentioned here, because his poetry was not only mainly composed in Christiania, but breathes a local spirit. He has been called the Father of Danish lyrical verse. From Tullin's day for about thirty years Denmark was principally supplied with poets from Norway. That portion of the chronicle of Danish literature which extends between the great names of Evald and Baggesen presents us with hardly a single figure which is not that of a Norseman. The director of the Danish national theatre in 1771 was a Norwegian, Niels Krog Bredal (1733-1778), who was the first to write lyrical dramas in Danish, and who exercised wide influence. A Norwegian, Johan Nordahl Brun (1745-1816), was the principal tragedian of the time, in the French taste. It was a Norwegian, J. H. Wessel (1742-1785), who laughed this taste out of fashion. In 1772 the Norwegian poets were so strong in Copenhagen that they formed a *Norske Selskab* (Norwegian Society), which exercised a tyranny over contemporary letters which was only shaken when Baggesen appeared. Among the leading writers of this period we can but just mention, besides those above named, Claus Frimann (1746-1829), Peter Harboe Frimann (1752-1839), Claus Fasting (1746-1791), Johan Wibe (1748-1782), Edvard Storm (1749-1794), C. H. Pram (1756-1821), Jonas Rein (1760-1821), Jens Zetlitz (1761-1821), and Lyder Christian Sagen (1771-1850), all of whom, though Norwegians by birth, find their place in the annals of Danish literature. To these poets must be added the philosophers Niels Treschow (1751-1833) and Henrik Steffens (1773-1845), and in later times the poet Johannes Carsten Hauch (1790-1872). There is no example of a writer of importance, born in Norway since 1800, who is counted among Danish authors.

The first form which Norwegian literature took as an independent thing was what was called "Syttendemai-Poesi," or poetry of the seventeenth of May, that being the day on which Norway obtained her independence and proclaimed her king. Three poets, called the Trefoil, came forward as the inaugurators of Norwegian thought in 1814. Of these Conrad Nicolai Schwach (1793-1860) was the least remarkable. Henrik Anker Bjerregaard (1792-1842), born in the same hamlet of Ringsaker as Schwach, had a much brighter and more varied talent. His poems, collected at Christiania in 1829, contain some charming studies from nature. He brought out a tragedy of *Magnus Barfods Sönner* (Magnus Barefoot's Sons) and a lyrical drama, *Fjeldeventyret* (The Adventure in the Mountains), 1828. The third member of the Trefoil, Mauritz Christopher Hansen (1794-1842), was a laborious and fecund worker in many fields. His novels, of which *Ottar de Bretagne*, 1819, was the earliest, were much esteemed in their day, and after Hansen's death were collected and edited, with a memoir by Schwach. Hansen's *Poems*, printed at Christiania in 1816, were among the earliest publications of a liberated Norway, but were preceded by a volume of *Smaadigte* (Short Poems) by all three poets, edited by Schwach in 1815, as a semi-political manifesto. These writers, of no great genius in themselves, did much by their industry and patriotism to form a basis for Norwegian literature to be built upon. They wrote, however, on national themes without much knowledge, and in complete bondage to the conventional forms in vogue in Copenhagen in their youth.

The creator of Norwegian literature, however, was the poet Henrik Arnold Wergeland (1808-1845), a man of great genius and enthusiasm, who contrived within the limits of a life as short as Byron's to concentrate the labours of a dozen ordinary men of letters. He held views in most respects similar to those pronounced by Rousseau and Shelley; he never ceased to preach the dignity of man, the worth of liberty to the individual and of independence to the nation, and the relation of republican politics to a sound form of literature. His own ideal of literature, however, was at first anything but sound. He was the eldest son of Professor Nikolai Wergeland (1780-1848), who had been one of the constitutional assembly who proclaimed the independence of Norway in 1814 at Eidsvold. Nikolai was himself pastor of Eidsvold, and the poet was thus brought up in the very holy of holies of Norwegian patriotism. His earliest efforts in literature were wild and formless. He was full of imagination, but without taste or knowledge. He published poetical farces under the pseudonym of "Siful Sifadda," trifles unworthy of attention. These were followed, in 1828, by *Sinclair's Death*, an unsuccessful tragedy; and in 1829 by a volume of lyrical and patriotic poems, which attracted the liveliest attention to his name. At the age of twenty-one he became a power in literature,—nay more, an influence in the state. But these writings were coldly received by connoisseurs, and a monster epic, *Skabelsen, Mennesket, og Messias* (Creation, Man, and Messiah), which followed in 1830, showed no improvement in style. From 1831 to 1835 Wergeland was submitted to severe satirical attacks from Welhaven and others, and his style became improved in every respect. His popularity waned as his poetry improved, and in 1840 he found himself a really great poet, but an exile from political influence. His *Jan van Huysums Blomsterstykke* (J. van Huysum's Flower-piece), 1840, *Svalen* (The Swallow), 1841, *Jöden* (The Jew), 1842, *Jödinden* (The Jewess), 1844, and *Den Engelske Lods*

(The English Pilot), 1844, form a series of narrative poems in short lyrical metres which remain the most interesting and important of their kind in Norwegian literature. He was less successful in other branches of letters; in the drama, neither his *Campbellerne* (The Campbells), 1837, *Venetianerne* (The Venetians), 1843, nor *Sökadetterne* (The Cadets), 1848, has achieved any lasting success, while his elaborate contribution to political history, *Norges Konstitutions Historie*, 1841-43, is forgotten. The poems of his last five years, however, enjoy as true a popularity as ever, and are not likely to lose it. The only influence which Wergeland, in spite of his genius, has had on Norwegian literature is the removal of traditions and the release of style in various directions. His obscurity and extravagance have stood in the way of his teaching, and his only disciples in poetry have been Sylvester Sivertson (1809-1847), a journalist of talent whose verses were collected in 1848, and Christian Monsen (1815-1852)

A far more wholesome and constructive influence was that of Johann Sebastian Cammermeyer Welhaven (1807-1873), who was first brought to the surface by the conservative reaction in 1830 against the extravagance of the radical party. His first publications were polemical, and were mainly directed against Wergeland. A savage attack on *Henrik Wergeland's Poetry*, published in 1832, caused a great sensation, and produced an angry pamphlet in reply from the father, Nikolai Wergeland. The controversy became the main topic of the day, and in 1834 Welhaven pushed it into a wider arena by the publication of his beautiful cycle of satirical sonnets called *Norges Dæmring* (The Dawn of Norway), in which he preached a full conservative gospel. Norway has not followed Welhaven in politics, but it certainly has in literature. The salutary character of his advice was instantly felt by the younger men of letters. As a poet and as a critic he continued to do admirable work. He published volumes of lyrical and romantic poems in 1839, 1845, 1848, 1851, and 1860; and he enriched the language by two excellent critical studies, one on *Holberg*, 1854, and the other on *Ewald and the Norwegian Club*, 1863. His collected works appeared in eight volumes in 1867-68. He was assisted in his controversy with Wergeland by Henrik Hermann Foss (1790-1853), author of *Tidsnornerne* (The Norns of the Age), 1835, and other verses.

Andreas Munch (b. 1811), the oldest now-living Norwegian author of any repute, has been one of the most rapid and industrious of poetical writers. He took no part in the feud between Wergeland and Welhaven, but addicted himself to the study of Danish models independently of either. He published a series of poems and dramas, one of which latter, *Kong Sverres Ungdom*, 1837, attracted some notice, without securing much position. His popularity commenced with the appearance of his *Poems Old and New* in 1848, and has only lately begun to decline. Andreas Munch makes little or no appeal to the highest poetical susceptibilities; his work is melodious, facile, and graceful, but without depth of feeling or artistic beauty. His highest level as a poet was reached by his epic called *Kongedatterens Brudefart* (The Bridal Journey of the King's Daughter), 1861. Two of his historical dramas have enjoyed a popularity greatly in excess of their merit; these are *Solomon de Caus*, 1854, and *Lord William Russell*, 1857. Munch published a fragment of an autobiography in 1874, with the title of *Barndoms- og Ungdoms-minder* (Memoirs of Childhood and Youth).

A group of minor poetical writers may now be considered. Magnus Brostrup Landstad (1802-1881) was born on Maasö, an island in the vicinity of the North Cape, and therefore in higher latitudes than any other man of letters. He was a hymn-writer of merit, and he was the first to collect, in 1853, the *Norske Folkeviser*, or Norwegian folk-songs. Landstad was ordered by the Government to prepare an official national hymn-book which was brought out in 1861. Peter Andreas Jensen (1812-1867) published volumes of lyrical poetry, mostly to edification, in 1838, 1849, 1855, and 1861, and two dramas. He was also the author of a novel, *En Erindring* (A Souvenir), in 1857. Aasmund Olafsen Vinje (1818-1870) was a peasant of remarkable talent, who was the principal leader of the movement known as the "maalstræv," an effort to distinguish Norwegian from Danish literature by the adoption of a peasant dialect, or rather a new language arbitrarily formed on a collation of the various dialects. Vinje wrote a volume of lyrics, which he published in 1864, and a narrative poem, *Storegut* (Big Lad), 1866, entirely in this fictitious language, and he even went so far as to issue in it a newspaper, *Dölen* (The Dalesman), which appeared from 1858 to Vinje's death in 1870. In these efforts he was supported by Ivar Aasen, to whom we shall return, and by Kristoffer Jansen (b. 1841), now the only remaining "maalstræver," who resides in the United States, and who is the author of various important works,—an historical tragedy, *Jon Arason*, 1867; several novels,—*Fraa Bygdom*, 1865; *Torgrim*, 1872; *Fra Danskætid*, 1875; *Han og Ho*, 1878; and *Austanfyre Sol og Vestanfyre Maane* (East of the Sun and West of the Moon), 1879; besides a powerful but morbid drama in the ordinary language of Norway, *En Kvindeskjebne* (A Woman's Fate), 1879. Superior to all the preceding in the quality of his lyrical writing was the late bishop of Christiansand, Jörgen Moe (1813-1882), author of three little volumes of exquisite verses, published in 1850, 1851, and 1853. He is, however, better known by his labours in comparative mythology, in conjunction with P. C. Asbjörnsen.

The mixture of such opposite elements as the wild genius of Wergeland and the cold critical judgment of Welhaven would seem to have formed a singularly happy basis for the writers of the next generation to build a literature upon. The now-living poets of Norway may hold their own without fear of too severe a rivalry, not merely with those of Denmark and Sweden, whom they easily excel, but with those of the great powers. There can be no reasonable question that Ibsen and Björnson are the two most original figures of their generation in the Teutonic world of imagination. But their energy, and that of their companions, has been almost entirely confined to two fields,—the drama and the novel. The narrative and epical forms of poetry, and even the lyric in its more ambitious directions, have not flourished in the modern Norwegian school. The most conspicuous name in Norwegian literature is that of Henrik Ibsen (b. 1828). His early efforts were not remarkable, and to this day he has not succeeded in any field but the drama, where he is a master. His first tragedy, *Catilina*, 1850, was a work of little importance. It was not until 1856 that he came forward with a romantic drama, *Gildet paa Solhaug* (The Feast at Solhaug), in which an individual style was noticeable. Two successive tragedies, *Fru Inger til Österaad*, 1857, and *Hærmændene paa Helgeland* (The Warriors on Helgeland), 1858, displayed a sudden development of power. In 1863, at last, he wrote an historical tragedy, *Kongsemnerne* (The Pretenders), which is a work of maturer genius. He had by this time, however, been drawn into a new channel. In 1862 he began his series of lyrico-satirical dramas on modern Norwegian life with his *Kjærlighedens Komedie* (Love's Comedy), a brilliant study, which was succeeded by two masterpieces of a similar kind, *Brand* in 1866, and *Peer Gynt* in 1867. These were long dramas, written entirely in octosyllabic rhyming verse. In *De Unges Forbund* (The Young Men's League), 1869, which was a political satire of much force, he abandoned verse, and has since written all his dramas in prose. In 1871 he collected his lyrical poems, and in 1873 he published *Kejser og Galilæer* (Emperor and Galilean), a double drama of portentous size, on the career of Julian the Apostate. Since that time he has published, about once in every two years, satirical comedies of great pungency and wit, laying bare some sore of modern social life among his countrymen,—*Samfundets Stötter* (The Pillars of Society), in 1877; *Et Dukkehjem* (A Doll's House, or Nora), in 1879; *Gengangere* (Ghosts), in 1881; and *En Folkefiende* (An Enemy to the People), in 1883. The last of these is a humorous apology for the poet's severity as a satirist, which in his latest works has seemed excessive even to his greatest admirers. He has lived in voluntary exile from Norway since 1864.

It has been a misfortune to Björnstjerne Björnson (b. 1832) that he was born four years later than Ibsen, with whose powers his might else be more exactly matched. It is possible that in some respects his mind is more richly endowed than Ibsen's, and it would seem to be more versatile; the elder poet, however, is the superior artist, and has his qualities under more severe control. Björnson has made several false starts; Ibsen scarcely one. The first successes of Björnson were made in the field of the novel, where he adapted from the German school of "dorfgeschichten," a species of realistic and yet romantic tale of life among the peasants in the mountains, which was singularly charming and attractive. Of these the two first, *Synnöve Solbakken*, 1857, and *Arne*, 1858, were among the best, and made his name famous. His ambition, however, was to excel in dramatic writing, and after three comparative failures—*Halte Hulda* (Halting Hulda), 1858; *Mellem Slagene* (Between the Battles), 1859; and *Kong Sverre* (King Sverre), 1861—he made a great success with his heroic trilogy of *Sigurd Slembe* in 1862. In the meantime small sketches of peasant life, and the exquisite little story called *En Glad Gut* (A Merry Lad), had supported his reputation. In 1863 he brought out a tragedy of *Maria Stuart i Skotland*, and in 1865 a little comedy *De Nygifte* (The Newly-married

Couple), which enjoyed an overwhelming success. Another story, *Fiskerjenten* (The Fisher-Girl), in 1868, was found less fresh and unaffected than his early stories, and he returned to his charming pristine manner in *Brudeslaaten*, 1873. Since that year he has published but one novel, *Magnhild*, 1877, and a slight study of Italian life, *Kaptejn Mansana*, 1879, neither quite worthy of his genius. All his other productions have been dramatic. Fired with emulation for Ibsen, he has written *Sigurd Jorsalfar*, in 1878, an historical saga-drama, and a series of satirical comedies,—*En Fallit* (A Bankruptcy), 1875, an admirable piece; *Redaktören* (The Editor), 1875; *Kongen* (The King), 1877, a political manifesto in four acts; *Leonarda*, 1879; *Det ny System* (The New System), 1879; *En Handske* (A Glove), 1883; and *Over Ævne* (Beyond his Reach), 1883,—the last a very singular study of epileptic hysteria as a factor in religious enthusiasm. Björnson is a republican of the most advanced order, and his views are pushed forward too crudely for artistic effect in several of his later works.

Two writers of novels who owe much to the example of Ibsen and Björnson are Jonas Lie (b. 1833) and Alexander Kielland (b. 1849). Lie was late in developing his talent, and has lost much time in wavering between the sentimental and the realistic schools of treatment. He has finally thrown in his cause with the latter in his last novel *Livs-Slaven*, 1883. His best books have been stories of seafaring life—*Den Fremsynte* (The Man with the Second Sight), 1870; *Tremasteren Fremtiden* (The Threemaster "Future"), 1872; *Lodsen og hans Hustru* (The Pilot and his Wife), 1874; and *Rutland*, 1880. His tales of town-life—*Thomas Ross*, 1878, and *Adam Schröder*, 1879—have less of the novelist's illusion. Kielland may prove to possess a stronger talent than Lie; his progress has been more rapid and steady, and he has a clearer idea of what he wishes to do. He began by being strongly influenced by Zola in his *Garman og Worse*, 1879, and his *Arbeidsfolk* (Working People), 1880. His latest works have shown steady improvement in style and a growing independence of French models. From this, the youngest of distinguished Norwegian writers, we may turn back to a few older names which close the list of novelists. Nicolai Ramm Östgaard (1812-1873) to some extent preceded Björnson in his graceful romance *En Fjeldbygd* (A Mountain Parish), in 1852. Frithjof Foss, who wrote under the pseudonym of Israël Dehn (b. 1830), attracted notice by a series of no less than seven separate stories published between 1862 and 1864, but has been silent since. The two most important women-novelists have been Jacobine Camilla Collett (b. 1813), a cousin of the poet Wergeland, author of *Amtmandens Döttre* (The Governor's Daughters), 1855, an excellent novel, and many other volumes; and Anna Magdalene Thoresen (b. 1819), a Dane by birth, author of a series of novels.

The labours of Peter Christen Asbjörnsen (b. 1812), in conjunction with Bishop Moe, in the collection of the old Norse folk-tales, demand prominent recognition in any sketch of Norwegian literature. Before they were twenty years of age these friends began to write down the stories of the peasants. In 1838 Asbjörnsen first made public some of the results of his investigations in a little publication for children called *Nor*. Not until 1842 did the first authorized edition of the *Norske Folkeeventyr* see the light. It was followed in 1845 by *Huldreeventyr*, or stories about the fairies or sirens which haunt the mountain dairies, by Asbjörnsen alone. Of these a second series appeared in 1848, and in 1871 a new series was published again by Asbjörnsen alone of the *Folkeeventyr*. It was from minstrels, boatmen, vagabonds, and paupers that the best stories were collected, and it is a significant fact that most of these professional reciters are now dead. Had Asbjörnsen and Moe neglected the duty of preserving the ancient legends, they would now, in all probability, be entirely lost. What has been done by Asbjörnsen for the peasant-stories has been done for the dialects in which they were composed by Ivar Aasen (b. 1813). Since 1850 he has received a pension from the state to enable him to study the peasant-patois, and his great dictionary, *Norsk Ordbog*, first printed in 1858, and his other linguistic publications have been the result. He is the creator of the artificial language, the "maal," which Vinje, K. Jansen, and others have written in; and he has published in it a valuable collection of proverbs, 1851.

The principal historian of Norway has been Peter Andreas Munch (1810-1863), whose multifarious writings include a grammar of Old Norse, 1847; a collection of Norwegian laws until the year 1387, 1846-49; a study of Runic inscriptions, 1848; a history and description of Norway during the Middle Ages, 1849; and a history of the Norwegian people, in 8 vols., 1852-63; Jakob Aall (1773-1844) was associated with Munch in this work. Jakob Rudolf Keyser (1803-1864) performed services scarcely less important in printing and annotating the most important documents dealing with the mediæval history of Norway. Carl Richard Unger (b. 1817) has taken part in the same work and edited *Morkinskinna* in 1867. Sophus Bugge (b. 1833) is a leading philologist of a younger school, and Oluf Rygh (b. 1833) has contributed to the archæological part of history. The modern language of Norway found an admirable grammarian in Jakob Olaus Lökke (1829-1881). A careful historian and ethnographer was Ludvig Kristensen Daa (1809-1877). Ludvig Daae (b. 1834) has written the history of Christiania, and has traced the chronicles of Norway during the Danish possession. Bernt Moe (1814-1850) was a careful biographer of the heroes of Eidsvold. Eilert Lund Sundt (1817-1875) published some very curious and valuable works on the condition of the poorer classes in Norway. Professor J. A. Friis (b. 1821) has published the folk-lore of the Lapps in a series of very curious and valuable volumes.

In jurisprudence the principal Norwegian authorities are Anton Martin Schweigaard (1808-1870) and Frederik Stang (b. 1808). Peter Carl Lasson (1798-1873) and Ulrik Anton Motzfelt (d. 1865) were the lights of an earlier generation. In medical science, the great writer of the beginning of the century was Michael Skjelderup (1769-1852), who was succeeded by Frederik Holst (b. 1791). Daniel Cornelius Danielsen (b. 1815) is a prominent dermatologist; but probably the most eminent of recent physiologists in Norway is Carl Wilhelm Boeck (b. 1808). The elder brother of the last-mentioned, Christian Peter Bianco Boeck (1798-1877), also demands recognition as a medical writer. Christopher Hansteen (1784-1873) was prominent in several branches of mathematical and chemical literature, and was professor of mathematics at the university for nearly sixty years. Michael Sars (b. 1805) has obtained a European reputation through his investigations in invertebrate zoology. He has been assisted by his son Georg Ossian Sars (b. 1837). Baltazar Michael Keilhau (1797-1858) and Theodor Kjerulf (b. 1825) have been the leading Norwegian geologists. Mathias Numsen Blytt (1789-1862) represents the section of botany. His *Norges Flora*, part of which was published in 1861, was left incomplete at his death. Niels Henrik Abel (1802-1829) was a mathematician of extraordinary promise; Ole Jakob Broch (b. 1818) must be mentioned in the same connexion. Marcus Jakob Monrad (b. 1816), an Hegelian, is the most prominent philosophical writer of modern Norway. Among theological writers may be mentioned Hans Nielsen Hauge (1771-1824), author of the sect which bears his name; Svend Borchman Hersleb (1784-1836); Stener Johannes Stenersen (1789-1835); Wilhelm Andreas Wexels (1797-1866), a writer of extraordinary popularity; and Carl Paul Caspari (b. 1814), the learned professor of theology in the university of Christiania.

No very recent compendium of Norwegian literature exists. *La Norvège Littéraire*, by Paul Botten-Hansen (1824-1869), is an admirable piece of bibliography so far as it reaches, but comes down no farther than 1868. Professor L. Dietrichson published in 1866 the first and only part of an *Omrids af den Norske Poesis Historie* (Outline of the History of Norwegian Poetry). J. B. Halvorsen is now publishing a *Norsk Forfatter-Lexikon*, 1814-1880 (Norwegian Dictionary of Authors); this promises to be a very valuable work, but has not as yet proceeded beyond the letter B. In English see the earlier chapters of Gosse's *Northern Studies* (1879; 2d edition, 1883). (E. W. G.)

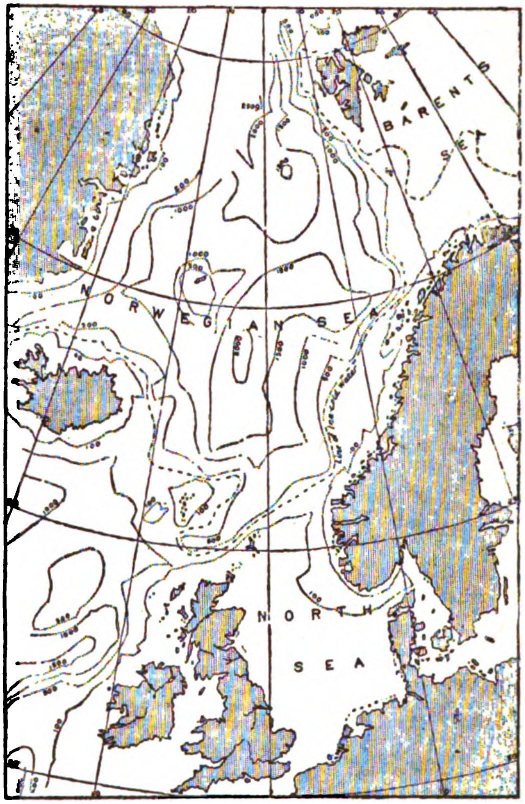
NORWEGIAN SEA. The sub-polar regions of the Atlantic lying between the Scandinavian peninsula and Greenland have been in recent years carefully investigated by Norwegian expeditions under Professors Mohn and Sars; and, as the sea immediately to the west of Norway has not hitherto been known by any distinctive name, Mohn has proposed the name of "Norwegian Sea,"—a suggestion which has been now generally adopted. The Norwegian Sea, therefore, includes the whole of the region between Greenland and Norway, a portion of which, to the north-west of the island of Jan Mayen, is sometimes known as the Greenland Sea. The Norwegian Sea is a well-marked basin cut off from the Atlantic by submarine ridges connecting the north of Scotland, the Faroe Islands, Iceland, and Greenland. On the summit of these ridges there is an average depth of about 250 fathoms. Between Spitzbergen and Lapland there is a wide opening into the Barents Sea, where the depth is from 100 to 200 fathoms. Between Spitzbergen and Greenland a wide and deep opening extends into the frozen Arctic Ocean, with a depth of 2500 fathoms. The surrounding land is almost everywhere high, rugged, deeply indented with fjords, and skirted with outlying islands, which are mostly composed of stratified rocks and ancient geological formations. Jan Mayen, situated near the centre of the basin, Iceland, and the Faroe Islands are of volcanic origin.

The marked peculiarity of the Norwegian Sea is the striking contrast in the climate of its eastern and western portions. If we draw a line from the east side of Iceland to the south end of Spitzbergen we have, generally speaking, on the west of this line a sea covered with ice during the whole of the year, throughout nearly its entire extent. It is only rarely that the east coast of Greenland can be approached through the lanes and openings formed in the ice. An arctic current passes southward along the coast of Greenland, carrying with it vast fields of hummocky ice, and enters the North Atlantic through the straits which separate Iceland from the coast of Greenland. To the eastward of this line we have a sea free from ice throughout the year. A warm current—the so-called extension of the Gulf Stream—passes between the coasts of Scotland and Iceland, and carries a large amount of heat to the shores of Norway and Lapland, rendering them relatively mild and habitable. The prevailing wind over the western part of the Norwegian Sea is from the north-east, while that over the eastern is from the south-west, in each case corresponding with the direction of the ocean currents. With respect to the relations of the barometric minimum to the prevailing winds and currents see METEOROLOGY, vol. xvi. p. 139.

In March and April a very extensive seal fishery is carried on to the north and east of Jan Mayen along the edge of the ice-fields,—as many as 300,000 young seals having been captured in one season. Large numbers of polar bears are at this time noticed in the neighbourhood of the seal rookeries, and are captured on the ice at great distances from land. Later in the season there is a right whale fishery to the north and west of the island of Jan Mayen. A large number of small vessels from Hammerfest and Lapland ports visit the coasts of Spitzbergen each season to collect eider-down, and to engage in the walrus and shark fisheries. Narwhals (*Monodon*) are also captured along the edge of the ice-floes. Guillemots, little auks, gulls, and other sea-birds are found in vast numbers near the coast of Spitzbergen and along the edge of the pack-ice. Along the coast of Norway there are valuable cod, mackerel, herring, and lobster fisheries. The Norwegian Sea has a depth almost rivalling that of the great Atlantic and Pacific Oceans, that of the whole of the central parts exceeding 1000 fathoms, while to the south-east of Jan Mayen there is a depth of 2000 fathoms, and off Spitzbergen of 2500 fathoms.

The bottom in the western portion is composed of a mixture of mud and stones formed from the detrital matter carried from the land by floating ice, and containing not more than 5 or 6 per cent. of carbonate of lime. In the deeper parts of the eastern portion we have a fine mud or clay containing sometimes 50 per cent. of carbonate of lime, and a total absence of the ice-borne stones and gravel so abundant in the western portion. The carbonate of lime consists chiefly of the shells of *Globigerina* which have fallen from the surface, and some other species of Foraminifera (the most frequent of which is *Biloculina*) which live on the bottom. In some places this deposit approaches in character the *Globigerina* ooze or mud of the Atlantic, but is very poor in pelagic shells when compared with the deposits in lower latitudes. The pelagic Foraminifera and Pteropod shells so abundant in tropical parts of the Gulf Stream are killed off and fall to the bottom as they are carried into the colder areas of the North Atlantic. The upper layer of this deposit is of a brownish colour, and is less compact and contains more lime than the deeper layers, which have a blue or greyish colour. In this respect it agrees with the deposits found at similar depths around all continental shores. The deposits along the Norwegian coast, in depths less than 1000 fathoms, consist chiefly of detrital matter from the shores, the mineral particles consisting of quartz, felspars, mica, hornblende, magnetite, and fragments of rocks. Around Jan Mayen and Iceland the deposits consist largely of volcanic sand. In all the deposits there are many Diatom frustules.

The isotherms of the atmosphere receive a very remarkable deflexion to the north along the coast of Norway, as may be seen by reference to the article METEOROLOGY, figs. 8-11 (vol. xvi. pp. 133, 135, 136). A similar remarkable deflexion takes place with the isotherms of the ocean, showing the temperature of the sea surface. In January the warmest water is found at a distance of over 100 miles from the coast, and ranges from 46° Fahr. in the south to 36° Fahr. in the north. In July and August the warmest water is found close along the shore, the range being from 60° Fahr. in the south to 47° Fahr. in the north. This is due to the cooling effect of the land in winter and its warming effect in summer. In the western part of the Norwegian Sea ice-cold water is found at the surface throughout the year. The deeper parts are wholly filled with ice-cold water, this temperature being met with off the coast of Norway at a depth of 400 or 600 fathoms. The remarkably mild and genial temperature of Norway, considering its latitude, is to be accounted for (1) by the warm current from the south which flows northwards over the banks and fills up the deep fjords beyond with water of a relatively high temperature; (2) by the banks which extend along its shores with a depth of between 100 and 200 fathoms,—sometimes stretching out several hundred miles from the land and thus keeping the ice-cold water of the basin out of the deep bays and fjords. The water at the bottom of the deep fjords usually ranges from 40° Fahr. to 43° Fahr. throughout the year. In summer the surface is warmer than the bottom water in these fjords, but in winter it is several degrees colder (see NORWAY, p. 580). The bottom water in the fjords is not affected by the cold of winter or heat of summer, owing to the great depth in connexion with the slow rate at which changes of temperature are communicated through the water. The specific gravity ranges from 1·0265 along the coast of Norway to 1·0250 among the ice-floes off the coast of Greenland.



Map of Norwegian Sea.

The narrow and deep channel running between the Faroe Islands and the north of Scotland must be specially referred to on account of the deep-sea investigations which have been there carried on. Indeed the widespread interest taken at the present time in the deep sea arose in a great degree from the interesting discoveries made in this channel by Dr Carpenter and Wyville Thomson in 1868 and 1869, in H.M.S. "Porcupine" and "Lightning." Two areas were found, one having at the bottom a temperature of 30° Fahr. and the other a temperature of 45° Fahr. The faunas in the two areas were likewise characterised by remarkable differences. There appears to have been no suspicion that a submarine ridge separated the bottom water of the one area from that of the other. The researches carried on in H.M.S. "Challenger" showed that in all cases there were indications of submarine ridges separating areas in which a difference of temperature was found at the bottom. In the years 1880 and 1882 this channel was again investigated by H.M.S. "Knight Errant" and "Triton." A ridge, now called the Wyville Thomson ridge, was discovered running in a north-north-west direction from the north of Scotland to the Faroe banks, and separating the warm and cold areas. The average depth on this ridge is 250 fathoms, but there is a small saddle-back in the northern portion of it with a depth of a little over 300 fathoms. Ice-cold water was traced to the top of this ridge, and through the saddle-back to the south-west margin. Here the cold water is met by the warm current passing to the north-east, a mixture takes place, and the whole flows towards the north-east. No true ice-cold current appears to pass into the Atlantic through the Faroe channel (see the map). That the ridge is swept by strong tidal currents as well as by the steady flow to the north-east is shown by the fact that no fine deposit is allowed to accumulate on it, and by the particles of sand and gravel from the ridge which are spread over the sea-bottom to the north-east. Over the ridge large smooths and wellings up of water take place at certain times as the great tidal wave passes through this channel into the North Sea. The top of the ridge, which is about 5 miles wide, is covered with gravel and rocks, many of them rolled and glaciated, consisting of granite, gneiss, mica-schists, sandstone, limestone, diorites, &c. On both sides of the ridge a mud is found containing Foraminifera shells, Diatoms, and minute mineral fragments, such as quartz, mica, hornblende, augite, felspars, magnetite, glauconite, &c. Mineral particles from the ridge are much more numerous and larger in the cold than in the warm area, thus indicating the direction in which the currents sweep. The stones resemble those of the Orkneys, and were most probably carried to their present position by glaciers or icebergs during the Glacial period. Since temperature is the most important factor in the distribution of marine species it is not astonishing to find a considerable difference in the fauna on each side of the ridge. Mr Murray states that in the "Knight Errant" dredgings, of seventy-one species from the warm area and forty-seven from the cold area, the depths being about the same and the distance only about 40 miles apart, there were only two common to both areas. The animals from the cold area are chiefly arctic forms, and resemble closely those from similar depths off the east coast of North America, while those from the warm area have a southern and abyssal character. We have indeed in the Faroe channel a curious mixture of arctic, abyssal, and modified British faunas, the distribution and limits of which have not yet been worked out. A thorough investigation of this channel in its hydrographical and biological relations is still a great desideratum.

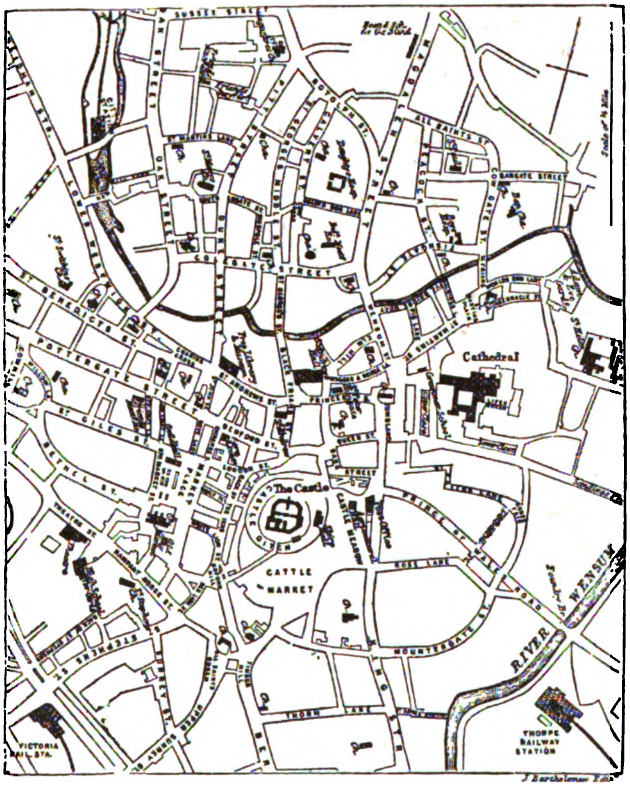
The Norwegian Sea exhibits an abundant pelagic fauna and flora. The warm water of the Gulf Stream very frequently brings to the coasts of Norway animals usually met with only at lower latitudes. Diatoms and other minute Algæ are found in vast banks, especially in the neighbourhood of the melting ice, giving the water a peculiar green colour. This green-coloured water is regarded by the whalers as one of the best indications of good fishing grounds. Entomostraca, Medusæ, Ctenophora, Siphonophora, Pteropods, and Radiolarians are also to be found in great abundance on the whaling grounds. The deep-sea dredgings of the Norwegians do not show such an abundant or rich fauna as is met with at similar depths in more southern latitudes.

See Wyville Thomson, *The Depths of the Sea* (2d ed., London, 1874); "Preliminary Report of the Scientific Exploration of the Deep Sea in H.M. Surveying-vessel 'Porcupine' during the Summer of 1869, conducted by Dr Carpenter, Mr J. Gwyn Jeffreys, and Professor Wyville Thomson," in *Proc. Roy. Soc.*, vol. xviii. p. 397 (1870); *The Norwegian North-Atlantic Expedition* (1876-78), by Professors Mohn, Sars, and others; "Exploration of the Faroe Channel during the Summer of 1880, in H.M.'s hired ship 'Knight Errant,' by Staff-Commander Tizard, R.N., and John Murray, with subsidiary reports by various scientific men," in *Proc. Roy. Soc. Edin.*, vol. xi. p. 638 (1882); and "Remarks on the Soundings and Temperatures obtained in the Faroe Channel during the Summer of 1882," by Staff-Commander T. H. Tizard, R.N., in *Proc. Roy. Soc.*, vol. xxxv. p. 202 (1883). (J. MU.)

NORWICH, a city of England, the capital of Norfolk, a county of itself and a municipal and parliamentary borough, stands mainly on the right bank of the winding Wensum, a little above its confluence with the Yare, by rail being 20 miles west of Yarmouth, 68½ north-east of Cambridge, and 114 north-north-east of London. The municipal and parliamentary boundaries enclose an area of 7472 acres; but the ancient walls (1294-1342), some portions of which remain, with their twelve gate-houses—the last demolished in 1808—were only 4 miles in circuit. Those narrow limits were long ago outgrown, for Evelyn writes in 1671 that "the suburbs are large, the prospects sweete, with other amenities, not omitting the flower-gardens, in which all the inhabitants excel." Beneath the low chalky heights of Mousehold Heath, once wooded now heathery, lies antique Norwich. "A fine old city, truly," to quote George Borrow, "view it from whatever side you will; but it shows best from the east, where the ground, bold and elevated, overlooks the fair fertile valley in which it stands. At the foot of the heights flows the narrow and deep river, with an antique bridge [Bishop's Bridge, 1295] communicating with a long and narrow suburb, flanked on either side by rich meadows of brightest green, beyond which spreads the city; the fine old city, perhaps the most curious specimen extant of the genuine old English town."

In 1094 the seat of the East Anglian bishopric was removed by Bishop Herbert de Lozinga or Lorraine from Thetford to Norwich, where in 1096 he laid the foundation of the cathedral, and dedicated it to the Holy Trinity in 1101, establishing at the same time a Benedictine monastery. As completed by his successor before the middle of the 12th century the cathedral in style was purely Norman; and it still retains its original Norman plan to a much greater degree than any other English example of equal magnitude. True, changes and additions were made from time to time in the successive styles—the Early English lady chapel (demolished about 1580) belonging to the middle of the 13th century, the mixed Decorated and Perpendicular spire to the 14th, the west front and porch and the lierne stone vaulting of the nave, with its elaborate 328 bosses, to the 15th, and to the 16th the vaulting of the transepts and Bishop Nix's chantry, whilst the fine cloisters, 175 feet square, 12 feet wide, with 45 windows, in style mainly Decorated, were begun in 1297 and not completed till 1430. The following are the dimensions in feet of the cathedral:—total length, 407; length of nave, 204; length of transepts, 178; breadth of nave and aisles, 72; total height of spire, 315 (in England ceeded by Salisbury only); height of tower, $140\frac{5}{12}$; height of nave, 69½; height of choir, 83½. The chief entrance on the west is a Perpendicular archway, above which is an immense window filled with poor modern stained glass. The nave within is grand and imposing, divided by fourteen semicircular arches of great depth and solidity, whose massive piers are in two instances ornamented with spiral mouldings. The triforium is composed of similar arches. The side aisles are low, their vaultings plain. The choir, extending westward some way beyond the crossing, is of unusual length, and terminates in an apse, with the only fragment of an ancient episcopal chair that has been allowed to remain *in situ*. The oak stalls and *misereres* are very richly carved. A curious quatrefoil, opening on the north side of the presbytery, beneath the confessio or relic chapel, deserves mention. There are but two monumental effigies—one of Bishop Goldwell (*c.* 1499), the other of Bishop Bathurst (1837) by Chantrey. Mural monuments are plentiful. Sir William Boleyn, great-grandfather of Queen Elizabeth, is buried on the south side of the presbytery, in the midst of which stood the tomb of Bishop Herbert, the founder. Of three circular apsidal chapels two remain; and in one—the Jesus chapel—the ancient colouring has lately been renewed, this being part of a series of restorations carried out at great cost since 1801. Two richly-sculptured gateways lead to the cathedral—the Erpingham gate (1420) and the Ethelbert gateway (*c.* 1300). The bishop's palace and the deanery are buildings of high antiquity, but both have undergone many alterations. The latter has a well-restored chapel. A beautiful Early Decorated ruin in the palace garden, known as "Bishop Salmon's gateway," is supposed to have been the porch to the great hall (*c.* 1319). The grammar-school is a Decorated edifice of *c.* 1316, originally a chapel, with a "carnary" or crypt below. Among its scholars have been Coke, Lord Nelson, Rajah Brooke, and George Borrow. St Andrew's Hall (124 by 64 feet) is the seven-bayed nave of the Black Friars' church, rebuilt with the aid of the Erpinghams between 1440 and 1470. A splendid specimen of Perpendicular work, with its twenty-eight clerestory windows and chestnut hammer-beam roof, it has served since the Reformation as a public hall, in which from 1824 have been held the triennial musical festivals, second only in date and in fame equal to those of Birmingham. It was restored in 1863. The guildhall, on the site of an earlier tolbooth, is a fine flint Perpendicular structure of 1408-13; one of its rooms, the mayor's council-chamber, fitted up with furniture of the time of Henry VIII., is an interesting specimen of a court of justice of that period.

Of forty-three churches—Perpendicular flintwork, mostly of the 15th century—St Peter Mancroft, restored in 1880-83, is by many esteemed the finest parish church in England. Measuring 212 by 70 feet, it has a richly-ornamented tower and flèche, 148 feet high, with a matchless peal of twelve sweet bells, a long light clerestory of thirty-four windows, a beautiful carved-oak roof, a remarkable font cover, and the tomb of Sir Thomas Browne. St Andrew, St Stephen, St Michael Coslany, St John Maddermarket, St Lawrence, and St Giles—the last with a tower 126 feet high—are also noticeable. A new Roman Catholic church, about to be built at the cost of the duke of Norfolk, will be much the largest and finest of a number of Nonconformist places of worship.



Plan of Norwich.

The museum (1839) has collections of fossils and birds (especially *Raptores*). It houses the literary institution (1822; 26,000 vols.), as also archæological, medical, art, and meteorological societies. Adjoining it is the free library (1857; 8000 vols.). These two buildings mark the site of the 17th-century palace of the dukes of Norfolk, said to have been the largest town-house in the kingdom out of London. The public library (1784; 50,000 vols.) in 1835 was transferred to its present quarters, a handsome building with Doric portico. The Norfolk and Norwich Hospital, first built in 1772, and rebuilt in 1879-83, is in the Queen Anne style, and on the pavilion system, with 220 beds. Other buildings are the lunatic asylum (1877-80; accommodation, 300), the workhouse (1858-60; accommodation, 1057), Jenny Lind Infirmary for sick children (1853), St Giles's or the old men's hospital (1249), Doughty's Hospital (1687), an asylum and school for the indigent blind (1805), the cavalry barracks (1791), the drill hall (1866), the agricultural hall (1882; 175 by 108 feet), the corn exchange (1861; 125 by 81 feet), the post-office (1865), and the theatre (1826). The cemetery (1856; 43 acres) has four mortuary chapels and a striking soldiers' monument (1878).

The textile manufactures of Norwich, once so important, have declined; and now its great industrial establishments are a mustard and starch works employing upwards of 2000 hands, three or four large breweries, and ironworks. Boots, clothing, vinegar, and agricultural implements are also made in large quantities. There is one daily paper, and eight others are published weekly. The corporation consists of a mayor, deputy mayor, and sheriff (elected annually), sixteen aldermen, and forty-eight councillors; and the city has sent two members to parliament since the reign of Edward I. The population has been successively (1801) 36,832, (1831) 61,110, (1871) 80,386, (1881) 87,842—males 40,288, females 47,554—in 20,764 houses (1881).

Norwich seems to have been the *Caer-Gwent* of the Britons, the *Venta Icenorum* of the Romans; and its name of *Nord-wic*, or "north-town," which first appears in the Saxon Chronicle under date 1004, is thought to refer to the large and perfect Roman camp of Caister, 3 miles to the south, which by earlier antiquaries was itself identified with *Venta Icenorum*, and by tradition is said to have been "a city when Norwich was none, for Norwich was built of Caister stone." A Saxon "burh" appears to have stood at Norwich in 767, but the present castle was probably built or rebuilt in the reign of Rufus. Only its keep remains, which, crowning the summit of a steep mound, has been adapted to prison purposes.

Frequently sacked by the Norsemen, Norwich was Guthrum's headquarters in 878, in 1004 was burned by Sweyn, and in 1017 was Canute's residence. In Domesday the city is described as having 1320 burgesses with their families, 25 parish churches, and between 800 and 900 acres of land. Ralph de Guaer in 1075, rebelling against the Conqueror, defended the castle unsuccessfully; in 1122 Henry I. gave Norwich a charter containing the same franchise as that of London, and the government of the city was then separated from that of the castle, the chief magistrate being styled *Præpositus* or provost. In the same reign a colony of Flemish weavers introduced the woollen manufacture at Worstead, about 13 miles from Norwich; and a second colony settled at Norwich itself under Edward III., when the city was made a staple town for the counties of Norfolk and Suffolk. The dauphin plundered and burned the city in 1216; and in 1272 the priory was burnt in a riot between the monks and the citizens. The "black death" of 1348-49 cut off two-thirds of the inhabitants, and in 1381 the Norfolk Levellers, under John le Littester, did much damage; but by 1403 the city had sufficiently recovered to be honoured with a charter, under which it might elect a mayor and two sheriffs. In 1422 the doctrines of the Reformation made their appearance in Norwich; and several persons were executed as Wickliffites or Lollards. Among the list of martyrs is the name of Thomas Bilney, who was burned in 1531. In 1549 the city was the scene of an insurrection which grew out of the enclosure of commons, and was headed by Robert Kett *alius* Knight, a tanner. Norwich, in common with all Norfolk and Suffolk, warmly espoused the cause of the Reformation, and under Elizabeth the burnings of Roman Catholics rivalled the flames which Protestants had fed in former reigns, whilst martyrdoms for heresy of doctrine even among Protestants themselves were far from uncommon. In 1582 the city contained 5000 Dutch and Walloons, Protestant refugees from the Low Countries, who did much to foster manufactures. During the Commonwealth the city was put in defence against the royal cause and the castle was fortified for the service of Cromwell. But at the Restoration Norwich was amongst the earliest to do homage to Charles. In June 1660 the fee-farm of the city was resigned to him, with a present of £1000 in gold; and in 1663 the charter of the city was renewed and enlarged. In 1701 the art of printing, which had been introduced in 1570 but discontinued for many years, was revived, and newspapers began to be printed. The famous "Norwich school" of landscape painting flourished during the first half of the present century, the principal artists being Crome, Cotman, Stark, and Vincent. Distinguished natives were John Kaye or Caius, Archbishop Parker, Robert Greene, Thomas Legge, Bishop Cosin, Bishop Pearson, "Old Crome," William Taylor, Amelia Opie, Harriet Martineau, and Dr Crotch, whilst among residents the best known have been Sir Thomas Erpingham, Bishop Hall, and Sir Thomas Browne.

See A. D. Bayne, *Norwich, its Political, Religious, and Municipal History* (1868); Dean Goulburn, *Sculptures in the Roof of Norwich Cathedral, with a History of the See* (1876); Jarrold, *Handbook to the City of Norwich* (1883); and other works cited under NORFOLK. (F. H. G.)

NORWICH, a city of the United States, one of the county seats of New London county, Connecticut, lies 16 miles from Long Island Sound at the junction of the Yantic and the Shetucket to form the Thames, and 13 miles north of New London by the New London Northern Railroad. The greater part of the city is built on rising ground between the valleys of the confluent streams, and with its white and handsome houses has a highly picturesque effect. Besides the court-house (1873), used for county, township, and city affairs, the more conspicuous edifices are the free academy (1856), the Park Church (Congregational), and Christ Church (Episcopalian). Among the numerous industrial establishments settled at Norwich, on account of the abundant water-power in the district, are cotton, wool, paper and rolling mills (all or a very large scale), as well as factories for firearms, printing-presses, water-wheels, locks, stoves, belts, bolts, wood-type, carriages, &c. Steamers ply daily between the city and New York, and there is a thriving trade in coal, lumber, and general goods. The population of the town was 14,048 in 1860, 16,653 in 1870, and that of the city 15,112 (of the town 21,143) in 1880.

In 1659 the Indian chief Uncas, whose grave may still be seen in the old Indian burying-ground, sold the site of Norwich to Major John Mason and a body of thirty-four settlers. The incorporation of the city dates from 1784.

NORWOOD, a large suburban district of London, county of Surrey, is situated in a hilly and finely-wooded district about 1 mile south-west of Dulwich and 4 south of Lambeth. It is divided into Upper, Lower, and South Norwood, all consisting principally of villa residences and detached houses inhabited by the better classes. Almshouses for the poor of St Saviour's, Southwark, were opened at South Norwood in 1863, a Jewish convalescent home in 1869, and the royal normal college and academy of music for the blind at Upper Norwood in 1872. There is also a Catholic convent and orphanage of the Faithful Virgin. Red pottery ware is manufactured in the neighbourhood. Norwood received its name from an old forest of oak trees. Near it is Gipsy Hill, where at one time dwelt the celebrated Margaret Finch, who died in 1740 at the age of 109, and to whom a monument has been erected in Beckenham churchyard. The population of Norwood (area 1009 acres) in 1871 was 12,536, and in 1881 it was 19,017.

NORWOOD, a municipal suburb of Adelaide, South Australia, is situated about 2 miles north-east of the centre of the city, with which it is connected by a tramway. It possesses a post and telegraph office, a mechanics' institute, and a branch of the bank of Adelaide. Norwood along with Kensington forms a municipality, with an area of 1½ square miles and a population in 1881 of 10,087.

NOSE. See SMELL.

NOSSI-BÉ, an island off Passandava Bay, on the north-west coast of Madagascar, in 13° 23′ S. lat. and 45° 59′ E. long., is situated 149 miles from Mayotte, and governed, along with the smaller island of Nossi-komba, by a French commandant subordinate to the governor of Mayotte. Nossi-bé is of volcanic formation, the north and south parts of older, the central part of more modern date. Besides a number of true volcanic craters of no great height (the culminating point of the island is only 1486 feet above the sea), M. Velain found a great many crater-lakes or circular troughs level with the ground—the result, probably, of subterranean explosions which did not last long enough to allow the lava to reach the surface (see *Nature*, March 1877, p. 417). Nossi-bé has an area of 481,845 acres (nearly 750 square miles), of which not more than 1800 or 2000 acres are planted with sugar-cane, coffee, &c. Trade is mainly carried on with Madagascar, though a few vessels come directly from Zanzibar or Bombay. In 1878 the value of the imports was 1,470,449 francs, that of the exports 2,092,385. The population, consisting mainly of Sakalavas, varies considerably in number. Hellville, the European chief town (so called after De Hell, governor of Réunion at the time of the French annexation), had in 1878 from 1200 to 1500 inhabitants and the rest of the island about 6000.

In 1837 Tsiomeika, queen of the Sakalavas, was expelled by the Hovas and fled to Nossi-bé and Nossi-komba. Failing to obtain assistance from the imam of Muscat, she accepted French protection. In 1349 a vigorous attempt was made to expel the French. See Von Jedina in *Revue géogr. internat.*, 1877.

NOSTRADAMUS (1503-1566), the assumed name of MICHEL DE NOTREDAME, a French astrologer, who was descended from a family of Jewish origin, and was born at St Remi in Provence 13th December 1503. After completing a course of study in humanity and philosophy at Avignon, he entered the school of medicine at Montpellier, where he eventually took the degree of doctor of medicine in 1529. Shortly afterwards he settled at Agen, and in 1544 he established himself at Salon near Aix in Provence. Both at Aix and at Lyons he acquired great distinction by his devoted and skilful labours during terrible outbreaks of the plague, and he was already well known before he appeared in the character of a seer. In 1555 he published at Lyons a book of rhymed prophecies under the title of *Centuries*, which secured him the notice of the superstitious Catherine de' Medici of France; and in 1558 he published a second and enlarged edition with a dedication to the king. The seeming fulfilment of some of his predictions greatly increased his influence, and Charles IX. named him his physician in ordinary. He died 2d July 1566.

The *Centuries* of Nostradamus have been frequently reprinted, and have been made the subject of many commentaries. In 1781 they were condemned by the papal court, being supposed to contain a prediction of the fall of the papacy. Nostradamus was the author of a number of smaller treatises. See especially Bareste, *Nostradamus* (Paris, 1840).

NOTARY or NOTARY PUBLIC. In Roman law the *notarius* was originally a slave or freedman who took notes (*notæ*) of judicial proceedings in shorthand or cipher. The notary of modern law corresponds rather to the *tabellio* or *tabularius* of Roman law than to the *notarius*. In the canon law the notary was a person of great importance, and it was a maxim of that law that his evidence was worth that of two unskilled witnesses.

In most European countries he still holds something of his old position under the canon law. In France, for instance, a document attested by a notary is said to be "legalized," a term much too strong to express the effect of such attestation in England, where the notary public, in spite of his name, is not recognized as a public officer to such a degree as the notary in other countries. The office of notary in England is a very ancient one. It is mentioned in statute law as early as the Statute of Provisors, 25 Edward III. stat. 4. The English notary is a skilled person, nominated since 25 Henry VIII. c. 21 by the archbishop of Canterbury through the master of the faculties (now the judge of the provincial courts of Canterbury and York), in order to secure evidence as to the attesta-

tion of important documents. All registrars of ecclesiastical courts must be notaries.

The office is still nominally an ecclesiastical one, though its duties are mainly of a secular character. "The general functions of a notary consist in receiving all acts and contracts which must or are wished to be clothed with an authentic form; in conferring on such documents the required authenticity; in establishing their date; in preserving originals or minutes of them which, when prepared in the style and with the seal of the notary, obtain the name of original acts; and in giving authentic copies of such acts" (Brooke, *On the Office of a Notary*, chap. iii.). The act of a notary in authenticating or certifying a document is technically called a "notarial act." In most countries the notarial act is received in evidence as a semi-judicial matter, and the certificate of a notary is probative of the facts certified. But English law does not recognize the notarial act to this extent. An English court will, in certain cases, take judicial notice of the seal of a notary, but not that the facts that he has certified are true, except in the case of a bill of exchange protested abroad.

The most important part of an English notary's duty at the present day is the noting and protest of foreign bills of exchange in case of non-acceptance or non-payment. This must be done by a notary in order that the holder may recover. He also prepares ship protests and protests of other kinds relating to mercantile matters. The office of notary is now usually, though not necessarily, held by a solicitor. In London he must be free of the Scriveners' Company. The principal statutes relating to English notaries are 25 Henry VIII. c. 21; 41 George III. c. 79; 3 and 4 William IV. c. 70; 6 and 7 Vict. c. 90.

In Scotland, before the reign of James III., papal and imperial notaries practised until the third parliament of that king, held at Edinburgh on the 29th November 1469, when an Act was passed declaring that notaries should be made by the king. It would appear, however, that for some time afterwards there were in Scotland two kinds of notaries, clerical and legal,—the instruments taken by the latter bearing faith in civil matters. In 1551 an Act was passed directing sheriffs to bring or send both kinds of notaries, to the lords of session to be examined; and in a subsequent statute, passed in 1555, it was ordained that no notary, "by whatsoever power he be created," should use the office "except he first present himself to the said lords, showing his creation, and be admitted by them thereto." It does not appear that this statute vested the right of making notaries in the court of session; but in 1563 it was by law declared that no person should take on him the office, under the pain of death, unless created by the sovereign's special letters, and thereafter examined and admitted by the lords of session. Since then the court of session has in Scotland exercised full and exclusive authority on the admission of notaries in all legal matters, spiritual and temporal. The position of notaries in Scotland is somewhat higher than it is in England. Certain facts connected with the title to land must be authenticated by notarial instrument, 21 and 22 Vict. c. 76. A notary may execute a deed for a person unable to write, 37 and 38 Vict. c. 94, s. 41. The parish clergyman has notarial powers to the extent of executing a will,—a relic of the old ecclesiastical position of notaries.

In America the duties of a notary vary in different States. "They are generally as follows:—to protest bills of exchange and draw up acts of honour; to authenticate and certify copies of documents; to receive the affidavits of mariners and draw up protests relating to the same; to attest deeds and other instruments; and to administer oaths" (Bouvier, *Law Dictionary*).

NOTICE. The primary meaning of notice is knowledge (*notitia*), as in "judicial notice;" thence it comes to signify the means of bringing to knowledge, as in "notice to quit;" at last it may be used even for the actual writing by which notice is given. The most important legal uses of the word are judicial notice and the equitable doctrine of notice. Judicial notice is the recognition by courts of justice of certain facts or events without proof. Thus in England the courts take judicial notice of the existence of states and sovereigns recognized by the sovereign of England, of the dates of the calendar, the date and place of the sittings of the legislature, &c. The equitable doctrine of notice, so called because it was a doctrine formerly peculiar to the courts of equity, is that a person who purchases an estate, although for valuable consideration, after notice of a prior equitable right, will not be enabled by getting in the legal estate to defeat that right. On the other hand, a purchaser for valuable consideration without notice of an adverse title is as a rule protected in his enjoyment of the property. Other common uses of the word are notice to quit, notice of dishonour, notice of action (generally necessary in case of a breach of duty created by statute), notice of trial, notice in lieu of service of a writ (where the defendant is a foreigner out of the jurisdiction), notice to produce, &c. Notice may be either express or constructive. The latter is where knowledge of a fact is presumed from the circumstances of the case, *e.g.*, notice to a solicitor is usually constructive notice to the client. Notice may be either oral or written. It is usually advisable to give written notice even where oral evidence is sufficient in law, as in the case of notice to quit. The American use of notice is practically the same as in England.

NOTKER, a name of somewhat frequent occurrence in the ecclesiastical history of the Middle Ages. Among those by whom it was borne two are specially distinguished. NOTKER BALBULUS (*c.* 840-912) was a native of northern Switzerland, and, having become a monk of the monastery of St Gall, held the position of "magister" in its school for many years. He was canonized in 1513. Balbulus compiled a martyrology and was the author of other works, but is mentioned principally in connexion with his services to church music and with the "sequences" of which he was the composer. See HYMNS, vol. xii. p. 583. NOTKER LABEO, also a monk of St Gall, died on 29th June 1022. His translations of the Old Testament Psalms, the *De Consolatione* of Boetius, the *Categories* of Aristotle, and some other works into Old High German are of considerable philological interest. See vol. x. p. 517.

NOTO, a city of Italy, in the province of Syracuse (Sicily), 24 miles south-west of Syracuse by road on the way to Modica. Built on a new site after the earthquake of 1693, it is laid out in modern style, and contains a number of handsome mansions belonging to the provincial aristocracy. The population of the city was 15,925 in 1881; that of the commune, 16,590 in 1871, reached 18,239 in 1881.

Netum or Neetum (Νέητον) was one of the cities left to Hiero of Syracuse by the treaty of 263 B.C. Like Messana and Tauromenium (Taormina) it was a *fœderata civitas* in the time of Cicero, and at a later date it still enjoyed the rare privileges of a Latin town. Under the Saracens it was a place of importance and gave its name to one of the divisions of the island, Val di Noto. It was one of the last of the towns of Sicily to surrender to Roger the Norman. In 1837 it was made capital of the province instead of Syracuse, but this dignity was restored to the larger city by the new Italian parliament.

NOTTINGHAM or NOTTS, an inland county of England, is bounded N. by Yorkshire and Lincolnshire, W. by Derbyshire, S. by Leicestershire, and E. by Lincolnshire. It is of an irregular oval shape, its length from north to south being about 50 miles, and its greatest breadth from east to west about 25 miles. The area is 527,752 acres, or nearly 825 square miles.

The surface, though for the most part low, generally presents a pleasant diversity of hill and dale. The northern part is included in the great plain of York, and in the extreme north there is some extent of marshes. The valley of the lower Trent and that of the Idle are also very flat. In the south-west, between Nottingham and Warsop, the undulations swell into considerable elevations, reaching near Mansfield a height of about 600 feet. This district includes Sherwood Forest, of which, in 1609, there were 44,839 acres enclosed, 9486 woods, and 35,080 waste.

Some portions of it are still retained in their original condition, and there are several very old oaks. The county generally is finely wooded, although to the east of the valley of the Soar there is a considerable stretch of wolds. The principal rivers are the Trent, the Erewash, the Soar, and the Idle. The Trent, which enters the county near Thrumpton, where it receives the Erewash from the north and the Soar from the south, flows north-east past Nottingham and Newark, where it takes a more northerly direction, forming the northern part of the eastern boundary of the county till it reaches the Isle of Axholm (Lincolnshire). The Soar forms for a short distance the boundary with Leicester, and the Erewash the boundary with Derby. The Idle, which is formed of several streams near Sherwood Forest, flows northwards to Bawtry, and then turns eastward to the Trent. The Idle has been made navigable from Bawtry to the Trent. There are also several canals.

Geology and Minerals.—The oldest rocks of the county are the Coal-measures, which, forming part of the Yorkshire, Nottingham, and Derby coalfield, stretch in from Derby, occupying principally the district west of a line drawn from Nottingham to Kirkby, although coal is obtainable below the other rocks as far east as Lincolnshire, at a depth of probably less than 4000 feet. The principal workable seams are the Top Hard, the Deep Soft, the Deep Hard, and the Kilbourne coal. In 1881 there were thirty-nine collieries, producing together 4,758,060 tons. Ironstone is found, but not in sufficient quantities to make its working profitable. The Coal-measures are bounded by a narrow strip of Permian rocks, consisting chiefly of magnesian limestone, which is overlaid by the Middle Permian marls and sandstones. Red and white sandstone, freestone, and magnesian limestone are quarried in the neighbourhood of Mansfield. The lower beds of the limestone are made use of for paving-stones. The remainder of the county is occupied chiefly by the New Red Sandstone. The higher ridge between the Idle and the Trent is occupied by the Upper Keuper marls and sandstones. Lias occurs southeast from Cropwell to the neighbourhood of Newark. Along the valleys and on the tops of the hills there is generally a coating of drift. The banks of the Trent are occupied by river gravels, and along the Idle there is a large deposit of mud as well as of gypsum, the latter being dug for manure and for plastering and floors. Valuable beds of gypsum also occur in various parts of south Nottinghamshire.

Agriculture.—As the higher regions of Derby and Yorkshire attract the rain-clouds, the climate of Nottingham is much above the average in dryness, and on that account crops ripen nearly as early as in the southern counties. The soil of about one-half the county is gravel and sand, including Sherwood Forest, where it inclines to sterility, and the valley of the Trent, where there is a rich vegetable mould on a stratum of sand or gravel. The land along the banks of the Trent is equally suitable for crops and pasture. The farms generally are of moderate size, the great majority being under 300 acres. Most of the immediate occupants are tenants-at-will. Considerable improvements have taken place in the farm buildings and cottages, most of them being now built of brick and tile. According to the agricultural returns for 1883, there were 454,217 acres, or nearly nine-tenths, of the total area under crops. Corn crops occupied 142,305 acres, of which 51,250 were under wheat, 47,479 under barley or bere, and 27,090 under oats. Green crops occupied 50,151 acres, 34,925 of these being occupied by turnips and swedes, 6613 by potatoes, and 4685 by vetches. As many as 185,060 acres were in permanent pasture, while 54,684 were under clover, and 21,956 fallow. A common custom is to fallow the arable land once in three years. There were 1806 acres under orchards, 685 under market gardens, 146 of nursery grounds, and 26,387 of woods. The soil in many places is supposed to be specially suited for apples and pears, but, although they are grown in considerable quantities, there are not many orchards of large size. Hops were at one time extensively grown in the clay districts, which produce stronger plants, though less mild in flavour, than are grown in Kent and Sussex, but in 1883 they occupied only 33 acres. The total number of horses in 1883 was 20,511, of which 15,191 were used solely for agricultural purposes. Cattle numbered 76,229, of which 24,822 were cows and heifers in milk or in calf. Shorthorns are the favourite breed. Dairy farming is pretty common. Sheep numbered 211,893 and pigs 30,371. The old forest breed of sheep is almost extinct, Leicesters and various crosses being common.

According to the latest return there were 14,519 proprietors, possessing 507,337 acres with a gross annual rental of £1,560,853, or an average of about £3, 2s. per acre. The estimated extent of commons and waste lands is 1450 acres. Of the owners, 9891, or about sixty-eight per cent., possessed less than one acre, twenty-six possessed between 2000 and 5000 acres, nine between 5000 and 10,000 acres, and the following six above 10,000 acres each, viz., duke of Portland, 35,209; duke of Newcastle, 34,468; Earl Manvers, 26,460: Henry Savile, 17,821; Lord Middleton, 14,135; Earl Howe, 11,601.

Manufactures.—Nottinghamshire has for more than a century been the centre of the hosiery trade of England, and it is now equally famous for its lace manufactures. Besides the numerous silk-mills and worsted-mills, there are also cotton-mills, bleach works, sailcloth works, paper works, iron- and brass-foundries, engineering-shops, chemical works, malt works, tanneries, and breweries.

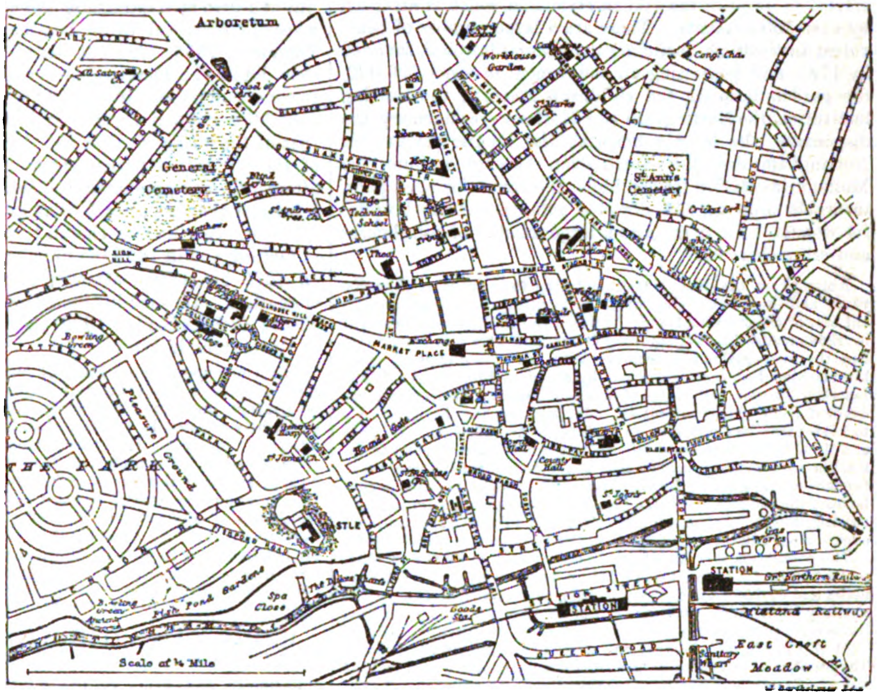
Railways.—The county is traversed in various directions by branches of the Midland, the Great Northern, the Manchester, Sheffield, and Lincoln, and the London and North-Western Railways.

Administration and Population.—Nottinghamshire comprises six wapentakes—Bassetlaw, Broxtow, Bingham, Newark, Rushcliffe, and Thurgarton; and the municipal boroughs of East Retford (population 9748), Newark (14,018), and Nottingham (186,575). In addition to these three boroughs there are eleven urban sanitary districts, viz., Arnold (5745), Beeston (4479), Heanor (6822), Hucknall Torkard (10,023), Hucknall-under-Huthwaite (2028), Ilkeston (14,122), Mansfield (13,653), Mansfield Woodhouse (2618), Sutton in Ashfield (8523), Warsop (1329), and Worksop (11,625). The county has one court of quarter-sessions, and is divided into seven petty and special sessional divisions. The boroughs of Newark and Nottingham have commissions of the peace and separate courts of quarter-sessions, and the borough of East Retford has a commission of the peace. Before the Reform Bill of 1832 the county sent eight members to parliament, and it now returns ten. For parliamentary purposes it is divided into North Nottinghamshire and South Nottinghamshire, each returning two members, as does also each of the boroughs of Nottingham, Newark, and East Retford. The parliamentary borough of East Retford has an area of 207,906 acres, including, in addition to the municipal borough, the wapentake of Bassetlaw; on the other hand, the parliamentary borough of Nottingham is now less extensive than the municipal borough. Nottinghamshire is in the province of York, and was almost entirely in the diocese of Lincoln, but an Act of 1878 has provided for the formation of the new diocese of Southwell, which comprises Derbyshire and Nottinghamshire. The county forms an archdeaconry with ten deaneries, comprising 278 civil parishes, townships, or places, and parts of five others. The population, which in 1801 was 140,350, had increased in 1821 to 186,873, in 1851 to 270,427, in 1871 to 319,758, and in 1881 to 391,815, of whom 190,778 were males and 201,037 females. The number of inhabited houses was 82,435, and the average number of persons to an acre 0·74.

History and Antiquities.—There is some probability that the numerous caves in Nottinghamshire were occupied by the early inhabitants, but there are no architectural remains which can be proved of earlier date than the Roman invasion. The ancient Fosse Way entered the county from Leicester near Willoughby-on-the-Wolds, where Roman coins and other remains have been found, and proceeded by East Bridgford—supposed by some to be the Roman Margidunum—and Newark, entering Lincoln near South Scarle. Several Roman roads crossed it in various directions. A camp on Holly Hill near Arnold is supposed to have been a central Roman station, and Nottingham may possibly occupy the site of Causennis. Broughton and Attenborough were also Roman stations; near Mansfield have been discovered the remains of a Roman villa, and a variety of relics have been found near Newstead and in other places. The remains of an ancient fortress at Brent's Hill near Barton are supposed to be those of a British camp, although it also in all probability was occupied by the Romans. At Oxton there is a tumulus where coins with ashes have been discovered. Few or no events of historical importance took place within Nottinghamshire during the early centuries of the present era with the exception of the defeat of Alfred the Great at Nottingham Castle in 868. During the 10th century it was frequently invaded by the Danes, whose predominance in it is sufficiently attested by the retention of such suffixes in the proper names as "beck," "holme," "thwaite," "thorpe," and "by." At the Conquest 174 manors in Nottingham were given to Roger de Buseli, and 55 to William de Peverel, who received the title of earl of Nottingham, and had an honour court, which still exists, for the recovery of debts and damages. The county was the frequent scene of contests during the reigns of the early Norman sovereigns, and it occupied a conspicuous position during the parliamentary wars, the castles of Newark and Nottingham being more than once besieged and taken by each of the parties. Legend speaks of the county as the chief scene of the adventures of the famous outlaw Robin Hood, and at the verge of Sherwood Forest there exists a curious amphitheatre called Robin Hood's Hill.

At the dissolution of the monasteries there were no fewer than forty religious houses in Nottinghamshire, eight of them in the neighbourhood of the town of Nottingham, including a cell, three hospitals, a house dedicated to St Sepulchre, and monasteries of Grey Friars and White Friars. There were hospitals at Bawtry, Blyth, Bradebusk near Gonalstone, Newark, Southwell, and Stoke; colleges at Bingham, Clifton, Ruddington, Sibthorpe, Southwell, and Tuxford; a Benedictine priory at Blyth, and a nunnery of the same order at Wallingwells; Premonstratensian abbeys at Broadholme and Welbeck; a Carthusian priory at Beauvale; Austin abbeys at Newstead and Radford, and Austin priories at Felley, Newark, Shelford, and Thurgarton; a Cluniac monastery at Lenton, a Gilbertine priory at Mattersey, and a Cistercian abbey at Rufford. The only important monastic remains are those at Newstead, but the building has been partly transformed into a mansion-house, which was formerly the residence of Lord Byron. There are also traces of monastic ruins at Beauvale, Mattersey, Radford, and Thurgarton. The finest parish church in the county is that of Newark. The churches of St Mary, Nottingham, and of Southwell were collegiate churches; the latter contains examples of Norman and the former of Early English. Balderton, Bawtry, Hoveringham, Mansfield, and Worksop are also partly Norman, and Coddington, Hawton, and Upton St Peter near Southwell Early English. Of the old castles, Nottingham and Newark are the only ones of which there are remains, but there are several interesting old mansions, such as Kingshaugh, Scrooby, Shelford, and Southwell.

For the town and county of Nottingham see Domesday Book relating to Nottingham; Thoroton, *Antiquities of Nottinghamshire* (1677); Deering, *Nottinghamia vetus et nova* (1751); Throsby, *History of Nottingham* (1795); Bailey, *Annals of Nottinghamshire* (1856); Wylie, *Old and New Nottingham* (1853, 1865); Felkin, *History of Machine-wrought Hosiery* (1867); J. H. Brown, *Historical Sketch of Nottingham Castle* (1878); Thomas Chambers Hine, *Nottingham, its Castle* (1876; supp., 1879); Briscoe, *Old Nottinghamshire* (1881).



Plan of Nottingham.

NOTTINGHAM, a municipal and parliamentary borough of England, a county in itself and the chief town of Nottinghamshire, is finely situated on an acclivity of a rock rising above the Trent and on several railway lines, 128 miles north-north-west of London and 15½ east of Derby. It is connected both with the Midland and Great Northern railway systems, while by means of the Trent, the Grantham Canal, and the Nottingham, Cromford, and Erewash Canal it has convenient water-communication with the counties of Lincoln, Leicester, Stafford, and Derby. Towards the north the town is sheltered by a chain of hills, but fine and varied views are commanded towards the south. In the neighbourhood there are many picturesque walks, and the corporation has laid out and ornamented a picturesque arboretum. Though the older streets are narrow and irregular, the rapid increase of the town has almost completely altered its character in this respect, most of the new streets being spacious, and some of them containing fine ranges of buildings. A new bridge across the Trent was opened in 1871. Nottingham possesses one of the largest market-places in England, its total area being about 5½ acres. Shortly after the Conquest a wall was built across the market, dividing it into two parts—the Norman and the Saxon. There are three old parish churches—St Mary's Church, a fine cruciform structure, lately restored, now entirely in the Perpendicular style, and possessing a fine tower rising from the centre in two stages, crowned with battlements and pinnacles; St Peter's, which was nearly all rebuilt in the Perpendicular style in the 15th century, and has been enlarged at different times; St Nicholas, a plain building in red brick with stone facings, erected in 1676. There are numerous fine modern churches, but special mention may be made of the Roman Catholic cathedral of St Barnabas, in the Early English style, by Pugin, erected in 1842-44. Among the secular buildings are the exchange hall which is now used as the town-council chamber; the town or guild hall (rebuilt 1741), a plain stuccoed building; the municipal offices (formerly the post-office, 1848), in the classic style, with a Doric portico; the corn exchange; the county hall; the new post-office, erected in 1868 in the Italian style; the people's hall (1854); the Albert Hall, for concerts (1876), a Gothic building with a tower; and the masonic hall (1880). For the Midland Counties Art Museum a lease has been obtained by the corporation of the castle buildings for 500 years, and the exhibition was opened by the prince of Wales in 1878. The town also possesses a free museum of natural history, a mechanics' institute, and a free public library with nearly 40,000 volumes. Among the educational establishments the principal are University College, for which a splendid range of buildings was opened in 1881; the free grammar school, founded in 1513, for some time in disuse, but revived in 1807, and now, since its removal in 1868 to new buildings, known as the High School; the Nottingham High School for girls; the blue-coat school, founded in 1723; the people's college, founded in 1846 for children of the working classes, and now under the direction of the Board as a middle-class school; the Congregational institute for the education of students, chiefly for evangelistic and mission work; and the Nottingham school of art, for which a fine building was erected in 1865 in the Italian style, and which is attended by over 500 students. There are a large number of benevolent institutions, including the general hospital, founded in 1781, and possessing an endowment of over £26,000, the garden hospital, the children's hospital, the nursing institution, the Nottingham and Midland eye infirmary, the dispensary, the lunatic hospital, the lunatic asylum for Nottinghamshire, the Nottingham borough asylum, the Midland institution for the blind, the homes for aged poor, incurable orphans, and deserted infants, and the hospital for women. There are also a large number of almshouses and other charities.

Nottingham has been a manufacturing town for more than 600 years, and towards the close of the last century became an important seat of the stocking trade. It was here that Richard Arkwright in 1769 erected his first spinning frame, and here also Hargreaves had the year previously removed with his spinning jenny after his machine had been destroyed by a mob at Blackburn. While Leicester became the centre of woollen hosiery, Nottingham has devoted itself chiefly to cotton, silk, and merino hosiery. Up to 1815 point lace was also an important manufacture. In 1808 and 1809 John Heathcoat of Nottingham obtained patents for machines for making bobbin net, which inaugurated a new era in the lace manufacture. Besides hosiery and bobbin net lace manufacture, the industries include bleaching, the dyeing, spinning, and twisting of silk, the spinning of cotton and woollen yarn, tanning, engineering, and brewing. There is also an extensive trade in malt.

The population increased from 31,638 in 1801 to 79,604 in 1851, to 86,621 in 1871, and to 111,648 in 1881, of whom 51,892 were males and 59,756 females. Up to 1877 the municipal and parliamentary limits were coextensive, but in that year the municipal limits were increased from 1996 to 9960 acres, with a population in 1881 of 186,575, of whom 87,633 were males and 98,942 females. The number of inhabited houses in the parliamentary area in 1881 was 23,128, while 915 were uninhabited and 318 building. In the municipal area there were 38,548 inhabited houses, 1429 uninhabited, and 767 building.

Nottingham, or Snotingaham, is supposed to have been a Celtic settlement. It first became important in the 9th century. For some time after Alfred's defeat in 868 the town was in the hands of the Danes, and constituted one of their five boroughs, but it was restored and repeopled by Edward the Elder, who erected a portion of the town wall, rebuilt the castle, and threw a bridge over the Trent (920-4). The growing importance of Nottingham is evidenced by the fact that Athelstan, the successor of Edward the Elder, established there a royal mint. In 1013 the town submitted to Sweyn. After the Conquest Nottingham Castle was rebuilt to overawe the people north of the Trent, its governorship being bestowed on William de Peverel, reputed natural son of the Conqueror. And it was whilst residing in it that Roger Mortimer, earl of March, and Isabella, widow of Edward II., were seized in the dead of night by Edward III. in 1330. Parliaments were held at Nottingham in 1334, 1337, and 1357, and it was the scene of the conference of the judges with Richard II. in August 1387. Several important persons have been imprisoned in the castle, among others David II. of Scotland. Edward IV. assembled his troops at Nottingham in 1461; and it was the headquarters of Richard III. before the battle of Bosworth in 1485. In 1642 Charles I. finally broke with the Parliament by setting up his standard at Nottingham, and during the ensuing civil war the castle was held by each of the two parties more than once. In 1644 it was dismantled by Cromwell's orders; but in 1674-79 it was re-erected in the Palladian style by the duke of Newcastle. During the Reform riot in 1831 it was partly destroyed by fire. The town received a charter from Henry II. confirming privileges granted to it by Henry I. In the reign of Henry VI. it was constituted a county under the title of "the town and county of the town of Nottingham." A surreptitious surrender of its charter was obtained by Charles II., but he was persuaded subsequently to grant it a new one. This charter was withdrawn by James II., but restored by William III. Since the reign of Edward I. Nottingham has returned two members to parliament. In 1870 it was made the seat of a suffragan bishop in the diocese of Lincoln.

NOTTINGHAM, Earls of. I. **Heneage Finch** (1621-1682), first earl, lord chancellor of England, was descended from an old family, many of whose members had attained to high legal eminence, and was the eldest son of Sir Heneage Finch, recorder of London, by his first wife Frances, daughter of Sir Edmund Bell of Beaupré Hall, Norfolk. In the register of Oxford university he is entered as born in Kent, 23d December 1621, and probably his native place was Eastwell in that county. He was educated at Westminster and at Christ Church, Oxford, where he remained till he became a member of the Inner Temple in 1638. He was called to the bar in 1645, and soon obtained a lucrative practice, acquiring from his persuasive powers the titles of "the silver-tongued lawyer" and "the English Cicero," and from his graceful action that of the "English Roscius." He was chosen a member of the convention parliament of April 1660, and shortly afterwards was appointed solicitor-general, being created a baronet the day after he was knighted. In May of the following year he was chosen to represent the university of Oxford, and in 1665 the university created him a D.C.L. In 1670 he became attorney-general, and in 1675 lord chancellor. He died in Great Queen Street, Lincoln's Inn Fields, 18th December 1682, and was buried in the church of Ravenstone in Bucks.

The contemporaries of Lord Chancellor Nottingham of both sides of politics agree in their high estimate of his integrity, moderation, and eloquence, while his abilities as a lawyer are sufficiently attested by the fact that he is still spoken of as "the father of equity." His most important contribution to the statute book is "The Statute of Frauds." While attorney-general he superintended the edition of Sir Henry Hobart's *Reports*, 1671. He also published *Several Speeches and Discourses in the Tryal of the Judges of King Charles I.*, 1660; *Speeches to both Houses of Parliament*, 1679; *Speech at the Sentence of Viscount Stafford*, 1680. He left Chancery Reports in MS., and notes on Coke's *Institutes*.

See Burnet, *History of His Own Time* (1724-34); Wood, *Athenæ Oxonienses* (1691); Horace Walpole, *Royal and Noble Authors* (1758); Lord Campbell, *Lives of the Lord Chancellors* (1849); Foss, *Judges of England* (1848-64); and Blackstone, *Commentaries*.

II. **Daniel Finch** (1647-1730), second earl, son of the preceding, entered parliament for Lichfield in 1679. He was one of the privy councillors who in 1685 signed the order for the proclamation of the duke of York, but during the whole of the reign of James II. he kept away from the court. At the last moment he hesitated to join in the invitation to William of Orange, and after the abdication of James II. he was the leader of the party who were in favour of a regency. He declined the office of lord chancellor under William and Mary, but accepted that of secretary of state, retaining it till December 1693. Under Anne he in 1702 again accepted the same office in the ministry of Godolphin, but finally retired in 1704. On the accession of George I. he was made president of the council, but in 1716 he finally withdrew from office. He succeeded to the earldom of Winchelsea 9th September 1729, and died 1st January 1730.

NOVALIS. See Hardenberg, vol. xi. p. 472.

NOVARA, a city of Italy, the chief town of a province, stands between the Agogna and the Terdoppio on a hill 545 feet above sea-level in the plain between the Sesia and the Po. It is an important railway junction, 30 miles west of Milan, on the main line from Turin to Venice, which there connects with the continuation of the St Gotthard line and the Simplon route, as well as with a line to Alessandria and Genoa. Previous to 1830 Novara was still surrounded by its old Spanish ramparts, which were entered by only four gates, and gave the place a heavy appearance from the outside; it is now an open modern-looking town. Part of the old citadel is used as a prison. Of the churches it is enough to mention the cathedral, originally dating from 400, but (with the exception of the octagonal dome-roofed baptistery, separated from the west end by an atrium) rebuilt in the Romanesque style between 1860 and 1870 after designs by Antonelli; the church of S. Gaudenzio (so called after Bishop Gaudentius (*ob.* 417), who is buried under the high altar), rebuilt by Pellegrino Pellegrini Tibaldi, with its strange tower, more than 269 feet high; and San Pietro del Rosario, in which the papal anathema was pronounced against the followers of Fra Dolcino. The city also contains handsome market-buildings erected in 1817-42, a large hospital originally dating from the 9th century, a court-house constructed in 1346, a municipal library of 30,000 volumes (located in the market-buildings), a theatre, a statue of Cavour by Dini (1863), and another of Charles Albert. Besides being the largest grain market in the north-west of Italy, Novara trades in silk, linen, &c., and manufactures cotton, waxcloth, pottery, and starch. The communal population was 29,516 in 1871, and 33,077 in 1881; that of the city was 15,232 (or, with its suburbs, S. Martino, S. Andrea, S. Agabio, Bicocca, and Torrion, 26,206) in 1881.

Novara, the ancient Novaria, according to Pliny of Gaulish, according to Cato of Ligurian origin, was a municipal city of some importance during the Roman empire. Dismantled in 386 by Maximus for siding with his rival Valentinian, it was restored by Theodosius; but it was afterwards ravaged by Radagaisus (405) and Attila (452). A dukedom of Novara was constituted by the Lombards, a countship by Charlemagne. In 1110 the city was taken and burned by the emperor Henry V. Before the close of the 12th century it accepted the protection of Milan, and thus passed into the hands first of the Visconti and secondly of the Sforzas. In 1706 the city, which had long before been ceded by Maria Visconti to Amadeus VIII. of Savoy, was occupied by the Savoy troops. At the peace of Utrecht it passed to the house of Austria along with the duchy of Milan; but, having been occupied by Charles Emmanuel in 1734, it was granted to him in the following year. Under the French it was the chief town of the department of Agogna. Restored to Savoy in 1814, it was in 1821 the scene of the defeat of the Piedmontese by the Austrians, and in 1849 of the more disastrous battle which led to the abdication of Charles Albert and an Austrian occupancy of the city. Natives of Novara are C. Albucius Silus (ancient rhetorician) and Gaudenzio Ferrari (many of whose works are preserved in the city); and Peter Lombard was born at Lumello in the neighbourhood. The chapel-mastership has been held by some of the greatest Italian musicians, Paganini, Mercadante, La Coccia, &c.

NOVA SCOTIA, originally Acadia, a province of the Dominion of Canada, lies between 43° 25′ and 47° N. lat. and 59° 40′ and 66° 25′ W. long., and is composed of the peninsula proper and the adjoining island of CAPE BRETON (*q.v.*), which is separated from the mainland by the Gut of Canso. It is bounded on the N. by Northumberland Strait (which divides it from Prince Edward Island) and the Gulf of St Lawrence, N.E., S.E., and S. by the Atlantic Ocean, and W. by the Bay of Fundy and New Brunswick, being connected with the latter province by a narrow isthmus 13½ miles wide. The extreme length from south-west to north-east is 350 miles, the breadth 120 miles, and the area 20,907 square miles (13,382,003 acres).

Physical Features.—The province is intersected by chains of lofty hills, in most instances running parallel with the coast-line. The Cobequid Mountains, stretching in a long line from east to west and terminating in Cape Chignecto, form the chief ridge. Several of the elevations are as high as 1100 feet, and are cultivable almost to their summits. Lying on each side of this range are two extensive tracts of arable land which yield profitable crops. A sharply-outlined ridge of precipices runs for 130 miles along the Bay of Fundy from Briar Island at the farthest extremity of Digby Neck to Capes Split and Blomidon. Here and there masses of trap rocks, averaging from 200 to 600 feet in height and crowded with stunted firs, overhang the coasts. Beyond them lies the garden of Nova Scotia, the valley of the Annapolis, full of varied scenery, and unrivalled for its fruit, flowers, and cereals. The general slope of the country is south-easterly, in which direction there are several chains of lakes, the source of many rivers and streams of moderate length. The south-eastern coast is remarkable for its harbours, twelve of which are capable of affording shelter to ships of the line, while between Canso and Halifax, a distance of 110 miles, there are fourteen ports which possess ample accommodation for merchantmen of average size. The principal inlets are Bay Verte, Tatamagouche, and St George's Bay in Northumberland Strait; Chedabucto Bay at the head of the Gut of Canso; Halifax Harbour, Margaret's and Mahone Bays on the south-east coast; St Mary's Bay on the south-west; Annapolis Basin, Minas Basin and Channel, and Cobequid Bay on the west. Of these the most remarkable is Minas Basin, the eastern arm of the Bay of Fundy; it penetrates some 60 miles inland, and terminates in Cobequid Bay, where the tides rush in with savage impetuosity, rising sometimes as high as 60 feet, while on the opposite coast, in Halifax Harbour, the spring tides scarcely exceed 7 or 8 feet. The principal inlets in Cape Breton are Aspy Bay, St Anne's Bay, Sydney Harbour, Mire Bay, and St Peter's Bay. All along the coast of Nova Scotia there are many small islands, the south-east shore being literally studded with them. The chief are Caribou and Pictou in Northumberland Strait; St Paul, Scatari, and Isle Madame off the coast of Cape Breton. Sable, a dangerous and sandy island, almost barren, lies 150 miles east of Halifax, and has long been noted as the scene of fearful shipwrecks. Its length is 25 miles by about 1½ miles in breadth, the eastern end being in 43° 59′ N. lat. and 59° 45′ W. long. An effective humane establishment is maintained on this island by the provincial Government. Other islands are Cape Sable, Seal, and Mud in the south, and Long Island at the entrance of St Mary's Bay. The principal capes (apart from those of Cape Breton) are Malagash, John, and St George on the northern coast; Porcupine, Canso, Sambro Head, Pennant Point, Crown Point, and La Have on the south-east; Sable on the south; St Mary, Split, Chignecto, and Blomidon on the west. The interior of the country is traversed and watered by many rivers and lakes, which cover an estimated area of 3000 square miles. The rivers are, with few exceptions, navigable for coasting vessels for distances averaging from 2 to 20 miles. The principal are the Annapolis, Avon, Shubenacadie, East, Middle, and West, St Mary's, Musquodoboit, La Have, Mersey. The Annapolis river, which is navigable for a long distance, takes its rise in King's county, flows between the North and South Mountains through a fertile tract of territory and discharges into Annapolis Bay. The Shubenacadie flows from the Grand Lake in Halifax county, receives the waters of ten other streams, and, after winding through Hants county, empties itself into Minas Basin. It is navigable for craft of large size, and its banks are rich in forest trees. The East, West, and Middle rivers, also navigable for similar vessels, discharge into Pictou Harbour. The La Have empties into the Atlantic, the Avon into the Bay of Fundy, and the Mersey into Liverpool Harbour. The Medway, Shelburne, Clyde, Tusket, St Mary's, and several others have their sources in the numerous lakes which lie in the interior. The largest of the latter is Lake Rossignol, situated in Queen's county, and more than 20 miles long. Ship Harbour Lake, 15 miles in length, and Grand Lake are in Halifax county, College Lake is in the eastern part of the peninsula. The Bras d'Or Lake (Cape Breton) may be best described as an imprisoned sea. It is 50 miles long and of great depth, bordered by the counties of Victoria, Inverness, Richmond, and Cape Breton; it is full of fish, and expands into several streams and bays, each of which affords excellent sport to the angler.

Geology.—The Lower Cambrian runs along the whole extent of the Atlantic seaboard in one uninterrupted line. To the north of this stretches an extensive district composed of rocks of Upper Silurian and probably others of Lower Silurian age. Along the section on the south coast of the Bay of Fundy, and at Minas Basin and Channel, is to be found the New Red Sandstone formation. Grey granite, gneiss, and mica-slate prevail along the shore. Trap rocks, often embedded in clay-slate, abound in several sections of the province, and the newer Red Sandstone prevails in the western division. There are vast Carboniferous beds, occupying a large area, and forming a source of great wealth to the inhabitants. Millstone grit, the gypsiferous series, limestones, slates, the metamorphic series, the Huronian, &c., are also to be noted. The Carboniferous plain of New Brunswick is connected with that of Nova Scotia at its eastern extremity. The coal-fields of the latter are especially valuable and productive. They are situated in Cape Breton, Cumberland, Pictou, Inverness, and Richmond counties. In 1882 there were twenty-one collieries in operation, which produced 1,365,811 tons of coal, consumed principally in Quebec, New Brunswick, Newfoundland, Prince Edward Island, and the United States. About 4235 persons are employed in this industry. The coal is bituminous and very rich in quality. In the Carboniferous areas there are immense deposits of pyroschist or bituminous shale, "capable," says Dawson, "of yielding as much as 63 gallons of oil, or 7500 feet of illuminating gas per ton. Owing to the great cheapness of petroleum little attention has been paid to these shales for some years, but it is likely that they will before long again be in demand."

Gold is found in workable quantities, the production in 1882 being 14,107 ounces. The gold district includes Caribou, Gay's River, Montagu, Oldham, Renfrew, Sherbrooke, Stormont, Tangier, Uniacke, Waverley, Wine Harbour, and unproclaimed,—thirty mines in all. Iron ore abounds also in profitable quantities, and of excellent quality; the production in 1882 was 42,135 tons. Other minerals, such as manganese ore, gypsum, barytes, &c., abound. A fair business is annually done in coke, fire-clay, building-stone, and grindstones. Some veins of copper, silver, lead, and galena, especially rich in quality, exist. There are many curious and beautiful fossils, besides amethysts, agates, chalcedonies, jaspers, cairngorms, &c.

Climate and Vegetation.—The climate of Nova Scotia somewhat resembles that of New Brunswick. There are extremes of heat and cold, and sudden changes of temperature, varying sometimes in one day as much as 50°. Considering its northern latitude, it is remarkably temperate on the whole. The extreme of cold is about 20° below zero in the depth of winter, and the greatest heat is 98°. The climate varies in the different counties, those in the west averaging from 6° to 8° Fahr. warmer than those in the east. The coldest period is from the end of December to the first week in March, during which the weather is tolerably uniform. The spring is usually brief and chilly, but the autumn, which is the most favoured season of the year, is delightfully pleasant. Vegetation develops rapidly. At certain times dense fogs line the banks along the Atlantic coast, but they are not considered unhealthy.

Nova Scotia is a valuable agricultural country; wheat, oats, rye, barley, buckwheat, Indian corn, potatoes, turnips, beets, tomatoes, &c., grow in abundance, while apples, pears, plums, cherries, strawberries, raspberries, cranberries, gooseberries, currants, and other fruits ripen to perfection. Even grapes and peaches grow in the open air in some districts. The Nova Scotia apple is an article of commerce, and quantities have been exported to England. The orchards of Annapolis and King's counties extend along the roadsides for upwards of 50 miles. The soil is of various degrees of fertility. The intervale lands, which form an extensive part of the country, are rich, and yield largely. The uplands, lying between the hilly sections and the rivers, are of moderate capacity. The high lands are as productive as the intervales. The produce in 1881 was 529,251 bushels of wheat, 228,748 of barley, 47,567 of rye, 1,873,113 of oats, 339,718 of buckwheat, 37,220 of pease and beans, 8128 of grass and clover seeds, 7,378,387 of potatoes, 1,006,711 of turnips, 326,143 of other roots, and 597,731 tons of hay. Of live stock there were 57,167 horses, 33,275 working oxen, 137,639 milch cows, 154,689 other horned cattle, 377,801 sheep, and 47,256 swine.

The forests of Nova Scotia are extensive and valuable, the principal trees found in New Brunswick also growing in the sister province. They are chiefly pine, oak, tamarack, birch, maple, hemlock, spruce, butternut, ash, &c. The yield of timber is very great, the shipments in 1881 amounting in value to $1,587,941.

Industries, Commerce, &c.—Nova Scotia is not strong as a manufacturing country, but every year some new industries are added to the list. At present there are two sugar-refineries and a cotton-factory in Halifax. Coarse "homespuns," coarse flannels, bed-linen, blankets, carpets, and tweeds are made in considerable quantities. Tanning is extensively carried on, and there are several factories where household and other furniture, agricultural implements, boots and shoes, saddlery, harness, tobacco, printing and wrapping paper, machinery, nails, pails and wooden ware, fuse gunpowder, carriages, and sleighs, &c., are made. In 1881 the province contained 1190 saw-mills, 263 grist-mills, 151 tanneries, 68 carding and weaving establishments, 8 breweries, and various other manufactories; 217,481 lb of maple sugar were produced. The value of the boots and shoes manufactured was $754,128, of iron smelted $720,000, and of sugar refined $1,702,000. The exports of mining produce amounted to $676,078, of agricultural products to $830,504, of manufactures to $487,503, and of animals and their produce to $836,052. The total exports were $9,217,295 and the total imports $8,701,589. Shipbuilding is extensively carried on. In 1882 there were 122 vessels built, tonnage 31,361; and 174 vessels of all classes were registered. In the same year 6615 craft, representing a tonnage of 709,167, were engaged in the coasting trade. The total number on the registry books of the province was 3026, tonnage 546,778.

Next to Newfoundland, Nova Scotia possesses the largest and most valuable fisheries in British North America. Along the entire coast, extending over 1000 miles, food fish of almost every description (salmon, trout, cod, holibut, haddock, bass, mackerel, herring, shad, lobsters, &c.) may be taken. Immense quantities of these are shipped to the West Indies, the United States, various ports in Canada; and of late years several varieties have been welcomed in British markets. In 1882 fish to the value of $4,437,364 were exported. About 19,000 men are employed in this industry.

Most of the principal birds of North America are to be found in Nova Scotia, and the game of the country includes moose, caribou, duck, teal, geese, woodcock, partridge, snipe, plover, &c. The game laws are very strict, and are rigidly enforced. The wild animals remaining in the province are bears, wolves, foxes, wild-cats, and a few others.

Communication.—Nova Scotia is well furnished with railways, there being nearly 600 miles in operation at the present time. The Intercolonial runs from Halifax to Amherst, 138 miles, and thence to St John, N.B., and Quebec. There are two canals in the province, one from Halifax to Cobequid Bay, and the other, the St Peter's, connecting St Peter's Bay on the southern side of Cape Breton with the Bras d'Or Lake. The roads of Nova Scotia are exceedingly good and well maintained. Telegraphic lines are established nearly all over the province, and connect with the United States system.

Government, Finance, &c.—The executive authority is in the hands of a lieutenant-governor and a council of eight members, four with portfolios and four without. Thirty-eight representatives are elected every four years to the house of assembly, and twenty legislative councillors are appointed for life by the local government. The lieutenant-governor is appointed by the governor-general of Canada in council. The system of administration is known as responsible government. The province returns twenty-one members to the Dominion House of Commons, and ten senators are appointed by the crown to the senate of Canada. They hold their positions for life. The province has the right to make its own civil laws, but in all criminal cases the form which obtains in all the courts is the criminal law of the Dominion. The judiciary consists of a chief justice, an equity judge, and five puisne judges, a supreme court having law and equity jurisdiction throughout the province, a vice-admiralty court, and a court of marriage and divorce. In each county there is a court of probate. There are also seven county court judges.

Nova Scotia forms the ninth military district in the militia of Canada. The established strength of the active force by arms is composed of 1 troop of cavalry, 1 field battery of artillery, 17 batteries of garrison artillery, 9 battalions of infantry and rifles; total, 318 officers, and 3638 non-commissioned officers and men. The period of service in time of peace is three years. British regiments of the line are also stationed at Halifax.

The public revenue of the province is a little more than half a million dollars annually, and the expenditure is about the same. The chief source of revenue is the yearly subsidy granted to the province by the Dominion, under the terms of the British North America Act of 1867. In 1882 it amounted to $380,000. The remainder of the revenue is derived from the sales of wild lands, royalties from mines, miscellaneous fees, marriage and other licences.

Religion, Education, &c.—There are two Roman Catholic dioceses in Nova Scotia—the archdiocese of Halifax and the diocese of Arichat; the clergy of the two combined number 76. A Church of England see was established at Halifax in 1787; the bishop, who has jurisdiction in Prince Edward Island also, has under him an archdeacon and 85 clergymen. The synod of the maritime provinces in connexion with the Presbyterian Church in Canada includes 101 ministers in Nova Scotia. The Methodist Church has 100 clergymen and supernumeraries, and the Baptist denomination has 104. The following table shows the number of the adherents of the various bodies:—

Church of England	60,235	Lutherans	5,639
Church of Rome	117,487	Adventists	1,586
Presbyterians	112,488	Other denominations	3,331
Baptists	83,761	Jews	10
Methodists	50,811	No creed stated	1,618
Of no religion	121		
Congregationalists	3,506	Total..................................	440,572

The free-school system is in operation, the whole community paying for its maintenance. The total Government expenditure for this service in 1882 was $173,877; the local expenditure, county fund, was $106,948; the total expenditure for public schools amounted to $571,389. In this year there were 1910 schools in operation, taught by 1975 teachers, and attended by 81,196 pupils. Besides the public schools and academies, there are a model and a normal school, several convents, and six colleges, viz., Dalhousie College and University, St Mary's (R.C.) College, the Presbyterian College, Acadia College (Baptist) at Wolfville, St Francis (R.C.) College at Antigonish, and King's College and University (Episcopal) at Windsor, which was founded in 1787.

The public charitable institutions receiving aid from the province are the insane asylum, poor's asylum and provincial city hospital, blind asylum, transient poor and visiting dispensary, and the deaf and dumb asylum, which is also helped by the New Brunswick Government. Several other institutions are maintained by societies and the benevolence of private individuals.

Population.—The province is divided into eighteen counties (including Cape Breton), as follows (1881):—

Counties.	Pop.	Capitals.	Counties.	Pop.	Capitals.
Halifax	67,917	Halifax.	Cumberland	27,368	Amherst.
Lunenburg ..	28,583	Lunenburg.	Colchester ..	26,720	Truro.
Queen's	10,577	Liverpool.	Pictou	35,535	Pictou.
Shelburne ..	14,913	Shelburne.	Antigonish ..	18,060	Antigonish.
Yarmouth ..	21,284	Yarmouth.	Guysborough	17,808	Guysborough.
Digby	19,881	Digby.	Inverness ..	25,651	Port Hood.
Annapolis ..	20,598	Annapolis.	Richmond ..	15,121	Arichat.
King's	23,469	Kentville.	Cape Breton	31,258	Sydney.
Hants	23,359	Windsor.	Victoria ...	12,470	Baddeck.

The total population was 440,572, including 220,538 males and 220,034 females. In 1871 the population was 387,800. There are 2125 Indians in Nova Scotia, principally Malicites and Micmacs. The inhabitants consist chiefly of Scotch, English, Irish, American, German, Acadian French, Dutch, freed negroes, of whom there are 7062, and various other nationalities.

Besides Halifax, the capital, of which the population in 1881 was 36,100, the chief towns are Pictou (3403), New Glasgow (2595), Sidney (Sydney), C.B. (3667), North Sydney (5484), Yarmouth (6280), Liverpool (3000), and Lunenburg (4007). Windsor (3019), possessing one of the principal colleges in the province, is also the centre of a large trade in gypsum. Annapolis, formerly Port Royal, Truro, Amherst, Antigonish, and Pugwash are also rising and thriving towns.

History.—Nova Scotia was first visited by the Cabots in 1497, but it was 1604 before any attempt at colonization by Europeans was made. This was the expedition headed by De Monts, a Frenchman, which tried to form settlements at Port Royal, St Croix, and elsewhere, and endured severe hardships until 1614, when the English colonists of Virginia made a descent upon them, claimed the territory in right of the discovery by the Cabots, and expelled them from the soil. In 1621 Sir William Alexander obtained a grant of the whole peninsula, and it was named in the patent Nova Scotia instead of Acadia, the old name given the colony by the French. Alexander intended to colonize the country on an extensive scale, but the attempt was frustrated (1623) by the French. During the reign of Charles I. the Nova Scotia baronets were created, and their patents ratified in parliament. Their number was not to exceed 150, and in exchange for their titles and grants of land they agreed to contribute aid to the settlement. Cromwell despatched a strong force to the possession in 1654. In 1667 it was ceded by the treaty of Breda to the crown of France. But the restless English colonists, unmindful of treaty obligations, attacked the French from time to time at various points, until in 1713 the latter relinquished all claim to the country. England neglected it until 1749, when, the designs of the French again becoming marked, the Government made strenuous exertions to induce British settlers to go there. More than 4000 emigrants with their families sailed for the colony; and Halifax was founded. But the French settlers, who enjoyed privileges as neutrals, still embraced a considerable portion of the population, and, with their allies the Indians, proved exceedingly troublesome to the English. They were finally expelled; and in 1758 a constitution was granted to Nova Scotia. By the treaty of Paris in 1763 France resigned all pretension to the country. In 1784 New Brunswick and Cape Breton were separated from Nova Scotia; but in 1819 the two latter divisions were reunited, and in 1867 they became part of the Dominion of Canada.

See Campbell, *Nova Scotia in its Historical, Mercantile, and Industrial Relations* (Montreal, 1873); Dawson, *Acadian Geology* (Montreal, 1878); Fletcher in *Report of the Geological Survey of Canada* (1879-80); *Pub. Docs.* "Nova Scotia and Dominion of Canada (1882-83)." (G. ST.)

NOVATIANUS, Roman presbyter, and one of the earliest antipopes, founder of the sect of the Novatiani or Novatians, was born about the beginning of the 3d century. On the authority of Philostorgius (*H. E.*, viii. 15), he has often been called a native of Phrygia, but perhaps the historian intended by this nothing more than to indicate the Montanistic complexion of Novatian's creed. Of the facts of his life very little is known, and that only from his opponents. His conversion is said to have taken place after an intense mental struggle; he was baptized by sprinkling, and without episcopal confirmation, when on a sick-bed in hourly expectation of death; and on his recovery his Christianity retained all the stern and gloomy character of its earliest stages. He was ordained to the priesthood at Rome by Fabian, or perhaps by an earlier bishop; and during the Decian persecution he maintained very strenuously the severer view of the church's disciplinary function, which would have excluded for ever from ecclesiastical communion all those (lapsi) who after baptism had ever sacrificed to idols,—a view which had frequently found expression within the church previously, and which had indeed been the occasion of the schism of Hippolytus. Bishop Fabian suffered martyrdom in January 250, and, when Cornelius was elected his successor in March or April 251, Novatian objected to the new bishop on account of his known laxity on the above-mentioned point of discipline, and allowed himself to be consecrated bishop by the minority who shared his views. He and his followers were excommunicated by the synod held at Rome in October of the same year. He is said by Socrates (*H. E.*, iv. 28) to have suffered martyrdom under the emperor Valerian. After his death the Novatians, in spite of much opposition, increased, and spread rapidly to almost every province of the empire; they called themselves *καθαροί*, or Puritans, and insisted on rebaptizing their converts from the Catholic view. The eighth canon of the council of Nice provides in a spirit of considerable liberality for the readmission of the clergy of the *καθαροί* to the Catholic

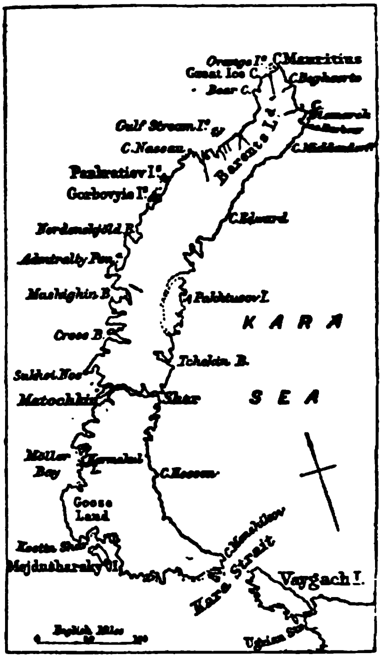
Church, and the sect finally disappeared some two centuries after its origin. Novatian has sometimes been confounded with his contemporary Novatus, a Carthaginian presbyter, who held similar views.

Novatian was the first Roman Christian who wrote to any considerable extent in Latin. Of his numerous writings three are extant: (1) a letter written in the name of the Roman clergy to Cyprian in 250; (2) a treatise in thirty-one chapters, *De Trinitate*; (3) a letter written at the request of the Roman laity, *De Cibis Judaicis*. They are well-arranged compositions, written in an elegant and vigorous style. The best editions are by Welchman (Oxford, 1724) and by Jackson (London, 1728); they are translated in vol. ii. of Cyprian's works in the *Ante-Nicene Theol. Libr.* (Edinburgh, 1869). The Novatian controversy can be advantageously studied in the *Epistles* of Cyprian.

NOVATION is a term derived from the Roman law, in which *novatio* was of three kinds—substitution of a new debtor (*expromissio* or *delegatio*), of a new creditor (*cessio nominum vel actionum*), or of a new contract. In English law the term (though it occurs as early as Bracton) is scarcely yet naturalized, the substitution of a new debtor or creditor being generally called an assignment, and of a new contract a merger. It is doubtful, however, whether merger applies except where the substituted contract is one of a higher nature, as where a contract under seal supersedes a simple contract. Where one contract is replaced by another, it is of course necessary that the new contract should be a valid contract, founded upon sufficient consideration (see CONTRACT). The extinction of the previous contract is sufficient consideration. The question whether there is a novation most frequently arises in the course of dealing between a customer and a new partnership, and on the assignment of the business of a life assurance company with reference to the assent of the policyholders to the transfer of their policies. The points on which novation turns are whether the new firm or company has assumed the liability of the old, and whether the creditor has consented to accept the liability of the new debtors and discharge the old. The question is one of fact in each case. See especially 35 and 36 Vict. c. 41, s. 7, where the word "novations" occurs in the marginal note to the section, and so has quasi-statutory sanction. Scotch law seems to be more stringent than English law in the application of the doctrine of novation, and to need stronger evidence of the creditor's consent to the transfer of liability. In American law, as in English, the term is something of a novelty, except in Louisiana, the only State where the civil law prevails.

NOVA ZEMBLA, or, more correctly, NOVAYA ZEMLYA (*i.e.*, "New Land"), is a large island, surrounded by many small ones, situated in the ARCTIC OCEAN (see vol. ii., plate xxvi.), and belonging to the Russian empire. It lies between 70° 30′ and 77° N. lat. and between 52° and 69° E. long., in the shape of an elongated crescent 600 miles in length, with an average width of 60 miles, and an estimated area of 40,000 square miles, separating the Kara Sea on the east from that part of the Arctic Ocean which is often called Barents's Sea. The north-eastern extremity of Novaya Zemlya lies a little to the west of the meridian of the peninsula of Yalmal, from the extremity of which it is only 160 miles distant. Its southern part, bending towards the south-east, appears as a continuation of the Vaigatch (Vaygach) Island, from which it is separated by the Kara Strait, 30 miles in width,—the island itself being separated from the continent by the narrow Ugrian Strait, only 7 miles broad. Novaya Zemlya is cut through about the middle by a narrow winding channel, the Matotchkin (Matochkin) Shar, which also connects the Arctic Ocean with the Kara Sea.

While the eastern coast runs as a regular curve, with deeper indentations only in its middle, the western is deeply indented by numerous and in some cases fjord-like bays, studded, like the rest of the coast, with many islands. Amongst the principal on the western coast are several parallel fjords at the southern extremity and the wide bay of Sakhanikha. Then farther north is the Kostin Shar, bounded on the north by Cape Podrezoff, which forms the southern extremity of Gusinaya Zemlya or Goose Land, in 72° N. lat.; Möller Bay, 40 miles wide, between Goose Land and Britvin Promontory, has several fjord-like bays, with good anchorages. A broad indentation between Britvin and Sukhoi Nos Promontories, which has received the general name of Marquis de Traversé Bay, includes several bays with good anchorages for larger vessels. Several other large and deep bays follow until Admiralty Peninsula (75° N. lat.) is reached; of these the chief are Krestovaya and Mashigin. Farther on, Nordenskjöld's Bay is worthy of notice.



Map of Nova Zembla.

Orography and Geology.—The interior of Novaya Zemlya is almost unknown; still, the broad features of its structure can be inferred from data obtained at various points on the coast. Two orographical regions must be distinguished. The first of these, south of lat. 72°, appearing as a continuation of the Pay-Kho mountains, is a plateau of moderate height, with several low parallel ridges (2000 feet) running north-west, and separated by level valleys dotted with numerous lakes. It consists of gneisses and clay-slates, with layers of augitic porphyry (north of Kostin Shar), and thick beds of Silurian and perhaps Devonian limestones, continued on Vaigatch Island, where they are partially covered with Carboniferous deposits. On the north-west it terminates in the low plateau (300 to 400 feet) of Goose Land. The middle and northern parts of Novaya Zemlya, on the other hand, form an alpine region with isolated peaks and a complicated system of spurs and deep valleys, extending even under the sea. Instead of being, as it has been frequently described, a single chain running in the main direction of the island closer to its western coast, it appears to be rather a system of shorter chains running due north-east, and disposed in échelons displaced eastwards as they advance towards the north. They terminate seawards in several promontories having the same direction; but the difference of the geological structure on the two sides of the Matotchkin Shar would suggest that it is rather a combination of two longitudinal valleys connected by a transverse cleft than one transverse valley. The highest parts of the alpine region (the Mitusheff Kamen, 3200 feet; Wilczek, 3900 feet; and other peaks to the west rising perhaps to 4000 and 4650 feet) are in the neighbourhood of this channel; south of the eastern entrance is a peak about 5000 feet in height. Farther north the region sinks much lower, while that part of northern Novaya Zemlya which bends eastward seems to consist of a more massive swelling of land, covered with an immense ice-sheet descending north and south to the sea-coast. The whole of the alpine region is covered with fields of snow descending in broad strips along the slopes of the isolated peaks, and feeding glaciers in the deeper valleys.

The geological structure of the central region is of the most varied description. The primary rocks which appear at Mitusheff Kameñ are overlaid with thick beds of quartzites and clay-slates containing sulphite of iron, with subordinate layers of talc or mica slate, and thinner beds of fossiliferous limestone, Silurian or Devonian. More recent clay-slates and marls belonging to the middle Jurassic occur in the western coast-region about Matotchkin Shar. About 74° N. lat. the crags of the eastern coast are composed of grey sandstone, while in 76° Barents's Islands, and possibly a much greater part of the northern coast, show Carboniferous strata. Traces of Eocene deposits, produced under a warmer climate, which are so widely developed in other parts of the polar basin, have not yet been discovered on Novaya Zemlya. During the Glacial period its glaciers were much larger than at present, whilst during a later portion of the Quaternary period (to judge by the marine fossils found as high as 300 feet above the sea) Novaya Zemlya, like the whole of the arctic coast of Russia, was submerged for several hundred feet. At present it appears to partake of the movement of upheaval common to the whole of northern Russia.

Climate.—Though milder than that of north-eastern Siberia, the climate of Novaya Zemlya is colder even than that of Spitzbergen. The average temperature about the Matotchkin Shar has been found from three years' observations to be 17° Fahr., and it decreases towards the south, being only 14°·9 at Kamenka (70° 35′ N.). At Shallow Bay, in 73° 55′, it has been found to be 19°·6. In the middle parts of the western coast the average temperature of the winter is – 4°; that of the summer at Matotchkin Shar is 36°·5,—that is, lower than at Boothia Felix, or Melville Island. On the western coast also warm west winds bring considerable moisture, which is condensed by the mountains, and thus a cloudy sky intercepts the already scanty sunlight. On the eastern coast the summer temperature is less still, the average for the year being probably 2° Fahr. lower than that of corresponding latitudes of the western coast. The coasts of Novaya Zemlya are less icebound than might be supposed owing to the influence of a warm current which flows along the coast on the north-west, and which may be considered as a continuation of the Gulf Stream. There are years in which the island can be circumnavigated without difficulty. The southern shores, besides experiencing the cold influence of the Kara Sea, are washed by a cold current which issues from Kara Strait and flows northwards along the south-western coast.

Flora.—Grass does not grow to any extent except in Goose Land, where the soil is covered with finer débris. Elsewhere even the leaved lichens are precarious, though the leather lichens flourish, especially the *Vermicaria geographia*. Of Phanerogams, only the *Dryas octopetala* covers small areas of the débris, and is interspersed with isolated *Cochlearia*, *Stereocaulon paschale*, and *Papaver nudicaule*. *Silene acaulis*, *Saxifraga oppositifolia*, *Arenaria rubella*, five or six species of *Draba*, as well as the *Dryas octopetala* and *Myosotis*, are found where the débris permits. Where a layer of thinner clay has been deposited in sheltered places, the surface is covered with *Platypetalum purpurascens*, *Saxifragæ*, and *Draba alpina*; and a carpet of mosses allows the *Salix polaris* to develop its two dwarf leaflets and its catkins. Where a thin sheet of humus, fertilized by lemmings, has accumulated in the course of ages, the *Rhodiola rosea*, the *Erigon uniflorum*, a *Ranunculus nivalis*, or an *Oxyria reniformis* make their appearance, with here and there a *Vaccinium* (which, however, never flowers). Even where a carpet of plants has developed under specially favourable circumstances, they do not dare raise their stems more than a few inches, and their brilliant flowers spring direct from the soil, concealing the developed leaflets, whilst their horizontally-spread roots grow out of proportion; only the *Salix lanata* rises to 7 or 8 inches, sending out roots 1 inch thick and 10 to 12 feet long. One hardly understands how these plants propagate; vegetation seems to be maintained, at least partially, by seeds brought by birds or by currents. All this, of course, applies only to the better-known neighbourhoods of Matotchkin and Kostin Straits; north of 74° N. but very few species have been found at all (*Saxifraga oppositifolia*, *Papaver nudicaule*, *Draba alpina*, and *Oxyria digyna*). In all, the phanerogamic flora of Novaya Zemlya and Vaigatch now numbers 185 species, of which 30 have not yet been found on the main island, but may yet be discovered in its southern part. Of the total, 131 are Dicotyledons. As to the much-discussed genetic connexions of the Novaya Zemlya flora, it appears, according to M. Kjellmann's researches, that it belongs to the Asiatic arctic region rather than to the European. Eleven species are what Hooker and Grisebach regard as old glacial, 56 are purely alpine, and 6 have been found in other alpine regions of Europe; 36 non-alpine species belong to the flora of middle Europe, 41 to the Scandinavian flora, and only 16 to that of arctic Russia, whilst 29 have not been found in Europe at all. Altogether, 156 species are European (132 from arctic Europe), and 177 Asiatic (164 from arctic Asia), whilst 11 are wanting in both arctic Europe and Asia.

Fauna.—The desolate interior of Novaya Zemlya shows hardly a trace of animal life, save perchance a solitary vagrant bird, a few lemmings, an ice-fox, a brown or white bear, and at times immigrant reindeer. Even insects are few; the very mosquitoes of the tundras are wanting, and only a solitary bee flies among the scanty flowers. The sea-coast, however, is occupied by countless numbers of birds, which come from the south for the breeding season, and at certain parts of the sea-coast the rocks are covered with millions of *Uria troile*, and the air is resonant with their cries, while numberless flocks of ducks, geese, and swans swarm every summer on the valleys and lakes of the southern part of the island. Whales, walruses, seals, and dolphins are still abundant. Only two species of fish are of any importance,—the *gollzy* (*Salmo alpinus*) in the western rivers, and the *omul* (*Salmo omul*) in the eastern.

The following is a list of the land mammals (some of them not satisfactorily determined):—*Ursus arctos* and *maritimus*, *Rangifer tarandus* (Pallas), *Vulpes vulgaris* and *lagopus*, *Canis lupus*, *Cuniculus torquatus* (Pallas), perhaps *Mus grœnlandica*, or *Myodes obensis*. The birds are:—*Stryx nictea*, *Falco buteo*, *Tringa maritima*, *Plectrophanes nivalis*, *Otocorys alpestris*, and *Strepsilas collaris*, all endemic; many species of ducks, *Harelda glacialis* being the most common, *Somateria spectabilis* and *mollissima* in company with the *Cephus Mandtii*; several species of geese and swans (*Cygnus musicus* included); as also *Larus glaucus*, *Uria troile*, *U. bruennichii*, and *Alca pistorhina*. The marine mammals are:—the walrus, *Odobænus rosmarus*; seals, *Phoca vitulina*, *P. leporina*, *P. grœnlandica* (O. Müller) in the Kara Sea, *P. barbata* (?); and dolphins, *Delphinus Orca* and *D. delphis* (?).

The numbers of sea mammals in the sea around Novaya Zemlya and the vast quantities of birds attracted Russian hunters as soon as they became acquainted with the northern Ural, and even in the 16th century they had extended their huts (*stanovishicha*) to the extreme north of the island. Many of them wintered for several consecutive years on Novaya Zemlya without suffering great losses from scurvy; but no inhabitants have ever tried to establish themselves permanently on the island. The hunters were very often extremely successful; but the industry has always been subject to great vicissitudes. During the last twenty-five years the Archangel and Kola hunters have but rarely visited Novaya Zemlya; on the other hand, both it and the Kara Sea are now more and more visited by Norwegians. A few Samoyede families, recently settled by the Russian Government at Karmakuly, have remained there for several consecutive years, living chiefly by hunting the reindeer which abound on the eastern coast, and of which two varieties are distinguished, one like that of Spitzbergen.

History.—Novaya Zemlya seems to have been known to Novgorod hunters in the 11th century; but its geographical discovery was four centuries later, at the time of the great movement for the discovery of the north-eastern passage. In 1553 Sir Hugh Willoughby sighted what was probably Goose Land; Chancellor penetrated into the White Sea. In 1556 Burrough reached the southern extremity of the island (the first western European to do so). William Barents touched the island (1594) at Sukhoi Nos (73° 46′), and followed the coast northward to the Orange Islands and southward to the Kostin Shar. Rumours of silver ore having been found induced the Russian Government to send out expeditions to the island during the second half of the 18th century. Yushkoff visited it in 1757; and in 1760 Savva Loshkin cruised along all the eastern coast, spent two winters there, and in the next year, after having reached Cape Begehrte (Begheerte), returned along the western coast, thus accomplishing the first circumnavigation; but the valuable records of his voyage in Russian archives have been lost. In 1768 Rozmysloff reached Goose Land and penetrated into the Kara Sea by the Matotchkin Shar, where he spent the winter; in the following year he pursued the exploration of the Kara Sea, but was compelled to return and abandon his ship. Pospeloff investigated the alleged discovery of silver at Silver Bay in 1806. The first real scientific information about the island is due to the expeditions of Count Lütke in 1821, 1822, 1823, and 1824. Nearly the whole of the western coast as far as Cape Nassau, as well as the Matotchkin channel, was visited and mapped during these expeditions, and abundance of most valuable scientific information obtained. In 1832 Pakhtusoff mapped the eastern coast as far as Matotchkin Shar; and in 1835 Pakhtusoff and Tsivolka mapped the coast as far as 74° 24′. The next expedition was that of Karl Baer in 1838, whose matchless descriptions still are the most valuable of all our sources of information about this region.

A new era of scientific exploration of Novaya Zemlya and of the neighbouring seas begins in 1868. The measurements of temperature made in that year by Bessels and by Dufferin between Bear Island and Novaya Zemlya, and partly those made by Yarjinsky in his dredgings off the Murman coast, established the existence of a warm current crossing Barents's Sea, and led to the publication of Petermann's remarkable treatise on the Gulf Stream. The existence of the warm current was further confirmed by the measurements of Yarjinsky in 1869, by Maydell and Middendorff in 1871, and by the more recent and closer investigations of Andreeff in 1880-82. On the other side, since 1868 the Norwegian sea-hunters, availing themselves of the suggestions of Mohn, Nordenskjold, and Petermann, have brought in most valuable geographical information. In 1870 Johannesen penetrated as far east as 79° E. long., in 76° 13′ N. lat., and afterwards accomplished the second circumnavigation of Novaya Zemlya. The measurements of Johannesen, Ulve, Mack, Torkildsen, Qvale, and Nedrevaag enabled the first map of the Kara Sea worthy of the name, as also of northern Novaya Zemlya, to be drawn up. These and subsequent explorations led the way for Nordenskjöld's famous voyages (see Polar Regions). Two recent undertakings must be mentioned, however,—the establishment of a permanent station on Novaya Zemlya, the wintering at Karmakuly of Lieutenant Tyaghin, and the crossing of the island in 1878 by M. Grinevetskiy from Karmakuly to the eastern coast; and the last Dutch expedition of the "Dijmphna," which, along with the steamer "Varna," wintered in the Kara Sea. (P. A. K.)

NOVEL. See Romance.

NOVELLO, Vincent (1781-1861), an artist whose efforts to diffuse an increased taste for classical music in England fifty years ago have been crowned with permanent success, was born in London 6th September 1781. He was organist at different times of the Sardinian, Spanish, and Portuguese chapels, and of St Mary's chapel, Moorfields. He was an original member of the Philharmonic Society, of the Classical Harmonists, and of the Choral Harmonists. He composed an immense quantity of sacred music, much of which is still deservedly popular; but his great work lay in the introduction to England of unknown compositions by the great masters. The Masses of Haydn and Mozart were absolutely unknown in England until he edited them, as were also the works of Palestrina, the treasures of the Fitzwilliam Museum, and innumerable great compositions now well known to every one. To his zeal is due the store of sacred music published, first by his son, and then by Novello, Ewer, and Co.; and it is not too much to say that benefit is still derived from the impulse given to English taste by these publications. Novello died at Nice on 9th August 1861.

NOVEMBER (or *Novembris*, sc. *mensis*, from *novem*), the ninth month of the old Roman year, which began with March. By the Julian arrangement, according to which the year began with 1st January, November, while retaining its old name, became the eleventh month and had thirty days assigned to it. The 11th of November was held to mark the beginning of winter (hiemis initium); the sacred banquet called "epulum Jovis" took place on the 13th. The principal November festivals in the calendar of the Roman Church are:—All Saints' Day on the 1st, All Souls' on the 2d, St Martin's on the 11th, the Presentation of the Virgin on the 21st, St Cecilia's on the 22d, St Catherine's on the 25th, and St Andrew's on the 30th. St Hubert is commemorated on the 3d. In the English calendar All Saints' and St Andrew's are the only feasts retained, and the "Papists' Conspiracy," for which a particular service is appointed, is commemorated on the 5th. The eve of St Andrew's is a fast. The Anglo-Saxon name of November was Blotmonath (blood month), the latter name probably alluding to the custom of slaughtering cattle about Martinmas for winter consumption. In the calendar of the first French republic November reappeared partly as Brumaire and partly as Frimaire.

NOVERRE, Jean Georges (1727-1810), an artist to whom the action and music of the modern ballet may almost be said to owe their existence, was born in Paris 29th April 1727. He first performed at Fontainebleau in 1743, and in 1747 composed his first ballet for the Opéra Comique. In 1755 he was invited by Garrick to London, where he remained two years. Between 1758 and 1760 he produced several ballets at Lyons, and published his *Lettres sur la Danse et les Ballets*. He was next engaged by the duke of Würtemberg, and afterwards by the empress Maria Theresa, for whom he wrote many celebrated works at Vienna. In 1775 he was appointed *Maître des Ballets* at the Académie; this post he retained until the Revolution reduced him to poverty, which he endured with dignity until his death, at St Germain, in 1810.

Noverre's life-work consisted in the reduction of the ballet to an artistic and consistent form by aid of intelligible pantomime, appropriate action, correct costume, and, above all, music well adapted to the sentiment and situations of the drama; and it is to his efforts in these several directions that the modern ballet owes the high esteem in which it has so long been held in Paris and elsewhere.

NOVGOROD, a government of north-western Russia, bounded on the W. and N. by St Petersburg and Olonetz, on the S.E. by Vologda, Yaroslavl, and Tver, and on the S.W. by Pskov, has an extreme length from south-west to north-east of 400 miles, and an area of 47,240 square miles. Its southern part is occupied by the Valdai or Alaun plateau, which has the highest elevations of middle Russia (800 to 1000 feet), and contains the sources of all the great rivers of the country. It is deeply furrowed by valleys with abrupt slopes, which give it the aspect of a highland region, and descends rapidly towards the valley of Lake Ilmen in the west, which is only 107 feet above the sea-level. The north-eastern part of the government belongs to the lake district of north-western Russia. This tract, gently sloping towards Lakes Ladoga and Onega in the north, is covered with innumerable sheets of water, of which Byelo-ozero (White Lake) and Vozhe are the largest, while more than 3000 smaller ones are figured on the maps. Immense marshes, relics of former lakes, covered with thin forests of birch and elm, occupy the flat depressions and cover more than one-sixth of the government; several of them have an area of from 300 to 450 square miles. In summer they are quite impassable; they admit of being crossed only when frozen. Six centuries ago they were even less accessible, and were perhaps the best protection Novgorod possessed against its enemies; but the slow upheaval of north-western Russia, going on at a rate of three or more feet per century, powerfully contributed towards the drainage of the country, as the rivers more deeply excavated their gently-sloping beds. Of recent years artificial drainage has been carried out on a large scale. The forests still occupy more than two-thirds of the government.

Geologically, Novgorod exhibits in the west vast beds of Devonian limestones and sandstones; these are elsewhere overlaid with Carboniferous limestone, dolomite, sandstones, and marls. The Devonian gives rise to salt-springs, especially at Staraya Russa, and contains iron-ores, while the later formation has coal strata of inferior quality. The whole is covered with a thick sheet of boulder-clay, very often arranged in ridges or *åsar*, the bottom moraine of the north European ice-sheet of the Glacial period. Numerous remains of the neolithic stone age are found, especially around the deposits of extinct lakes. The numerous rivers of Novgorod are distributed between the Arctic Ocean, Baltic Sea, and Caspian Sea basins; the last two basins are further connected by the Mariinsk, Tikhvin, and Vyshnii-Volochok canals, while the Alexander-von-Würtemberg canal connects the tributaries of the White Sea with those of the Baltic. The chief river is the Volkhoff, which flows from Lake Ilmen into Lake Ladoga. Other navigable rivers are the Syas, also flowing into Lake Ladoga, and the Sheksna and the Mologa, tributaries of the Volga. A brisk traffic is steadily carried by the Novgorod rivers, as all boats from the Volga to St Petersburg pass through this government, while the goods embarked within the province itself amount to more than 7,000,000 cwts., worth from 6,000,000 to 7,000,000 roubles.

The climate is very harsh, the yearly average temperature at Novgorod being only 38°·8 Fahr. (14°·5 in January, 62°·5 in July). The severe climate, the marshy or stony soil, and the want of grazing-grounds render agriculture unprofitable; though it is carried on everywhere, only rye, oats, barley, and some tobacco are raised, and this to so small an amount that nearly 1,000,000 quarters of grain have to be imported every year. Neither gardening nor the raising of cattle is very flourishing; in 1877 there were only 212,000 horses, 364,000 cattle, and 253,000 sheep. A number of petty trades are successfully carried on in the villages, all kinds of wooden wares being made and exported; the preparation of timber, pitch, tar, and charcoal is general, and shipbuilding is widely diffused in several districts. The fisheries on the great lakes are valued at 170,000 roubles annually, and, owing to the proximity of the capital, hunting is still profitable. But the greater number of the inhabitants are dependent on the river-boat traffic; and nearly one-fourth of the able-bodied male population are driven in search of work to other parts of Russia. The Novgorod carpenters and masons still maintain their old-established renown. The industrial establishments are few; in 1879 they numbered 245 (steam flour-mills, distilleries, paper-mills, glass-works, and saw-mills), employing about 4500 hands, and turned out an aggregate production worth 6,313,000 roubles. Trade, which is animated in several towns and at several points of the river-system, is chiefly in grain and timber, and in manufactures and grocery wares from St Petersburg. The fairs are numerous, and several of them (Kirilovsk monastery, Staraya Russa, and Tcherepovets) show considerable returns. The inhabitants are almost exclusively Great Russians, but they are distinguished by some historians from the Great Russians of the basin of the Oka, as showing some remote affinities with the Little Russians. They belong mostly to the Greek Church, but there are many Nonconformists. Lutherans and Catholics number respectively 4000 and 2000. Novgorod, apart from the usual schools and gymnasiums, is better provided with educational institutions than many other governments of Russia, and, through the successful efforts of its *zemstvo*, primary education is more widely diffused in the villages. The government is but thinly inhabited, the population (1,011,500 in 1870) being only 1,090,000 in 1884. The chief towns of the eleven districts are:—Novgorod, Borovichi (10,000 inhabitants), Byelozersk (6000), Tcherepovets (3600), Demiansk (1500), Kiriloff (3200), Krestsy (3200), Staraya Russa (6000), Ustyuzhna (7000), and Valdai (3800).

NOVGOROD, capital of the above government, is situated 119 miles to the south of St Petersburg, on the low flat banks of the Volkhoff, some two miles below the point where it leaves Lake Ilmen. The present town is but a poor survival of the wealthy city of mediæval times. It consists of a kremlin (old fortress) and of the city, which stands on both banks of the river, here connected by a handsome bridge. The kremlin was much enlarged in 1044, and again in 1116. Its stone walls, originally palisades, were begun in 1302, and much extended and embellished in 1490. It is very spacious, and formerly a great number of churches and shops with wide squares stood within the enclosure. Its valuable historical monuments include the cathedral of St Sophia, begun in 1045 by an architect from Constantinople to take the place of the original wooden structure (989), destroyed by fire in that year. Some changes were made in the walls in 1688 and 1692, and the windows were enlarged, but otherwise (notwithstanding several fires) the building remains unaltered. It contains many highly-prized relics. Another ancient building in the kremlin is Yaroslaff's Tower, in the square where the Novgorod *vyetche* (common council) met, and which still bears the name of "the court of Yaroslaff"; the tower was the *gridnitsa* or chancellery of the secretaries of the *vyetche*. Several other remarkable monuments of Russian architecture still exist at Novgorod, such as the church of St Nicholas, erected in 1135, and churches of the 14th and 15th centuries. Within the town itself there are four monasteries and convents; and the large number in the immediate neighbourhood shows the great extension the city formerly had. A monument to commemorate the thousandth anniversary of the foundation of the Russian state (the calling in of the Varangians by Novgorod in 862) was erected in 1864. It consists of a large globe on a massive pedestal, surrounded by numerous statues commemorating the leading events of Russian history. Another monument commemorates the campaign of 1812. On the whole, apart from its old churches and some portions of its walls, Novgorod has nothing to recall the leading part it has played in the history of Russia. Since the diversion from it of the great commercial highways of north-western Russia its commercial influence has been very limited. Its merchants still send timber, grain, and hay to St Petersburg; but the total production of its manufacturing establishments—paper-mills, flour-mills, saw-mills, glass-works, brick-works, match-works, and distilleries—does not reach 1,000,000 roubles. A trunk railway, 45 miles long, connects the city with Tchudovo on the Moscow and St Petersburg Railway. The population is 17,500.

The date at which the Slavonians on their northward advance first erected forts on the Volkhoff (where it leaves Lake Ilmen and where it flows into Lake Ladoga) is unknown. That situated on a low terrace close by Lake Ilmen was soon abandoned, and Novgorod or "New-town" arose on another which extended a mile lower on both banks of the river. The older fort (Gorodische) still existed in the 13th century. It is certain that, even in the 9th century, the new city on the Volkhoff, whilst maintaining close relations with Kieff, already exercised a kind of supremacy over the other towns of the lake region, when its inhabitants in 862 invited the Varangians to the defence of the Russian towns of the north. Down to the end of the 10th century Novgorod was in some sort dependent on Kieff; yet it must have maintained its internal autonomy, for in 997 its inhabitants obtained from their own Prince Yaroslaff a charter which granted them self-government, a jurisdiction of their own, and the rule of their proper *vyetche*. For five centuries this charter continued to be regarded as the chief written testimony of the independence of Novgorod, and was ever resorted to in the struggles with the princes. From the end of the 10th century the princes of Novgorod, chosen either from the sons of the great princes of Kieff (until 1136) or from some other branch of the family of Rurik, were always elected by the *vyetche*, and swore to maintain the free institutions of the town; but they were only its military defenders. Their delegates were merely assessors in the courts which levied the fixed taxes meant to defray the maintenance of the military force raised by the prince. The *vyetche* expelled the princes as soon as they provoked discontent. Their election was often a subject of dispute between the wealthier merchants and landowners and the poorer classes; and Novgorod, which was dependent for its corn supply upon the land of Suzdal, was sometimes compelled to accept a prince from the Suzdal branch instead of from that of Kieff, which was more popular among the poorer classes. After 1270 the city often refused to have princes at all, and the elected mayor (*posadnik*) was the representative of the executive in its limited attributes. Novgorod in its transactions with other cities took the name of "Sovereign Great Novgorod" (*Gospodin Velikii Novgorod*). The supreme power and the supreme jurisdiction were in the hands of the *vyetche*, whose resolutions were carefully inscribed by its secretaries (*diaki*). The city, which had a population of more than 80,000, was divided into sections (*kontsy*), radiating from its centre, and corresponding to some extent to the prevailing occupations of the inhabitants; each constituted a distinct commune which enjoyed a large share of independence. The *kontsy* were subdivided into streets (*ulitsy*), which also corresponded to the prevailing occupations of their inhabitants (artisans or merchants), and each of which was quite independent with regard to its own affairs, such as the election of priests, the maintenance of order, jurisdiction in inferior matters, trade, food supply, &c.

Trade was carried on by corporations which embodied, not only the merchants proper or *gosti*, but also the poorer classes; in fact, it was the chief source of income, and, owing to the existence of numerous trading corporations, everybody was enabled to participate in it more or less. Novgorod, owing to its very advantageous position, made great advances in trade. By the Volkhoff and the Neva it had direct communication with the Hanseatic and Scandinavian cities. The Dnieper brought it into connexion with the Bosphorus, and it was intermediary in the trade of Constantinople with northern Europe. The rich gifts offered by the corporations to the churches of Novgorod are a present testimony of the ancient wealth of the city.

The Novgorod *ukshuyniki* (who often associated robbery with trade) at an early date penetrated to the shores of the White Sea, hunted on Novaya Zemlya in the 11th century, colonized the basins of the northern Dwina, descended the Volga, and, as early as the 14th century, extended their dominions over the "Ugra," beyond the Ural, into Siberia. The Zavolotchie, or the basin of the northern Dwina, was early colonized, and forts were erected to maintain the dominions, while two great colonies, Vyatka and Vologda, organized on the same republican principles as the metropolis, favoured the further colonization of north-eastern Russia.

At the same time a number of flourishing minor towns (*prigorody*), such as Novyi Torg (Torzhok), Novaya Ladoga, Pskov, and many others, arose in the lake region. Pskov soon became quite independent of the metropolis, and had a history of its own; the others enjoyed a large measure of independence, still figuring, however, as subordinate towns in all those circumstances which implied a common action of the whole region. Several contemporary testimonies state the population of Novgorod in the 14th century to have reached 400,000, and add that the pestilences of 1467, 1508, and 1533 carried off no fewer than 134,000 persons. These figures, however, seem to relate rather to the Ilmen region; but it may be safely admitted that, before the visitations referred to, the city, with the suburbs, had a population of nearly 100,000.

Throughout its history Novgorod has had to sustain many contests. Its struggle against the Suzdal region began as early as the 12th century. In the following century it had to contend with the Swedes and the Germans, who were animated not only by the desire of territorial extension throughout the lake region but also by the spirit of religious proselytism. The advances of both were checked by the battles at Ladoga and Pskov in 1240 and 1242. Protected as it was by its marshes, Novgorod escaped the Mongol invasion, and was able to repel the attacks of the princes of Moscow by whom the Mongols were supported; but it was compelled to pay a tribute, which soon became a tribute to Moscow (end of the 14th century). It also successfully resisted the attacks of Tver, and aided Moscow in its struggle against this powerful neighbour, but it soon itself experienced the power of the growing Moscow state. The first serious invasion of its independence, in 1332, was turned back only with the aid of the Lithuanians. But a severe blow was inflicted in 1456 by the Great Prince of Moscow, Vasilii Temnyi, who, taking advantage of the internal troubles of the city, and finding supporters among the Novgorod *boyars*, succeeded in imposing a heavy tribute. Ivan III. took possession of the Zavolotchie colonies and the Perm region, and began two bloody wars, during which Novgorod fought for its liberty under the leadership of Martha Posadnitsa. In 1475 Ivan III. entered Novgorod, abolished its charters, and carried away 1000 of the wealthier families, substituting for them families from Moscow; the old free city now recognized his sovereignty. A century later Ivan IV. (the Terrible) abolished the last vestige of the independence of the city. Having learned of the existence of a party favourable to Lithuania, he took the field in 1570, and entered Novgorod (much weakened by the recent pestilences) without opposition. His followers seized nearly all the heads of monasteries and beat them to death with sticks. At a given signal a general pillage began: the shops were destroyed, the merchandize thrown out, the wealthier of the merchants and clergy killed and thrown into the Volkhoff, whilst other plundering parties burned and pillaged all stores in the villages. No less than 15,000 men, women, and children were killed at Novgorod alone (60,000 according to some authorities). A famine ensued, and the district of Novgorod fell into utter destitution. Thousands of families were transported to Moscow, Nijni-Novgorod, and other towns of the principality of Moscow. In the beginning of the 17th century Novgorod was taken and held for seven years by the Swedes; and in the 18th century the foundation of St Petersburg ultimately destroyed its trade. Its position, however, on the water highway from the Volga to St Petersburg, and on the trunk road from Moscow to the capital, still gave it some commercial importance; but even this was brought to an end by the opening of the Vishera canal and the Nicholas Railway, which passes 45 miles to the east of Novgorod. (P. A. K.)

NOVI, or (to distinguish it from Novi di Modena, &c.) **Novi Ligure**, a city of Italy, in the province of Alessandria (Piedmont), at the foot of the Apennines and on the edge of a fertile plain, about 20 miles south of the river Po. It is of importance mainly as the meeting-place of the railways from Alessandria, Genoa, and Piacenza, and is one of the leading seats of the silk industry in Italy. The ruins of its ancient castle, its collegiate church, the Piazza del Duomo with its central marble fountain, and some of the picturesque old palaces of the Genoese nobility are the chief objects of interest, though the city also possesses its theatres, public library, antiquarian museum, literary academy, &c. The population of the city was 9917 in 1881; that of the commune 11,445 in 1861, and 13,783 in 1881.

Novi begins to appear as Corte Nova in the 10th century, and in the Middle Ages it was a frequent object of dispute between Tortona, Milan, Pavia, and Genoa. In 1480 Nicolao Ghirardengo, a native of the town, set up his printing-press within its walls. In August 1799 was fought the great battle of Novi, in which the French under Joubert were defeated by the Russians under Suwaroff, and in November of the same year there was a lesser conflict, in which the French proved victorious over the Austrians.

NOVIBAZAR, **Novipazar**, or **Yenipazar** (*i.e.*, New Market), on the Rashka, a tributary of the Ibar and subtributary of the Danube, is the chief town of a sanjak in the Turkish vilayet of Bosnia (formerly of Kossovo), which was occupied by Austria-Hungary in 1879 in accordance with the terms of the treaty of Berlin. Owing to the configuration of the country it is a point of great strategical importance, commanding the lines of communication between Bosnia and Rumelia, and between Servia and Montenegro. The site was formerly occupied by the old Servian town of Rassia mentioned by Byzantine writers in the 9th century. In the neighbourhood is the old church of St Peter and St Paul, the metropolitan church of the bishopric of Rassia, in which Stephen Nemanya passed from the Roman to the Greek Church in 1143. According to Dr Blau, the sanjak had a male population of 83,983 in 1871, that of the town is estimated at from 9000 to 12,000.

NOVO-BAYAZET, or **Novuii Bayazet**, a town of trans-Caucasian Russia, at the head of a district (area 2390 square miles, population 67,800) in the Erivan government, 60 miles east-north-east of Erivan, and about 4 east of Goktchi Lake, lies 5870 feet above the sea on the rocky ravine of the Kavar-tchai. An Armenian village which had stood here from an early date was destroyed by Nadir Shah of Persia in 1736, and it was not till the Turkish war of 1828-29 that the site was again occupied by Armenian refugees from the Turkish town of Bayazet or Bayazid. The name Novuii Bayazet was adopted at the organization of the Erivan government in 1850. From 4518 in 1865 the population had increased by 1873 to 5363, still mainly Armenians. There are seventeen villages in the district, each with more than 1000 inhabitants.

NOVOGEORGIEVSK, a town, and a fortress of Russia. (1) The former, usually known under the name of Kriloff, in the government of Kherson, district of Alexandriya, stands at the junction of the Tyasmin with the Dnieper, 9 miles to the north-west of the Krementchug railway station. Its fort was erected by the Poles in 1615 to protect the passage across the Dnieper, and to guard the steppe on the left bank of the river. The 10,500 inhabitants of Kriloff now carry on a lively trade in timber, grain, and cattle, and have a few flour-mills and candle-works. (2) **Novogeorgievsk** or **Modlin** is a first-class fortress of Russia in Poland, at the junction of the Nareff with the Vistula, 19 miles to the north-west of Warsaw. It constitutes the right flank of the line of defence of the Vistula against attack from the west, the centre of this line being at Warsaw, and the left flank at Ivangorod; 12,000 men are needed for its defence, and the fortifications can shelter from 48,000 to 50,000 men. The small town of Novoye Myesto, opposite the fortress, has 5500 inhabitants.

NOVOMOSKOVSK, a district town of Russia, in the government of Ekaterinoslaff, 19 miles to the north-east of the capital of the province. Including several villages which have been incorporated with it, it extends for nearly 7 miles along the right bank of the Samara, a tributary of the Dnieper. In the 17th century the site was occupied by several villages of the Zaporog Cossacks, which were known under the name of Samartchik, and derived their wealth from valuable fisheries. In 1687 Prince Golitsyn founded here the Ust-Samara fort, which was destroyed after the treaty of the Pruth; it was rebuilt again in 1736, and the settlement of Novoselitsy established, which received a municipal constitution about the end of the last century. The very fertile surrounding country was rapidly colonized, and now has several villages each of more than 5000 and one above 10,000 inhabitants. The population of Novomoskovsk, which numbers 11,000, is chiefly engaged in agricultural pursuits. Some are employed in tanneries, and there is also some trade in horses, cattle, tallow, skins, tar, and pitch. As many as 150,000 head of cattle change hands at the yearly fair. In the immediate neighbourhood is the Samarsko-Nikolaevskii monastery, which is visited by many pilgrims.

NOVOTCHERKASSK, capital of the province of the Don Cossacks, is situated 737 miles south-south-east from Moscow, and 40 miles from the sea of Azoff. It was founded in 1805, when the inhabitants of the Tcherkassk *stanitsa* (now Old Tcherkassk) were compelled to leave their abodes on the banks of the Don on account of the frequent inundations. They were settled on a hill, 300 feet above the low plain, at the junction of the Don with the Aksai, and it was the intention of the authorities to create there, around the chief town of the Don Cossacks, a large agricultural colony; but the want of drinking water proved a great obstacle, and it was decided to transfer Novotcherkassk to another site, when Nicholas I., after a visit in 1837, ordered that it should remain where it was. In 1863 a water-supply was obtained by the construction of an aqueduct 18 miles long, with a steam-engine pumping 325,000 gallons per day. In the following year the town was brought into railway communication with Voronesh and Rostoff, from which last it is 32 miles distant. It is finely situated, and an extensive view over the low prairies of the Don is obtained from the top of the hill. The town has a public garden, a theatre, a clubhouse, and is adorned by the palace and gardens of the ataman of the Cossacks, and by a monument to Platoff. The educational institutions include a gymnasium for boys, and another for girls, besides several lower schools. Since the introduction of a water-supply and the construction of a branch railway line to the Grushevskiya coal-mines, Novotcherkassk has been developing rapidly; wide suburbs extend to the south-west, and the right bank of the Aksai is dotted with the villas of the Cossack officials. Manufactures, however, make but slow progress; there are only a few candle-works, brick-works, distilleries, tobacco-works, and manufactories of champagne, with an aggregate production in 1879 of 240,000 roubles (out of a total for all the province of 1,909,000 roubles). An active trade is carried on in corn, wine, and timber (exports), and manufactures and grocery wares (imports). There are two fairs of some local importance. The population of the town is 34,000.

NOWGONG or **Náogáon**, a district in the chief-commissionership of Assam, India, lying between 25° 45′ and 26° 40′ N. lat. and 92° and 93° 50′ E. long., is bounded on the N. by the Brahmaputra, separating it from Darrang, E. and S. by Sibságar and the Nágá and Khási Hills. The district, which has an area of 3417 square miles, consists of a wide plain much overgrown with jungle and canebrakes, intersected by numerous offshoots and tributaries of the Brahmaputra, and dotted with shallow marshes. It is estimated that about a hundred minor streams become navigable in the rainy season. The Míkír Hills cover an area of about 65 miles by 35 in the south of the district; the highest peak is about 3500 feet. The slopes are very steep, and are covered with dense forest. The Kámákhyá Hills are a small range near the bank of the Brahmaputra, about 1500 feet high. On the summit of the highest peak is a celebrated temple of Kámákhyá, the local goddess of love, where three annual festivals are held, attended by crowds of pilgrims from all parts of the country. Only about one-ninth of the area of the district has been as yet brought under cultivation. Wild beasts of all kinds abound.

The population in 1881 was 310,579, of whom about 12,000 were Mohammedans and the rest mainly aborigines or semi-Hinduized aborigines and Hindus in about equal proportions. The great bulk of the aborigines consists of the cognate tribes of Míkírs, Lalangs, and Cácháris. The population of the town of Nowgong was only 4200 in 1881.

The staple crop is rice. Tea cultivation and manufacture are carried on by means of European capital and under European supervision. The principal means of communication are afforded by the rivers. The chief road, that from Nowgong town to Gauháti in Kámrúp, runs for 44 miles through the district, but is unbridged. The climate of Nowgong is extremely unhealthy.

NOY, William (1577-1634), attorney-general, was born, it is believed, on the family estate of Pendrea in Buryan, Cornwall, in 1577, his father belonging to a family whose pedigree is included in the visitation of Cornwall in 1620. He matriculated at Exeter College, Oxford, 27th April 1593, and looked back upon his academical life with such affection that, twenty years later, when the privileges of that institution were invaded by Lord Petre, he pleaded its cause gratuitously and successfully. His legal career began at Lincoln's Inn, and throughout life he was a diligent student of the grounds and precedents on which English law is based. From 1603 until his death he was elected, with one exception, to each parliament, sitting invariably for a constituency of his native county. For several years his sympathies were in antagonism to the wishes of the court, so that his historical knowledge was freely laid at the service of the opposition. Every commission that was appointed numbered Noy among its members, and even those who were opposed to him in politics acknowledged his learning. A few years before his death he was drawn over to the side of the court, and in October 1631 he was created attorney-general, but was never knighted. It was through his advice that the impost of ship-money was levied, and popular feeling vented its rage against him for its disastrous revival. Noy had long been a martyr to disease of the stone, and his death occurred, under circumstances of great agony, 9th August 1634; two days later he was buried at New Brentford church. Though he was of a reserved, almost morose disposition, and after his change of principles had little regard for the feelings of his old friends, many acts of kindness which he showed can be gleaned from the literature of his time. His principal works, *On the grounds and maxims of the laws of this kingdom* (1641) and *The compleat lawyer* (1661), went through many editions. Further particulars concerning him and his children may be found collected in Davies Gilbert's *Cornwall*, iii. 143-60, and in the *Bibliotheca Cornubiensis*, vols. i. and iii.

NOYON, a city of France, department of Oise, 67 miles north-north-east of Paris by the railway to Brussels, is built at the foot and on the slopes of a hill, and traversed by a small stream, the Verse, which joins the Oise a mile farther down. The old cathedral of Notre Dame, constructed during the latter half of the 12th century, is a fine example of the mixture of Romanesque and Gothic architecture. In plan it is a Latin cross, with a total length from east to west of 343 feet, and from north to south of 66. The west front has a porch, added in the 14th century, and two unfinished towers, their upper portions dating from the 13th century; its decorations have been greatly mutilated. The nave (167 feet long and 66 broad) consists of eleven bays, including those of the west front, which, in the interior, forms a kind of transept. In the windows of the aisles, the arches of the triforium, and the windows of the clerestory the round type is maintained; but double Pointed arches appear in the lower gallery; and the vaults of the roof, originally six-ribbed, were rebuilt after the fire of 1293 in the prevailing Pointed style. Side chapels were added in the north aisle in the 14th century and in the south aisle in the 15th and the 16th, one of the latter (15th) is especially rich in decorations. The flying buttresses of the building are at present (1884) being restored in the style of the 12th century. From the north-west corner of the nave runs the western gallery of a fine cloister, erected in 1230; and next to the cloister is the chapter-house of the same date, with its entrance adorned with statues of the bishops and other sculpture. The bishops' tombs within the cathedral were destroyed during the Revolution. The chapel of the bishops' palace is an example of the Early Pointed style; the second bishops' palace is a brick and stone structure in the Renaissance style; the canons' library was built of wood in the 15th century; and the town-house (Gothic and Renaissance) dates from 1485-1523. Among the town manuscripts is the Red Book or communal charter of Noyon. Remains of the Roman walls may be traced in the foundations of various houses. Noyon has a good trade, and contains large sugar-refineries, chemical-works, tanneries, and cotton-spinning mills. The population of the commune and that of the city were respectively 6268 and 5236 in 1872, and 6252 and 5780 in 1881.

Noyon, the ancient Noviomagus Veromanduorum, was Christianized by St Quentin at the close of the 3d century; and in 531 St Medard, bishop of the district of Vermandois, transferred his see thither from St Quentin. The episcopate of St Eligius (640-648), the burial of Chilperic II., the coronation of Pippin the Short in 752, and on the same occasion the coronation of his infant son Carloman with the title of king of Noyon, the coronation of Charlemagne in 771, the plunder of the town by the Normans in 859 and 880, the expulsion of the castellan by the inhabitants, and in 997 the recognition of the overlordship of the count of Flanders are the chief points in the history of Noyon down to the 10th century. In the 11th the city, passing under the French crown, became one of the ecclesiastical peerages of the kingdom; and at the beginning of the 12th century it easily obtained a communal charter through the favour of its bishops. The extent of the bishopric was considerably curtailed in 1135 by the breaking off of the diocese of Tournay. Noyon was ravaged by the English and the Burgundians during the Hundred Years' War. In 1516 a truce was signed at Noyon by Francis I. and Charles V. The city was captured by the Spaniards in 1552, and afterwards by the Leaguers, who were expelled in 1594 by Henry IV. It lost its bishopric in 1791, and is at present only the chief town of a canton in the arrondissement of Compiègne. Calvin was born at Noyon in 1509.

See Le Vasseur, *Annales de l'Église Cathédrale de Noyon*, 1633; Lafons de Melicocq, *Rech. hist. sur Noyon*, 1839; Barthélemy, *Monogr. de l'Église Notre Dame de Noyon*; Vitet, *Mongr. de l'Église de N. D. de Noyon*, 1845; and Moet de la Forte Maison, *Antiquités de Noyon* (1845).

Plate XV & Plate II Vol I.

NUBIA, a country of north-east Africa, bounded on the N. by Egypt, on the S. by Abyssinia, Senaar, and Kordofan, and on the E. and W. by the Red Sea and the Libyan Desert respectively. It thus comprises the whole of the Nile valley, from Assuan (Oswán, Syene) near the first cataract southwards to Khartúm (Khartoum) at the confluence of the White and the Blue Niles, stretching in this direction for about 560 miles between 16° and 24° N. lat., and for nearly the same distance east and west between 31° and 39° E. long. But Nubia has at no time formed a strictly political, ethnical, or even administrative expression. Unless it can be identified with the Nob or Nub—that is, "Gold"—region of the hieroglyphic records, the term was unknown to the ancients, by whom everything south of Egypt was vaguely called Ethiopia, the land of the dark races. It is first associated historically, not with any definite geographical region, but with the Nobatæ, a negro people removed by Diocletian from the western oasis to the Nile valley above Egypt (Dodecaschœnus), whence the turbulent Blemmyes had recently been driven eastwards. From Núba, the Arabic form of the name of this people, comes the modern Nubia, a term about the precise meaning of which no two writers are of accord. Locally it is restricted to a comparatively small district, the Wády al-Núba, reaching from Sebú‘ along the Nile southwards to the north frontier of Dongola. Officially it finds no recognition as an administrative division of the khedive's possessions, the region commonly understood by Nubia, as above roughly defined, being completely absorbed for administrative purposes, partly in the government of Upper Egypt, but mainly in that of Egyptian or Eastern Súdan (Soudan).[1] Within these two governments it comprises the whole of the four mudíríehs (provinces) of Berber, Táká, Dongola (Donḳola), and Suákin (more correctly Sawákin), besides parts of Massowah, Khartúm, and Esneh (Upper Egypt), with a total area of about 345,000 square miles, and a population vaguely estimated (1878, 1882) at from 1,000,000 to 1,500,000.

But, apart from political and ethnical considerations, Nubia is physically a sufficiently intelligible expression. Merging westwards in the sands of the Libyan desert, and limited eastwards by the Red Sea, it comprises the whole of the rugged and mainly arid steppes and plateaus through which the united White and Blue Niles, after their junction at Khartúm, force their way down to Upper Egypt. In this section, which may be regarded as the upper course of the Nile proper, there occurs a continuous series of slight falls and rapids, including all the historical "six cataracts," beginning a few miles below Khartúm (the sixth at J. Garri), and terminating at Philæ, close to the Egyptian frontier. Between these extreme points the total fall in a distance of 1150 miles is about 760 feet (from 1160 feet above sea-level at Khartúm to 400 at Philæ). Here the river describes two great bends, the first, from Khartúm to Merawi (Napata) below the fourth cataract, comprising the Bahiúda desert on the west, the second, thence to Egypt, comprising the Nubian desert on the east,—the two roughly corresponding to the conventional divisions of Upper and Lower Nubia respectively.

Throughout the whole of this section the Nile receives no affluents on its left bank, and on its right one only, the Atbara, which joins it from Abyssinia just above Al-Meshérif (Berber). Hence all Nubia west of the Nile, and most of the region east of the Nile—that is, from the Atbara confluence to Egypt—are mainly arid wastes, rocky in the east, sandy in the west, relieved on both sides by some grassy steppe lands, and by a few small oases. Of the Nubian, which is sometimes called the Ḳorosko, desert, and the northern section of which is named from its nomad Bíshárí inhabitants, the prevailing features are bare or scrubby sandstone plains broken by moderately high rugged granite hills and ranges, such as the J. Jerfa, J. Elbe‘, J. Kawewad, and J. Shiḳr, and intersected in many places by numerous small "khórs" or wadies running in various directions across the plateau. The wells and oases occurring along these depressions afford the only means of communication across this region, as well as in the more sandy Bahiúda wilderness on the opposite side of the Nile. Thus are formed all the great caravan routes, of which the most important are—(1) from Derr and Ḳorosko across the Ababdeh country by the Hurat wells southwards to Abu Ḥámid, 230 miles, shorter by about one-third than the long and difficult water journey between these two points; (2) from Ambukól to Khartúm, which describes an arc of 200 miles to the southern curve enclosing the Bahiúda desert; (3) from Berber eastwards to the Red Sea at Suákin, 280 miles, difficult, with little fodder and rare wells, but of vital strategic and commercial importance as affording the most direct access from the coast to the interior, and the shortest highway from the Nile to Suákin, the only outport of Nubia; (4) a better but much longer route from Tokar below Suákin by the Khór Barka southwards to Kassala on the Mareb, a tributary of the Atbara, and thence through the Shukurieh country westwards to Khartúm. This route, which has been recently explored by G. Casati,[1] traverses the province of Táká, the most fertile and productive region in the whole of Nubia. Táká, being well watered by the Atbara, Mareb, and other streams from Abyssinia, is a true African tropical land, covered in some places with dense forest, in others with extensive pastures and arable tracts. Hence this route has lately been proposed in preference to that from Suákin to Berber for the projected line of railway from the coast to the interior.

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[1] See Behm in *Bevölkerung der Erde* for July 1882.

Besides Táká the only other fertile and permanently inhabitable region is the valley of the Nile itself. But this valley, expanding above Khartúm into open alluvial plains, is in Nubia proper confined mainly to very narrow limits, with a mean breadth of scarcely more than half a mile (Burckhardt). The river is here almost everywhere hemmed in between granite and sandstone hills, which approach at some points to the very banks, at others run transversely to it, thus giving rise to the continuous windings and rapids which characterize its course throughout Nubia. Nor does the Nile now flood its banks to the same extent as formerly in this region, as appears from the "nilometer" discovered by Lepsius. But it is a mistake to suppose, as is often stated, that no rising takes place.

In Táká much humus and alluvial soil overlie the older crystalline beds and later sedimentary rocks. Elsewhere throughout Nubia these rocks are now mostly denuded, and consist mainly of new sandstones, with large masses of granite, porphyry, and trachyte cropping out in many places. The extensive syenite range on the Egyptian frontier is pierced for 80 miles by the Nile, and runs thence interspersed with sandstones eastwards to the Red Sea, where it forms the bold headland of Ras Benás, projecting round the Gulf of Berenice. Westwards the same system develops the J. Kukur, beyond which it extends to about 25° E. long. in the direction of the Libyan desert. Higher up, at the second or "Great" cataract of Wády Ḥalfá, the sandstone is broken through by huge masses of granite and diorite rising 500 feet above the river-bed. Still farther south sandstones also prevail throughout Dongola, where the Nile presents the aspect of a mountain stream rushing for 250 miles over rapids. At Batn-al-Ḥajar the granite hills attain an altitude of 2000 feet above the river, and in this district the sandstone mostly disappears under the eruptive basalts, trachytes, diorites, phonoliths, and large beds of shale.

None of the porphyries appear to be metalliferous, and the only gold mines hitherto discovered are those in the east about Mount Elbe', which were worked by the ancient Egyptians, and even during mediæval times, but which are now abandoned, although apparently not yet quite exhausted (Linant de Bellefonds). This auriferous district of Nob or Nub, which according to some authorities has given its name to the whole country, lies close to the Red Sea in 22° N., nearly opposite Jidda. The only other minerals of economic importance are salt and alum, occurring at various points on the plateaus. The granites and syenites afford magnificent building materials, largely utilized by the ancient Egyptians.

The greater part of the land lies almost within the rainless zone, for the tropical rains are now arrested about the latitude of Khartúm (Petherick), beyond which point very little moisture is precipitated in any part of the Nile basin. Hence the Nubian climate, while intensely hot (108° to 114° Fahr. in the shade in May on the eastern plateau) is excessively dry and not unhealthy. The plague, formerly endemic in Egypt, never originates in Nubia; nor does the cholera penetrate up the Nile valley beyond Wády Ḥalfá. North of this point, however, the riverain parts are often rendered dangerous, especially to strangers, by the exhalations from the stagnant pools left after the subsidence of the Nile waters. It is noteworthy that here the right bank being periodically flooded is much more fertile than the left, although all the finest ruins lie on the left side. The contrast is probably due to the Libyan sands continually moving eastward and encroaching on the narrow arable zone along the great artery.

Except in Táká, the natural flora is very poor, all the arable districts being required for the cultivation of useful plants. Amongst these the most important are the dóm palm, durra (*Sorghum vulgare*), of which several varieties have the stalk from 7 to 10 feet high, maize, dokhn (panicum), barley, lentils, tobacco, beans, and melons. Cotton and the vine flourish in several places, and the dates of Ibrym and Sokkot are much prized. The banks of the Nile are often fringed with the mimosa; senna abounds in moist, the tamarind in sandy places; several varieties of gum trees occur in the south, and symka is common, its seed yielding oil, its leaves good camel fodder.

Wild animals are rare except in the Táká forests, where the elephant, lion, panther, rhinoceros, giraffe, hyæna, and wild boar are met with. The crocodile and hippopotamus infest all the streams; many species of large and small snakes occur, but few are poisonous; the stork, wild goose, partridge, ibis, are amongst the chief representatives of the local avifauna. There is a good breed of horses; the camel and ass are used as mounts, the ox and buffalo (not numerous) as pack animals and in irrigation, of which there are two methods (as in Egypt),—the sáḳiya, worked by oxen and liable to a tax of £3, and the shádúf, a hand lever and bucket, rated at 30s. (Petherick).

The population being almost exclusively agricultural and pastoral, the industries are unimportant, and limited mainly to coarse cottons and woollens, pottery, and household utensils made of the date tree. The exports also are confined to senna, some grain, leeches, musk, and honey. But although the local traffic is small there is a very large transit trade, carried on chiefly by caravans between Central Africa and Egypt. In this way considerable quantities of ivory, gold dust, ostrich feathers, and slaves have from the remotest times been brought down from the interior through Nubia to the seaports on the Mediterranean and the Red Sea. Of late years the slave trade had been almost entirely suppressed.

Few ethnological questions are beset with greater difficulties than those connected with the origin and affinities of the Nubian race; and, although much light has recently been thrown on the subject by Lepsius in the learned introduction to his *Nubische Grammatik*, there are several points which still remain matter of conjecture. As an ethnical expression the term Núba or Nubian itself has become equivocal. Rejected by the presumable descendants of Diocletian's Nobatæ, who now call themselves Berber, Barábira, it has become synonymous in the Nile valley with "slave," or "Negro slave." This is due to the large number of slaves drawn by the Arab dealers in recent times from the Núba tribes of Kordofan, who appear to constitute the original stock of the race. On the other hand, the expression has never at any time been applied to all the inhabitants of the region we now call Nubia. At present this region is occupied by peoples of three distinct stocks—the comparatively recent Semitic Arab intruders, mainly in Upper Nubia; the Hamitic Ababdeh and Beja (Bíshárín), everywhere between the Nile and the Red Sea; and the Negro or Negroid Núbas (Barábira), in Lower Nubia, where they are now almost exclusively confined to the banks of the Nile, from Assuan southwards to Dongola.

That these Nilotic Núbas are closely allied to those of Kordofan may now be regarded as placed beyond reasonable doubt. And, as the latter are admittedly of Negro stock and speech, it follows that the former also, hitherto affiliated by some to the Fulahs of west Sudan, by others to the Hamitic Beja, must henceforth be regarded as essentially a Negro people. But, whereas the Kordofan Núbas have preserved their racial purity, those of the Nile, while preserving their Negro speech intact, have in their new homes become physically modified, mainly by the admixture first of Hamitic (Beja), then of Semitic (Arab), and even of European blood. Ethnologically the modern Nubians are therefore to be considered as a very mixed people, forming the transition between the three great Hamitic, Semitic, and Negro branches of the human family who converge in the Nile basin. Their ultimate affiliation to the last-named rather than to either of the two others is determined partly by their physical appearance, which is still fundamentally of a Negro type, and partly by their language, which differs dialectically only from the Negro speech of the Kordofan Núbas.

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[1] *Esploratore* for August 1883, and *Boll. Ital. Geogr. Soc.*, July 1883, p. 538.

This conclusion, based on physical and linguistic grounds, is fully confirmed by what is known of the earliest migrations and history of the Nilotic peoples. The first inhabitants of the region beyond Egypt appear to have been the Uaua, whose name occurs in an inscription on a tomb at Memphis of the VIth Dynasty (about 2500 B.C.), and again constantly in subsequent inscriptions down to the time of the Ptolemies, as the leading Negro race to the south of Syene. It thus appears that throughout the historic period down to the arrival of the Romans the Nile above Egypt was occupied by a Negro people. Egyptian monuments are found as far south as Mount Barkal (Napata), but no Egyptian settlements beyond Syene. Hence these Uaua Negroes probably remained unaffected, or very slightly affected, by foreign elements until about the 3d century of our era, when their domain began to be encroached upon from the east by the Hamitic Blemmyes, who have been clearly identified with the present Beja or Bisharin of the Nubian desert. It was owing to the incessant raids of these troublesome marauders that Diocletian withdrew the Roman garrisons above the cataracts, and called in the warlike Nobatæ to protect the Egyptian frontier from their attacks. These Negro Nobatæ, originally from Kordofan, as is now evident, had advanced to the Great Oasis of Khargeh in Upper Egypt, whence they passed into the Nile valley between the cataracts. Here they absorbed the older Uaua of kindred stock, and ultimately came to terms with the Blemmyes. The two races even became intermingled, and, making common cause against the Romans, were defeated by Maximinus in 451 (Priscus). Thus were the Nilotic Núbas in the first instance affected by Hamitic elements.

Then came the conversion (545) of this new Negroid race to Christianity, and the growth of the Nubian political power in the upper Nile basin. Silko, founder of the famous Christian kingdom of Dongola, so named from its capital, called himself king of the Nobads and of all Ethiopians, that is, of the Nilotic Núbas and Hamitic Blemmyes. But the latter remaining pagan were soon after driven from the Nile valley eastwards to the kindred Megabares, Memnons, and other Hamitic nomads, who, with the Troglodytes, had from time immemorial held the whole steppe region between the Nile and the Red Sea from Axum to Egypt. Here their most collective name was Bugaitæ (*Βουγαεῖται*), as appears from the Axumite inscription, whence the forms Buja, Beja, which occur in the oldest Arab records, and by which they are still known.

Soon after overrunning Egypt (639) the Arabs themselves penetrated into Lower Nubia, where the two Jawábareh and Al-Gharbíya tribes became powerful, and amalgamated with the Núbas of that district. But their further progress was long arrested by the Dongolawi kings, who even reduced them for a short time. At length, however, after flourishing for 700 years, this native Christian state was in the 14th century overthrown by the Arabs, aided by a detachment of Bosnians sent from Turkey by Sultan Selim (Burckhardt). These Bosnians (Kalaji, as they called themselves) also settled in the country and intermarried with the Arabs and Nubians, their descendants still holding sundry tracts between Assuan and Derr. Hence it is that the Nubians of this district, fairest of all the race, still claim Arab and Osmanli (Bosnian) descent. And thus were the Nilotic Núbas affected in the second instance by Semitic and European elements.

Nevertheless the type remains essentially Negro, being characterized by a very dark complexion, varying from a mahogany brown and deep bronze to an almost black shade, with tumid lips, large black animated eyes, dolichocephalous head (index Nos. 73, 72), hair often woolly or strongly frizzled, and scant beard worn under the chin like the figures of the fugitives (Uaua?) in the battle-pieces sculptured on the walls of the Egyptian temples. At the same time, the nose is much larger and the zygomatic arches less prominent than in the full-blood Negro. The features are at times almost quite regular, with a decidedly Egyptian cast (Lepsius); and the Nilotic Nubians are on the whole a strong muscular people, essentially agricultural, more warlike and energetic than the Egyptians, whom they also greatly excel in moral qualities. Many find employment as artisans, small dealers, porters, and soldiers in Egypt, where they are usually noted for their honesty, and frank and cheerful temperament. Since the overthrow of the native Christian state all have become Mohammedans, but not of a fanatical type. Although a native of Dongola, the present (1884) Mahdi has found his chief support, not amongst his countrymen, but amongst the more recently converted Kordofan Negroes and the nomad Arabs and Beja. Nor do they appear at any time to have displayed a love of letters, and it remains uncertain whether to the Nubians or to their Hamitic neighbours are to be attributed the numerous still undeciphered rock inscriptions occurring along the Nile valley from Philæ to Khartúm. On the other hand, the colossal ruins reaching as far south as Meroe date almost exclusively from the Egyptian period.

The Núba language itself does not appear to have ever been cultivated, or even committed to writing until recently, although Eutychius of Alexandria (930) includes the "Nubi" among the six kinds of writing which he mentions in a somewhat doubtful passage as current amongst the Hamitic peoples. There is no present native literature, and most of the men speak Arabic as well as their mother tongue, which is very sonorous and expressive. Its distinctly Negro character is betrayed in the complete absence of grammatical gender, in its primitive vowel-system and highly-developed process of consonantal assimilation, softening all harsh combinations, lastly, in the peculiar infix *j* inserted between the verbal root and the plural pronominal object, as in *ai tokki-j-ir* = I shake them. As in Bantu, the verb presents a multiplicity of forms, including one present, three past and future tenses, with personal endings complete, passive, interrogative, conditional, elective, negative, and other forms, each with its proper participial inflexions. In Lepsius's grammar the verbal paradigm fills altogether 110 pages.

Of the Nilotic as distinguished from the Kordofan branch of the Núba language there are three distinct dialects current from Assuan along the Nile southwards to Meroe, as under:—

I. Northern: Dialect of *Bani Kens* or *Mattokki*, from the first cataract to Sebú' and Wády al-Arab, probably dating from the Diocletian period.

II. Central: The *Mahas* or *Marisi*, from Korosko to Wády Halfá (second cataract). Here the natives are called Saidokki, in contradistinction to the northern Mattokki.

III. Southern: *Dongolawi*, throughout the province of Dongola from the second cataract to J. Déja near Meroe, on the northern frontier of the Arab district of Dár-Sháikiya (Sheghya). By the Mahasi people it is called Bideria Bannid, "language of the poor," or, collectively with the Kenz, Ozhkirin Bannid, "language of slaves."

The northern and southern varieties are closely related to each other, differing considerably from the central, which shows more marked affinities with the Kordofan Núba, possibly because the Saidokki people are later arrivals from Kordofan.

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NUGEENAH. See Nagina.

NUGENT, Robert (d. 1788), who ultimately became Earl Nugent, was a native of Westmeath in Ireland, and a Roman Catholic, tersely described by Richard Glover as "a jovial and voluptuous Irishman who had left Popery for the Protestant religion, money, and widows." His change of religion took place at a very early period in life; the widow whom he married in 1736 was a daughter of Craggs, the postmaster-general, and a lady who had already been twice given in marriage. Her property comprised the borough of St Mawes in Cornwall, and Nugent naturally sat for that constituency from 1741 to 1754, after which date he represented Bristol until 1774, when he returned to his old love. At first he was numbered among the adherents of the little court of "only Fred," but with his usual skill he made his peace with the ministry of George II. at the right moment. A speaker of great liveliness joined to good sense—Horace Walpole said that he seemed now and then on the precipice of absurdity, but that he kept clear of it—his support of the ministry was so useful that he became in 1767 Viscount Clare, and in 1776 Earl Nugent, both Irish peerages. He died 13th October 1788.

Lord Nugent was the author of some poetical productions, several of which are preserved in the second volume of Dodsley's *Collections*. One of these pieces, an ode to William Pulteney, in which he combined a description of his own change of religion with compliments on Pulteney's attempts "to prop a nation's frame," was much admired at the time, and fragments of it are still quoted. A haunch of venison which Lord Clare sent to his fellow-countryman and fellow-poet Goldsmith gave rise to one of the most spirited poetic epistles in the language.

NUISANCE, in English law, is either public or private. A public or common nuisance is defined by Mr Justice Stephen as "an act not warranted by law, or an omission to discharge a legal duty, which act or omission obstructs or causes inconvenience or damage to the public in the exercise of rights common to all Her Majesty's subjects" (*Digest of the Criminal Law*, p. 120). A common nuisance is punishable as a misdemeanour at common law, where no special provision is made by statute. In modern times many of the old common law nuisances have been the subject of legislation. For instance, under the Public Health Act, 1875, many nuisances are punishable by imposition of a penalty after summary conviction, and local authorities are empowered to take measures for their suppression. The same Act, 38 and 39 Vict. c. 55, in s. 16 gives a definition of nuisances for the purposes of the Act. In some cases the common law and statutory remedy appear to be concurrent. It is no defence for a master or employer that a nuisance is caused by the acts of his servants, if such acts are within the scope of their employment, even though such acts are done without his knowledge and contrary to his orders. Nor is it a defence that the nuisance has been in existence for a great length of time, for no lapse of time will legitimate a public nuisance. Examples of public nuisances are the obstruction of highways, bridges, and navigable rivers, the keeping of disorderly houses and gaming houses, and the carrying on of offensive trades.

A private nuisance is an act or omission which causes inconvenience or damage to a private person, and is left to be redressed by action. It is not easy to define what amount of infringement of the rights of property will give a right of action. There must be some sensible diminution of these rights affecting the value or convenience of the property. "The real question in all the cases is the question of fact, whether the annoyance is such as materially to interfere with the ordinary comfort of human existence" (Lord Romilly in Crump *v.* Lambert, 1867). A private nuisance, differing in this respect from a public nuisance, may be legalized by uninterrupted use for twenty years. It used to be thought that, if a man knew there was a nuisance and went and lived near it, he could not recover, because, it was said, it is he that goes to the nuisance and not the nuisance to him. But such is not the law now. In such a case the newcomer has his civil remedy if the nuisance has not existed for twenty years, and of course his remedy at criminal law irrespective of time if the nuisance be public.

The remedy for a public nuisance is by information, indictment, summary procedure, or abatement. An information lies in cases of great public importance, such as the obstruction of a navigable river by piers. In some matters the law allows the party to take the remedy into his own hands and to "abate" the nuisance. Thus, if a gate be placed across a highway, any person lawfully using the highway may remove the obstruction, provided that no breach of the peace is caused thereby. The remedy for a private nuisance is by mandamus, injunction, action for damages, or abatement. An action lies in every case for a private nuisance; it also lies where the nuisance is public, provided that the plaintiff can prove that he has sustained some special injury. In such a case the civil is in addition to the criminal remedy. In abating a private nuisance, care must be taken not to do more damage than is necessary for the removal of the nuisance.

In Scotland there is no recognized distinction between public and private nuisances. The law as to what constitutes a nuisance is substantially the same as in England. A list of statutory nuisances will be found in the Public Health (Scotland) Act, 1867, 30 and 31 Vict. c. 101, s. 16. It resembles, but is not quite coincident with, the list in the English Public Health Act. The remedy for nuisance is by interdict or action.

The American law on the subject is practically the same as the English law.

NUKHA, a town of Russia in the Caucasian government of Elizabethpol (formerly of Baku), and previous to 1819 the capital of the khanate of Sheki, lies 173 miles east-south-east of Tiflis, at the foot of the main chain of the Caucasus, the cupola of the church in the fortress being 2454 feet above the sea-level in 41° 12′ 18″ N. lat. and 47° 12′ 7″ E. long. The fortress is a four-cornered enclosure 3000 feet in circumference, erected by Hosein Khan in 1765, and contains the palace, built somewhat later in the original Persian style under the shadow of a splendid group of plane trees. The town contains four churches and thirty-one mosques. Most of its 3000 houses are built of mud and roofed with reed-thatch, which is well suited for the breeding of silkworms, but apt to catch fire. In 1861 the number of silk-winding establishments was fifty, one of them with hundreds of basins in the European style, and worked by steam; but owing to the ravages of *gattine* the silk industry has greatly declined since 1864. At that time the trade of the town amounted to from two to three million roubles. In connexion with the silkworm plantation of Tsar-Abat (more than a mile long by 1½ furlongs broad, and enclosed by a stone wall) there was a Government school of sericulture up to 1863. The population of Nukha was 22,618 in 1861, and 20,917 in 1873 (mainly Tatars, but 3500 Armenians). Besides the town there were in the district (1442 square miles) twenty-one villages each with more than 1000 inhabitants.

Nukha was a mere village up to the middle of the 18th century, when it was chosen by Hajji Tchelyabi, the founder of the khanate of Sheki, as his residence. The Russian occupation dates from 1807, though the annexation was not completed till 1819.

NUMANTIA, a town in Hispania Tarraconensis, of great natural strength, is famous for the memorable siege by the Romans under Scipio Africanus the younger. The siege began in 134 B.C.; the city was defended with the utmost bravery and tenacity, but after enduring the last extreme of famine the Spaniards were forced to surrender at discretion in 133. The inhabitants were sold as slaves and the town levelled to the ground. The victor was honoured with the title Numantinus by his countrymen. The site of Numantia is to be sought at or near the modern village of Puente de Garray, about four miles to the north of the town of Soria (Old Castile).

NUMA POMPILIUS, the second of the legendary kings of Rome, was a Sabine, a native of Cures; his father's name was Pompo and his wife was daughter of Tatius, the Sabine colleague of Romulus. His election, which was made by the Roman people and ratified by the senate, took place at the close of a year's interregnum, during which the sovereignty had been exercised by the members of the senate in rotation. He is represented as having been a quiet unambitious man (Tacita was his favourite muse); but even the ancients perceived the difficulty of making him a disciple of Pythagoras of Samos. His peaceful reign of forty-three years was marked by the creation of many of the most characteristic institutions of Rome; it was he who set up the worship of the god Terminus, appointed the festival of Fides, built the temple of Janus, reorganized the calendar, fixed days of business and days of cessation therefrom, instituted the flamens of Mars and Quirinus, the virgins of Vesta, the salii, the fetiales, the pontifices; in a word, the city which had been founded by means of violence and arms he succeeded in "founding anew upon principles of justice, law, and morality." He derived his inspiration from Egeria or Ægeria, his spouse, whom he used to meet unattended in the grove of the Camenæ, where a perennial spring gushed from a dark recess. He was above eighty when he died of a gentle decline. His daughter Pompilia, wife of the pontifex Numa Marcius, was the mother of Ancus Marcius. Livy (xl. 29) tells a curious story of the finding at the foot of the Janiculum in 181 B.C. of two stone chests, with inscriptions in Greek and Latin, one purporting to contain the body of Numa and the other his books. The first when opened was found to be empty, but the second contained fourteen books relating to philosophy and pontifical law, which, being perceived to have "a tendency to undermine the established system of religion," were forthwith publicly burned.

NUMBERS, Book of. See Pentateuch.

NUMBERS, Partition of. This subject, created by Euler, though relating essentially to positive integer numbers, is scarcely regarded as a part of the Theory of Numbers. We consider in it a number as made up by the *addition* of other numbers: thus the partitions of the successive numbers 1, 2, 3, 4, 5, 6, &c., are as follows:—

1;
2, 11;
3, 21, 111;
4, 31, 22, 211, 1111;
5, 41, 32, 311, 221, 2111, 11111;
6, 51, 42, 411, 33, 321, 3111, 222, 2211, 21111, 111111.

These are formed each from the preceding ones; thus, to form the partitions of 6 we take first 6; secondly, 5 prefixed to each of the partitions of 1 (that is, 51); thirdly, 4 prefixed to each of the partitions of 2 (that is, 42, 411); fourthly, 3 prefixed to each of the partitions of 3 (that is, 33, 321, 3111); fifthly, 2 prefixed, not to each of the partitions of 4, but only to those partitions which begin with a number not exceeding 2 (that is, 222, 2211, 21111); and lastly, 1 prefixed to all the partitions of 5 which begin with a number not exceeding 1 (that is, 111111); and so in other cases.

The method gives *all* the partitions of a number, but we may consider different classes of partitions: the partitions into a given number of parts, or into not more than a given number of parts; or the partitions into given parts, either with repetitions or without repetitions, &c. It is possible, for any particular class of partitions, to obtain methods more or less easy for the formation of the partitions either of a given number or of the successive numbers 1, 2, 3, &c. And of course in any case, having obtained the partitions, we can count them and so obtain the number of partitions.

Another method is by Arbogast's rule of the last and the last but one; in fact, taking the value of a to be unity, and, understanding this letter in each term, the rule gives b; c, b^2; d, bc, b^3; e, bd, c^2, b^2c, b^4, &c., which, if b, c, d, e, &c., denote 1, 2, 3, 4, &c., respectively, are the partitions of 1, 2, 3, 4, &c., respectively.

An important notion is that of conjugate partitions. Thus a partition of 6 is 42; writing this in the form $\left\{\begin{matrix}1111,\\ 11\end{matrix}\right.$ and summing the columns instead of the lines, we obtain the conjugate partition 2211; evidently, starting from 2211, the conjugate partition is 42. If we form all the partitions of 6 into not more than three parts, these are 6, 51, 42, 33, 411, 321, 222, and the conjugates are $\left\{\right.$ 111111, 21111, 2211, 222, 3111, 321, 33, where no part is greater than 3; and so in general we have the theorem, the number of partitions of n into not more than k parts is equal to the number of partitions of n with no part greater than k.

We have for the number of partitions an analytical theory depending on generating functions; thus for the partitions of a number n with the parts 1, 2, 3, 4, 5, &c., without repetitions, writing down the product

$$1+x.1+x^2.1+x^3.1+x^4\ldots,=1+x+x^2+2x^3\ldots+Nx^n+\ldots,$$

it is clear that, if x^α, x^β, x^γ, ... are terms of the series x, x^2, x^3, .. for which $\alpha+\beta+\gamma+\ldots=n$, then we have in the development of the product a term x^n, and hence that in the term Nx^n of the product the coefficient N is equal to the number of partitions of n with the parts 1, 2, 3, .., without repetitions; or say that the product is the generating function (G. F.) for the number of such partitions. And so in other cases we obtain a generating function. Thus for the function

$$\frac{1}{1-x.1-x^2.1-x^3\ldots},=1+x+2x^2+\ldots+Nx^n+\ldots,$$

observing that any factor $1/1-x^j$ is $=1+x^j+x^{2j}+\ldots$, we see that in the term Nx^n the coefficient is equal to the number of partitions of n, with the parts 1, 2, 3, .., with repetitions.

Introducing another letter z, and considering the function

$$1+xz.1+x^2z.1+x^3z\ldots,=1+z\,(x+x^2+\ldots)\ldots+Nx^nz^k+\ldots,$$

we see that in the term Nx^nz^k of the development the coefficient N is equal to the number of partitions of n into k parts, with the parts 1, 2, 3, 4, ..., without repetitions.

And similarly, considering the function

$$\frac{1}{1-xz.1-x^2z.1-x^3z\ldots},=1+z\,(x+x^2+\ldots)\ldots+Nx^nz^k+\ldots$$

we see that in the term Nx^nz^k of the development the coefficient N is equal to the number of partitions of n into k parts, with the parts 1, 2, 3, 4, ..., with repetitions.

We have such analytical formulæ as

$$\frac{1}{1-xz.1-x^2z.1-x^3z\ldots}=1+\frac{zx}{1-x}+\frac{z^2x^2}{1-x.1-x^2}+\ldots,$$

which lead to theorems in the Partition of Numbers. A remarkable theorem is

$$1-x.1-x^2.1-x^3.1-x^4\ldots=1-x-x^2+x^5+x^7-x^{12}-x^{15}+\ldots,$$

where the only terms are those with an exponent $\frac{1}{2}(3n^2\pm n)$, and for each such pair of terms the coefficient is $(-)^n1$. The formula shows that except for numbers of the form $\frac{1}{2}(3n^2\pm n)$ the number of partitions without repetitions into an odd number of parts is equal to the number of partitions without repetitions into an even number of parts, whereas for the excepted numbers these numbers differ by unity. Thus for the number 11, which is not an excepted number, the two sets of partitions are

11, 821, 731, 641, 632, 542
10.1, 92, 83, 74, 65, 5321,

in each set 6.

We have

$$1-x.1+x.1+x^2.1+x^4.1+x^8\ldots=1;$$

or, as this may be written,

$$1+x.1+x^2.1+x^4.1+x^8\ldots=\frac{1}{1-x},=1+x+x^2+x^3+\ldots,$$

showing that a number n can always be made up, and in one way only, with the parts 1, 2, 4, 8, ... The product on the left-hand side may be taken to k terms only, thus if $k=4$, we have

$$1+x.1+x^2.1+x^4.1+x^8,=\frac{1-x^{16}}{1-x},=1+x+x^2\ldots+x^{15};$$

that is, any number from 1 to 15 can be made up, and in one way only, with the parts 1, 2, 4, 8; and similarly any number from 1 to 2^k-1 can be made up, and in one way only, with the parts 1, 2, 4, .. 2^{k-1}. A like formula is

$$\frac{1-x^3}{x.1-x}\cdot\frac{1-x^9}{x^3.1-x^3}\cdot\frac{1-x^{27}}{x^9.1-x^9}\cdot\frac{1-x^{81}}{x^{27}.1-x^{27}}=\frac{1-x^{81}}{x^{40}.1-x};$$

that is,

$$x^{-1}+1+x.x^{-3}+1+x^3.x^{-9}+1+x^9.x^{-27}+1+x^{27}$$
$$=x^{-40}+x^{-39}.\ +1+x\ldots+x^{39}+x^{40},$$

showing that any number from − 40 to + 40 can be made up, and that in one way only, with the parts 1, 3, 9, 27 taken positively or negatively; and so in general any number from $-\frac{1}{2}(3^k-1)$ to $+\frac{1}{2}(3^k-1)$ can be made up, and that in one way only, with the parts 1, 3, 9, .. 3^{k-1} taken positively or negatively. (A. C.)

NUMBERS, Theory of. The Theory of Numbers, or higher arithmetic, otherwise arithmology, is a subject which, originating with Euclid, has in modern times, in the hands of Legendre, Gauss, Lejeune-Dirichlet, Kummer, Kronecker, and others, been developed into a most extensive and interesting branch of mathematics. We distinguish between the ordinary (or say the simplex) theory and the various complex theories.

In the ordinary theory we have, in the first instance, positive integer numbers, the unit or unity 1, and the other numbers 2, 3, 4, 5, &c. We introduce the zero 0, which is a number *sui generis*, and the negative numbers -1, -2, -3, -4, &c., and we have thus the more general notion of integer numbers, 0, ± 1, ± 2, ± 3, &c.; $+1$ and -1 are units or unities. The sum of any two or more numbers is a number; conversely, any number is a sum of two or more parts; but even when the parts are positive a number cannot be, in a determinate manner, represented as a sum of parts. The product of two or more numbers is a number; but (disregarding the unities $+1$, -1, which may be introduced as factors at pleasure) it is not conversely true that every number is a product of numbers. A number such as 2, 3, 5, 7, 11, &c., which is not a product of numbers, is said to be a prime number; and a number which is not prime is said to be composite. A number other than zero is thus either prime or composite; and we have the theorem that every composite number is, in a determinate way, a product of prime factors.

We have complex theories in which all the foregoing notions (integer, unity, zero, prime, composite) occur; that which first presented itself was the theory with the unit i ($i^2 = -1$); we have here complex numbers, $a+bi$, where a and b are in the before-mentioned (ordinary) sense positive or negative integers, not excluding zero; we have the zero 0, $= 0 + 0i$, and the four units $1, -1, i, -i$. A number other than zero is here either prime or else composite; for instance, 3, 7, 11, are prime numbers, and 5, $=(2+i)(2-i)$, 9, $=3\,.\,3$, 13, $=(3+2i)(3-2i)$, are composite numbers (generally any positive real prime of the form $4n+3$ is prime, but any positive real prime of the form $4n+1$ is a sum of two squares, and is thus composite). And disregarding unit factors we have, as in the ordinary theory, the theorem that every composite number is, in a determinate way, a product of prime factors.

There is, in like manner, a complex theory involving the cube roots of unity—if a be an imaginary cube root of unity ($a^2+a+1=0$), then the integers of this theory are $a+ba$ (a and b real positive or negative integers, including zero)—a complex theory with the fifth roots of unity—if a be an imaginary fifth root of unity ($a^4+a^3+a^2+a+1=0$), then the integers of the theory are $a+ba+ca^2+da^3$ (a, b, c, d, real positive or negative integers, including zero); and so on for the roots of the orders 7, 11, 13, 17, 19. In all these theories, or at any rate for the orders 3, 5, 7 (see No. 37, *post*), we have the foregoing theorem: disregarding unit factors, a number other than zero is either prime or composite, and every composite number is, in a determinate way, a product of prime factors. But coming to the 23d roots of unity the theorem ceases to be true. Observe that it is a particular case of the theorem that, if N be a prime number, any integer power of N has for factors only the lower powers of N,—for instance, $N^3 = N.N^2$; there is no other decomposition $N^3 = AB$. This is obviously true in the ordinary theory, and it is true in the complex theories preceding those for the 3d, 5th, and 7th roots of unity, and probably in those for the other roots preceding the 23d roots; but it is not true in the theory for the 23d roots of unity. We have, for instance, 47, a number not decomposable into factors, but 47^3, $=AB$, is a product of two numbers each of the form $a+ba+\ldots+ka^{21}$ (a a 23d root). The theorem recovers its validity by the introduction into the theory of Kummer's notion of an ideal number.

The complex theories above referred to would be more accurately described as theories for the complex numbers involving the periods of the roots of unity: the units are the roots either of the equation $x^{p-1}+x^{p-2}\ldots+x+1=0$ (p a prime number) or of any equation $x^{\frac{p-1}{e}}+\ldots\pm 1=0$ belonging to a factor of the function of the order $p-1$ (in particular, this may be the quadric equation for the periods each of $\frac{1}{2}(p-1)$ roots); they are the theories which were first and have been most completely considered, and which led to the notion of an ideal number. But a yet higher generalization which has been made is to consider the complex theory, the units whereof are the roots of any given irreducible equation which has integer numbers for its coefficients.

There is another complex theory the relation of which to the foregoing is not very obvious, viz., Galois's theory of the numbers composed with the imaginary roots of an irreducible congruence, $F(x)\equiv 0$ (modulus a prime number p); the nature of this will be indicated in the sequel.

In any theory, ordinary or complex, we have a first part, which has been termed (but the name seems hardly wide enough) the theory of congruences; a second part, the theory of homogeneous forms (this includes in particular the theory of the binary quadratic forms $(a,\ b,\ c\,)(x,\ y)^2$); and a third part, comprising those miscellaneous investigations which do not come properly under either of the foregoing heads.

Ordinary Theory, First Part.

1. We are concerned with the integer numbers 0, ± 1, ± 2, ± 3, &c., or in the first place with the positive integer numbers 1, 2, 3, 4, 5, 6, &c. Some of these, 1, 2, 3, 5, 7, &c., are prime, others, 4, $=2^2$, 6, $=2\,.\,3$, &c., are composite; and we have the fundamental theorem that a composite number is expressible, and that in one way only, as a product of prime factors, $N=a^\alpha b^\beta c^\gamma\ldots$ (a, b, c, .. primes other than 1; α, β, γ, .. positive integers).

Gauss makes the proof to depend on the following steps: (1) the product of two numbers each smaller than a given prime number is not divisible by this number; (2) if neither of two numbers is divisible by a given prime number the product is not so divisible; (3) the like as regards three or more numbers; (4) a composite number cannot be resolved into factors in more than one way.

2. Proofs will in general be only indicated or be altogether omitted, but, as a specimen of the reasoning in regard to whole numbers, the proofs of these fundamental propositions are given at length. (1) Let p be the prime number, a a number less than p, and if possible let there be a number b less than p, and such that ab is divisible by p; it is further assumed that b is the only number, or, if there is more than one, then that b is the least number having the property in question; b is greater than 1, for a being less than p is not divisible by p. Now p as a prime number is not divisible by b, but must lie between two consecutive multiples mb and $(m+1)b$ of b. Hence, ab being divisible by p, mab is also divisible by p; moreover, ap is divisible by p, and hence the difference of these numbers, $=a(p-mb)$, must also be divisible by p, or, writing $p-mb=b'$, we have ab' divisible by p, where b' is less than b; so that b is not the least number for which ab is divisible by p. (2) If a and b are neither of them divisible by p, then a divided by p leaves a remainder α which is less than p, say we have $a=mp+\alpha$; and similarly b divided by p leaves a remainder β which is less than p, say we have $b=np+\beta$; then

$$ab=(mp+\alpha)(np+\beta),=(mnp+n\alpha+m\beta)\,p+\alpha\beta,$$

and $\alpha\beta$ is not divisible by p, therefore ab is not divisible by p. (3) The like proof applies to the product of three or more factors a, b, c, ... (4) Suppose that the number N, $=a^\alpha b^\beta c^\gamma\ldots$ (a, b, c, ... prime numbers other than 1), is decomposable in some other way into prime factors; we can have no prime factor p, other than a, b, c, ..., for no such number can divide $a^\alpha b^\beta c^\gamma\ldots$; and we must have each of the numbers $a, b, c, \ldots$, for if any one of them, suppose a, were wanting, the number N would not be divisible by a. Hence the new decomposition if it exists must be a decomposition $N=a^{\alpha'}b^{\beta'}c^{\gamma'}\ldots$; and here, if any two corresponding indices, say α, α', are different from each other, then one of them, suppose α', is the greater, and we have $N\div p^{\alpha}=b^{\beta}c^{\gamma}\ldots=a^{\alpha'-\alpha}b^{\beta'}c^{\gamma'}\ldots$ That is, we have the number $N\div p^{\alpha}$ expressed in two different ways as a product, the number a being a factor in the one case, but not a factor in the other case. Thus the two exponents cannot be unequal, that is, we must have $\alpha=\alpha'$, and similarly we have $\beta=\beta'$, $\gamma=\gamma'$, ...; that is, there is *only* the original decomposition $N=a^{\alpha}b^{\beta}c^{\gamma}\ldots$

3. The only numbers divisible by a number $N=a^{\alpha}b^{\beta}c^{\gamma}\ldots$ are the numbers $a^{\alpha'}b^{\beta'}c^{\gamma'}\ldots$, where each exponent α' is equal to or greater than the corresponding exponent α. And conversely the only numbers which divide N are those of the form $a^{\alpha'}b^{\beta'}c^{\gamma'}\ldots$, where each index α' is at most equal to the corresponding index α; and in particular each or any of the indices α' may be $=0$. Again, the least common multiple of two numbers $N=a^{\alpha}b^{\beta}c^{\gamma}\ldots$ and $N'=a^{\alpha'}b^{\beta'}c^{\gamma'}\ldots$ is $a^{\alpha''}b^{\beta''}c^{\gamma''}\ldots$, where each index α'' is equal to the largest of the corresponding indices α, α';—observe that any one or more of the indices $\alpha, \beta, \gamma, \ldots, \alpha', \beta', \gamma', \ldots$, may be $=0$, so that the theorem extends to the case where either of the numbers N, N', has prime factors which are not factors of the other number. And so the greatest common measure of two numbers $N=a^{\alpha}b^{\beta}c^{\gamma}\ldots$ and $N'=a^{\alpha'}b^{\beta'}c^{\gamma'}\ldots$ is $a^{\alpha''}b^{\beta''}c^{\gamma''}\ldots$, where each index α'' is equal to the least of the corresponding indices α and α'.

4. The divisors of $N=a^{\alpha}b^{\beta}c^{\gamma}\ldots$ are the several terms of the product $(1+a\ldots+a^{\alpha})(1+b\ldots+b^{\beta})(1+c\ldots+c^{\gamma})$, where unity and the number N itself are reckoned each of them as a divisor. Hence the number of divisors is $=(\alpha+1)(\beta+1)(\gamma+1)\ldots$, and the sum of the divisors is $=\dfrac{(a^{\alpha+1}-1)(b^{\beta+1}-1)(c^{\gamma+1}-1)\ldots}{(a-1)(b-1)(c-1)\ldots}$.

5. In $N=a^{\alpha}b^{\beta}c^{\gamma}\ldots$ the number of integers less than N and prime to it is $\phi(N), =N\left(1-\dfrac{1}{a}\right)\left(1-\dfrac{1}{b}\right)\left(1-\dfrac{1}{c}\right)\ldots$ To find the numbers in question write down the series of numbers 1, 2, 3, ... N; strike out all the numbers divisible by a, then those divisible by b, then those divisible by c.., and so on; there will remain only the numbers prime to N. For actually finding the numbers we may of course in striking out those divisible by b disregard the numbers already struck out as divisible by a, and in striking out with respect to c disregard the numbers already struck out as divisible by a or b, and so on; but in order to count the remaining numbers it is more convenient to ignore the previous strikings out. Suppose, for a moment, there are only two prime factors a and b, then the number of terms struck out as divisible by a is $=N.\dfrac{1}{a}$, and the number of terms struck out as divisible by b is $=N.\dfrac{1}{b}$; but then each term divisible by ab will have been twice struck out; the number of these is $=N.\dfrac{1}{ab}$, and thus the number of the remaining terms is $N\left(1-\dfrac{1}{a}-\dfrac{1}{b}+\dfrac{1}{ab}\right)$, which is $=N\left(1-\dfrac{1}{a}\right)\left(1-\dfrac{1}{b}\right)$. By treating in like manner the case of three or more prime factors $a, b, c, \ldots$ we arrive at the general theorem. The formula gives $\phi(1)=1$ (viz., $N=1$, there is no factor $1-\dfrac{1}{a}$), and it is necessary to consider $\phi(1)$ as being $=1$. The explanation is that $\phi(N)$ properly denotes the number of integers not greater than N and prime to it; so that in $N=1$ we have 1 an integer not greater than N and prime to it; but in every other case the two definitions agree.

6. If N, N', are numbers prime to each other then $\phi(NN')=\phi(N)\phi(N')$, and so also for any number of numbers having no common divisor; in particular $\phi(a^{\alpha}b^{\beta}c^{\gamma}\ldots)=\phi(a^{\alpha})\phi(b^{\beta})\phi(c^{\gamma})\ldots$; $\phi(a^{\alpha})=a^{\alpha}\left(1-\dfrac{1}{a}\right)$, and the theorem is at once verified. We have $N=\Sigma\phi(N')$, where the summation extends to all the divisors N' of N, unity and the number N itself being included; thus $15=\phi(15)+\phi(5)+\phi(3)+\phi(1), =8+4+2+1$.

7. The prime factor of the binomial function x^N-1 is $=\dfrac{(x^N-1)(x^{N/ab}-1)\ldots}{(x^{N/a}-1)(x^{N/b}-1)\ldots}$, a rational and integral function of the degree $\phi(N)$; say this is called $[x^N-1]$, and we have $x^N-1=\Pi\,[x^{N'}-1]$, where the product extends to all the divisors N' of N, unity and the number N included. For instance

$$[x^{15}-1]=\frac{(x^{15}-1)(x-1)}{(x^5-1)(x^3-1)}, =x^8-x^7+x^5-x^4+x^3-x+1;$$

and we have

$$(x^{15}-1)=[x^{15}-1][x^5-1][x^3-1][x-1],$$
$$=(x^8-x^7\ldots-x+1)(x^4+x^3+x^2+x+1)(x^2+x+1)(x-1).$$

8. Congruence to a given modulus. A number x is congruent to 0, to the modulus N, $x\equiv 0$ (mod. N), when x is divisible by N; two numbers x, y are congruent to the modulus N, $x\equiv y$ (mod. N), when their difference $x-y$ divides by N, or, what is the same thing, if $x-y\equiv 0$ (mod. N). Observe that, if $xy\equiv 0$ (mod. N), and x be prime to N, then $y\equiv 0$ (mod. N).

9. Residues to a given modulus. For a given modulus N we can always find, and that in an infinity of ways, a set of N numbers, say N residues, such that every number whatever is, to the modulus N, congruent to one and only one of these residues. For instance, the residues may be 0, 1, 2, 3, ... $N-1$ (the residue of a given number is here simply the positive remainder of the number when divided by N); or, N being odd, the system may be

$$0,\ \pm1,\ \pm2,\ldots\pm\tfrac{1}{2}(N-1),$$

and N even,

$$0,\ \pm1,\ \pm2,\ldots\pm\tfrac{1}{2}(N-2),\ +\tfrac{1}{2}N.$$

10. Prime residues to a given modulus. Considering only the numbers which are prime to a given modulus N, we have here a set of $\phi(N)$ numbers, say $\phi(N)$ prime residues, such that every number prime to N is, to the modulus N, congruent to one and only one of these prime residues. For instance the prime residues may be the numbers less than N and prime to it. In particular, if N is a prime number p, then the residues may be the $p-1$ numbers, 1, 2, 3, ... $p-1$.

In all that follows the letter p, in the absence of any statement to the contrary, will be used to denote an *odd* prime other than unity. A theorem for p may hold good for the even prime 2, but it is in general easy to see whether this is so or not.

11. Fermat's theorem, $x^{p-1}-1\equiv 0$ (mod. p). The generalized theorem is $x^{\phi(N)}-1\equiv 0$ (mod. N). The proof of the generalized theorem is as easy as that of the original theorem. Consider the series of the $\phi(N)$ numbers $a, b, c, \ldots$ each less than N and prime to it; let x be any number prime to N, then each of the numbers $xa, xb, xc, \ldots$ is prime to N, and no two of them are congruent to the modulus N, that is, we cannot have $x(a-b)\equiv 0$ (mod. N); in fact, x is prime to N, and the difference $a-b$ of two positive numbers each less than N will be less than N. Hence the numbers $xa, xb, xc, \ldots$ are in a different order congruent to the numbers $a, b, c, \ldots$; and multiplying together the numbers of each set we have $x^{\phi(N)}abc\ldots\equiv abc\ldots$

(mod. N), or, since $a, b, c, ..$ are each prime to N, and therefore also the product $abc..$ is prime to N, we have $x^{\phi(N)} \equiv 1$, or say $x^{\phi(N)} - 1 \equiv 0$ (mod. N).

In particular, if N be a prime number $= p$, then $\phi(N)$ is $= p - 1$, and the theorem is $x^{p-1} - 1 \equiv 0$ (mod. p), x being now any number not divisible by p.

12. The general congruence $f(x) \equiv 0$ (mod. p). $f(x)$ is written to denote a rational and integral function with integer coefficients which may without loss of generality be taken to be each of them less than p; it is assumed that the coefficient a of the highest power of x is not $= 0$. If there is for x an integer value a such that $f(a) \equiv 0$ (mod. p, throughout), then a is said to be a root of the congruence $f(x) \equiv 0$; we may, it is clear, for a substitute any value whatever $a' = a + kp$, or say any value a' which is $\equiv a$, but such value a' is considered not as a different root but as the same root of the congruence. We have thus $f(a) \equiv 0$; and therefore $f(x) \equiv f(x) - f(a)$, $= (x - a) f_1(x)$, where $f_1(x)$ is a function of like form with $f(x)$, that is, with integer coefficients, but of the next inferior order $n - 1$. Suppose there is another root b of the congruence, that is, an integer value b such that $f(b) \equiv 0$; we have then $(b - a) f_1(b) \equiv 0$, and $b - a$ is not $\equiv 0$ (for then b would be the same root as a). Hence $f_1(b) \equiv 0$, and $f(x) = (x - a) \{f_1(x) - f_1(b)\}$, $= (x - a)(x - b) f_2(x)$, where $f_2(x)$ is an integral function such as $f(x)$, but of the order $n - 2$; and so on, that is, if there exist n different (non-congruent) roots of the congruence $f(x) \equiv 0$, then $f(x) = A(x - a)(x - b) \ldots (x - k)$, and the congruence may be written $A(x - a)(x - b) .. (x - k) \equiv 0$. And this cannot be satisfied by any other value l; for if so we should have $A(l - a)(l - b) \ldots (l - k) \equiv 0$, that is, some one of the congruences $(l - a) \equiv 0$, &c., would have to be satisfied, and l would be the same as one of the roots $a, b, c, \ldots k$. That is, a congruence of the order n cannot have more than n roots, and if it have precisely n roots $a, b, c, .. k$, then the form is $f(x) \equiv A(x - a)(x - b) \ldots (x - k)$, $\equiv 0$.

Observe that a congruence may have equal roots, *viz.*, if the form be $f(x) \equiv A(x - a)^{\alpha} (x - b)^{\beta} \ldots, \equiv 0$, then the roots $a, b, ..$ are to be counted α times, β times, ... respectively; but clearly the whole number of roots $\alpha + \beta + ..$ is at most $= n$.

It is hardly necessary to remark that this theory of a congruence of the order n is precisely analogous to that of an equation of the order n, when only real roots are attended to. The theory of the imaginary roots of a congruence will be considered further on (see No. 41).

13. The linear congruence $ax \equiv c$ (mod. b). This is equivalent to the indeterminate equation $ax + by = c$; if a and b are not prime to each other, but have a greatest common measure q, this must also divide c; supposing the division performed, the equation becomes $a'x + b'y = c'$, where a' and b' are prime to each other, or, what is the same thing, we have the congruence $a'x \equiv c'$ (mod. b'). This can always be solved, for, if we consider the b' numbers $0, 1, 2, \ldots b' - 1$, one and only one of these will be $\equiv c'$ (mod. b'). Multiplying these by any number a' prime to b', and taking the remainders in regard to b', we reproduce in a different order the same series of numbers $0, 1, 2, \ldots b' - 1$; that is, in the series $a', 2a', \ldots (b' - 1) a'$ there will be one and only one term $\equiv c'$ (mod. b'), or, calling the term in question α, we have $x = \alpha$ as the solution of the congruence $a'x \equiv c'$ (mod. b'); $a'\alpha - c'$ is then a multiple of b', say it is $= -b'\beta$, and the corresponding value of y is $y = \beta$. We may for α write $\alpha + mb'$, m being any positive or negative integer, not excluding zero (but, as already remarked, this is not considered as a distinct solution of the congruence); the corresponding value of y is clearly $= \beta - ma'$.

The value of x can be found by a process similar to that for finding the greatest common measure of the two numbers a' and c'; this is what is really done in the apparently tentative process which at once presents itself for small numbers, thus $6x \equiv 9$ (mod. 35), we have $36x \equiv 54$, or, rejecting multiples of 35, $x \equiv 19$, or, if we please $x = 35m + 19$.

In particular, we can always find a number ξ such that $a'\xi \equiv 1$ (mod. b'); and we have then $x = c'\xi$ as the solution of the congruence $a'x \equiv c'$. The value of ξ may be written $\xi \equiv \frac{1}{a'}$ (mod. b'), where $\frac{1}{a'}$ stands for that integer value ξ which satisfies the original congruence $a'\xi \equiv 1$ (mod. b') and the value of x may then be written $x \equiv \frac{c'}{a'}$ (mod. b'. Another solution of the linear congruence is given in No. 21

14. Wilson's theorem, $1 . 2 . 3 \ldots \overline{p - 1} + 1 \equiv 0$ (mod. p) It has been seen that for any prime number p the congruence $x^{p-1} - 1 \equiv 0$ (mod. p) of the order $p - 1$ has the $p - 1$ roots $1, 2, \ldots p - 1$; we have therefore

$$x^{p-1} - 1 \equiv (x - 1)(x - 2) \ldots (x - \overline{p - 1}),$$

or, comparing the terms independent of x, it appears that $1 . 2 . 3 \ldots p - 1 \equiv -1$, that is, $1 . 2 . 3 \ldots \overline{p - 1} + 1 \equiv 0$ (mod. p), —the required theorem. For instance, where $p = 5$, then $1 . 2 . 3 . 4 + 1 \equiv 0$ (mod. 5), and where $p = 7$, then $1 . 2 . 3 . 4 . 5 . 6 + 1 \equiv 0$ (mod. 7).

15. A proof on wholly different principles may be given. Suppose, to fix the ideas, $p = 7$; consider on a circle 7 points, the summits of a regular heptagon, and join these in any manner so as to form a heptagon; the whole number of heptagons is $\frac{1}{2} . 1 . 2 . 3 . 4 . 5 . 6$. Now of these we have $\frac{1}{2}(7 - 1)$, $= 3$, which are regular heptagons (convex or stellated); the number of remaining heptagons must be divisible by 7, for with any one such heptagon we connect the 6 heptagons which can be obtained from it by making it rotate through successive angles of $\frac{1}{7}$ 360°. That is, $\frac{1}{2} . 1 . 2 . 3 . 4 . 5 . 6 - \frac{1}{2}(7 - 1) \equiv 0$ (mod. 7), whence $1 . 2 . 3 . 4 . 5 . 6 - 7 + 1 \equiv 0$, or finally $1 . 2 . 3 . 4 . 5 . 6 + 1 \equiv 0$ (mod. 7). It is clear that the proof applies without alteration to the case of any prime number p.

If p is not a prime number, then $1 . 2 . 3 \ldots \overline{p - 1} \equiv 0$ (mod. p); hence the theorem shows directly whether a number p is or is not a prime number; but it is not of any practical utility for this purpose.

16. Prime roots of a prime number—application to the binomial equation $x^p - 1 = 0$. Take, for instance, $p = 7$. By what precedes we have

$$\begin{aligned} x^6 - 1 &= [x^6 - 1][x^3 - 1][x^2 - 1][x - 1], \\ &= (x^2 - x + 1)(x^2 + x + 1)(x + 1)(x - 1); \end{aligned}$$

and we have

$$x^6 - 1 \equiv (x - 1)(x - 2)(x - 3)(x - 4)(x - 5)(x - 6) \text{ (mod. 7)};$$

whence also

$$\begin{aligned} &(x^2 - x + 1)(x^2 + x + 1)(x + 1)(x - 1) \\ &\equiv (x - 1)(x - 2)(x - 3)(x - 4)(x - 5)(x - 6). \end{aligned}$$

These two decompositions must agree together, and we in fact have

$$\begin{gathered} x^2 - x + 1 \equiv (x - 3)(x - 5),\ x^2 + x + 1 \equiv (x - 2)(x - 3), \\ x + 1 \equiv x - 6,\ x - 1 \equiv x - 1. \end{gathered}$$

In particular, we thus have 3, 5, as the roots of the congruence $x^2 - x + 1 \equiv 0$, that is, $[x^6 - 1] \equiv 0$, and these roots 3, 5, are not the roots of any other of the congruences $[x^3 - 1] \equiv 0$, $[x^2 - 1] \equiv 0$, $[x - 1] \equiv 0$; that is, writing $a = 3$ or 5 in the series of numbers $a, a^2, a^3, a^4, a^5, a^6$, we have a^6 as the first term which is $\equiv 1$ (mod. 7); the series in fact are

$$\begin{aligned} 3,\ 9,\ 27,\ 81,\ 243,\ 729 &\equiv 3,\ 2,\ 6,\ 4,\ 5,\ 1, \\ 5,\ 25,\ 125,\ 625,\ 3125,\ 15625 &\equiv 5,\ 4,\ 6,\ 2,\ 3,\ 1. \end{aligned}$$

And so in general the congruence $x^{p-1} - 1 \equiv 0$ (mod. p) has the $p - 1$ real roots $1, 2, 3, \ldots p - 1$; hence the congruence $[x^{p-1} - 1] \equiv 0$, which is of the order $\phi(p - 1)$, has this number $\phi(p - 1)$ of real roots; and, calling any one of these g, then in the series of powers $g, g^2, g^3, \ldots g^{p-1}$, the first term which is $\equiv 1$ (mod. p) is g^{p-1}, that is, we have $g, g^2, g^3, \ldots g^{p-1} = 1, 2, 3, \ldots p-1$ in a different order. Any such number g is said to be a prime root of p, and the number of prime roots is $\phi(p-1)$, the number of integers less than and prime to $p-1$.

The notion of a prime root was applied by Gauss to the solution of the binomial equation $x^p - 1 = 0$, or, what is the same thing, to the question of the division of the circle (Kreistheilung), see EQUATION, Nos. 30 and 31 (vol. viii., p. 507); and, as remarked in the introduction to the present article, the roots or periods of roots of this equation present themselves as the units of a complex theory in the Theory of Numbers.

17. Any number x less than p is $\equiv g^m$, and, if m is not prime to $p-1$, but has with it a greatest common measure e, suppose $m = ke$, $p-1 = ef$, then

$$x \equiv g^{ke},\ x^f \equiv g^{kef} \equiv g^{k(p-1)} \equiv 1,$$

that is, $x^f \equiv 1$; and it is easily seen that in the series of powers $x, x^2, \ldots x^f$, we have x^f as the first term which is $\equiv 1$ (mod. p). A number $\equiv g^m$, where m is not prime to $p-1$, is thus not a prime root; and it further appears that, g being any particular prime root, the $\phi(p-1)$ prime roots are $\equiv$ the numbers g^m, where m is any number less than $p-1$ and prime to it. Thus in the foregoing example $p=7$, where the prime roots were 3 and 5, the integers less than 6 and prime to it are 1, 5; and we in fact have $5 \equiv 3^5$ and $3 \equiv 5^5$ (mod. 7).

18. Integers belonging to a given exponent; index of a number. If, as before, $p-1 = ef$, that is, if f be a submultiple of $p-1$, then any integer x such that x^f is the lowest power of x which is $\equiv 1$ (mod. p) is said to belong to the exponent f. The number of residues, or terms of the series $1, 2, 3, \ldots p-1$, which belong to the exponent f is $\phi(f)$, the number of integers less than f and prime to it; these are the roots of the congruence $[x^f - 1] \equiv 0$ of the order $\phi(f)$. It is hardly necessary to remark that the prime roots belong to the exponent $p-1$.

A number $x \equiv g^m$ is said to have the index m; observe the distinction between the two terms exponent and index; and further that the index is dependent on the selected prime root g.

19. Special forms of composite modulus. If instead of a prime modulus p we have a modulus p^m which is the power of an odd prime, or a modulus $2p$ or $2p^m$ which is twice an odd prime or a power of an odd prime, then there is a theory analogous to that of prime roots, viz., the numbers less than the modulus and prime to it are congruent to successive powers of a prime root g; thus,

if $p^m = 3^2$, we have 2, 4, 8, 16, 32, $64 \equiv 2, 4, 8, 7, 5, 1$ (mod. 9),
and if $2p^m = 2 \,.\, 3^2$, we have 5, 25, 125, 625, 3125, $15625 \equiv 5, 7, 11, 13, 17, 1$ (mod. 18).

As regards the even prime 2 and its powers—for the modulus 2 or 4 the theory of prime roots does not come into existence, and for the higher powers it is not applicable; thus with modulus = 8 the numbers less than 8 and prime to it are 1, 3, 5, 7; and we have $3^2 \equiv 5^2 \equiv 7^2 \equiv 1$ (mod. 8).

20. Composite modulus $N = a^\alpha b^\beta c^\gamma \ldots$—no prime roots—irregularity. In the general case of a composite modulus it has been seen that, if x is any number less than N and prime to it, then $x^{\phi(N)} - 1 \equiv 0$ (mod. N). But (except in the above-mentioned cases p^m, $2p^m$, 2 or 4) there is not any number a such that $a^{\phi(N)}$ is the first power of a which is $\equiv 1$; there is always some submultiple $i = \frac{1}{g}\phi(N)$ such that a^i is the first power which is $\equiv 1$. For instance, say $N = 24$, $\phi(N) = 8$, then the numbers less than 24 and prime to it are 1, 5, 7, 11, 13, 17, 19, 23; and we have $1^1 \equiv 1$, $5^2 \equiv 7^2 \equiv 13^2 \equiv 17^2 \equiv 19^2 \equiv 23^2 \equiv 1$ (mod. 24), that is, 1 has the exponent 1, but all the other numbers have the exponent 2. So again where $N = 48$, the 16 numbers less then 48 and prime to it have, 1 the exponent 1, and 7, 13, 17, 23, 25, 31, 35, 41, 47 each the exponent 2, and the remaining numbers 5, 11, 19, 29, 37, 43 each the exponent 4. We cannot in this case by means of any single root or of any two roots express all the numbers, but we can by means of three roots, for instance, 5, 7, 13, express all the numbers less than 48 and prime to it; the numbers are in fact $\equiv 5^\alpha 7^\beta 13^\gamma$, where $\alpha = 0, 1, 2$, or 3, and β and γ each $= 0$ or 1.

[Comparing with the theorem for a prime number p, where the several numbers $1, 2, 3, \ldots p-1$, are expressed by means of a single prime root, $\equiv g^\alpha$, where $\alpha = 0, 1, 2, \ldots p-1$, we have the analogue of a case presenting itself in the theory of quadratic forms,—the "irregularity" of a determinant (*post*, No. 31); the difference is that here (the law being known, $N =$ a composite number) the case is not regarded as an irregular one, while the irregular determinants do not present themselves according to any apparent law.]

21. Maximum indicator—application to solution of a linear congruence. In the case $N = 48$ it was seen that the exponents were 1, 2, 4, the largest exponent 4 being divisible by each of the others, and this property is a general one, viz., if $N = a^\alpha b^\beta c^\gamma \ldots$ in the series of exponents i (or, as Cauchy calls them, indicators) of the numbers less than N and prime to it, the largest exponent I is a multiple of each of the other exponents, and this largest exponent Cauchy calls the maximum indicator; the maximum indicator I is thus a submultiple of $\phi(N)$, and it is the smallest number such that for every number x less than N and prime to it we have $x^I - 1 \equiv 0$ (mod. N). The values of I have been tabulated from $N = 2$ to 1000.

Reverting to the linear congruence $ax \equiv c$ (mod. b), where a and b are prime to each other, then, if I is the maximum indicator for the modulus b, we have $a^I \equiv 1$, and hence it at once appears that the solution of the congruence is $x \equiv ca^{I-1}$.

22. Residues of powers for an odd prime modulus. For the modulus p, if g be a prime root, then every number not divisible by p is $\equiv$ one of the series of numbers $g, g^2, \ldots g^{p-1}$; and, if k be any positive number prime to $p-1$, then raising each of these to the power k we reproduce in a different order the same series of numbers $g, g^2, \ldots g^{p-1}$, which numbers are in a different order $\equiv 1, 2, \ldots p-1$, that is, the residue of a kth power may be any number whatever of the series $1, 2, \ldots p-1$.

But, if k is not prime to $p-1$, say their greatest common measure is e, and that we have $p-1 = ef$, $k = me$, then for any number not divisible by p the kth power is $\equiv$ one of the series of f numbers $g^e, g^{2e}, \ldots g^{fe}$.; there are thus only $f, = \frac{1}{e}(p-1)$, out of the $p-1$ numbers $1, 2, 3, \ldots p-1$, which are residues of a kth power.

23. Quadratic residues for an odd prime modulus. In particular, if $k = 2$, then $e = 2$, $f = \frac{1}{2}(p-1)$, and the square of every number not divisible by p is $\equiv$ one of the $\frac{1}{2}(p-1)$ numbers $g^2, g^4, \ldots g^{p-1}$; that is, there are only $\frac{1}{2}(p-1)$ numbers out of the series $1, 2, 3, \ldots p-1$ which are residues of a square number, or say quadratic residues, and the remaining $\frac{1}{2}(p-1)$ numbers are said to be quadratic non-residues of the modulus p,—we may say simply, residues and non-residues. But this result can be obtained more easily without the aid of the theory of prime roots. Every number not divisible by p is, to the modulus p, $\equiv$ one of the series of numbers $\pm 1, \pm 2, \pm 3, \ldots \pm \frac{1}{2}(p-1)$; hence every square number is $\equiv$ one of the series of numbers $1^2, 2^2, 3^2, \ldots \frac{1}{2}(p-1)^2$; and thus the $p-1$ numbers $1, 2, 3, \ldots p-1$, are one-half of them residues and the

other half non-residues of p. Thus in the case $p=11$ every number not divisible by 11 is, to this modulus, $\equiv$ one of the series ±1, ±2, ±3, ±4, ±5; whence the square of any such number is $\equiv$ one of the series 1, 4, 9, 16, 25, or say the series 1, 4, 9, 5, 3; that is, we have

$$\begin{array}{r|cccccccccc|}\text{residues} & 1, & & 3, & 4, & 5, & . & . & . & 9, & . \\ \text{non-residues} & . & 2, & . & . & . & 6, & 7, & 8, & . & 10\end{array}$$

Calling as usual the residues a and the non-residues b, we have in this case $\frac{1}{11}(\Sigma b-\Sigma a)=\frac{1}{11}(33-22)$, $=1$, a positive integer; this is a property true for any prime number of the form $4n+3$, but for a prime number of the form $4n+1$ we have $\Sigma b-\Sigma a=0$; the demonstration belongs to a higher part of the theory.

It is easily shown that the product of two residues or of two non-residues is a residue; but the product of a residue and a non-residue is a non-residue.

24. The law of reciprocity—Legendre's symbol. The question presents itself, given that P is a residue or a non-residue of Q, can we thence infer whether Q is a residue or a non-residue of P? In particular, if P, Q, are the odd primes p, q, for instance, given that $13=R(17)$, can we thence infer that $17=R(13)$, or that $17=NR(13)$? The answer is contained in the following theorem: if p, q, are odd primes each or one of them of the form $4n+1$, then p, q, are each of them a residue or each of them a non-residue of the other; but, if p, q, are each of them of the form $4n+3$, then according as p is a residue or a non-residue of q we have q a non-residue or a residue of p.

The theorem is conveniently expressed by means of Legendre's symbol, viz., p being a positive odd prime, and Q any positive or negative number not divisible by p, then $\left(\frac{Q}{p}\right)$ denotes $+1$ or -1 according as Q is or is not a residue of p; if, as before, q is (as p) a positive odd prime, then the foregoing theorem is

$$\left(\frac{p}{q}\right)\left(\frac{q}{p}\right)=(-1)^{\frac{1}{2}(p-1)(q-1)}$$

The denominator symbol may be negative, say it is $-p$, we then have as a definition $\left(\frac{Q}{-p}\right)=\left(\frac{Q}{p}\right)$—observe that $\left(\frac{-Q}{p}\right)$ is not $=\left(\frac{Q}{-p}\right)$—and we have further the theorems

$$\left(\frac{-1}{p}\right)=(-1)^{\frac{1}{2}(p-1)}\qquad\left(\frac{2}{p}\right)=(-1)^{\frac{1}{8}(p^2-1)}$$

viz., -1 is a residue or a non-residue of p according as $p\equiv1$ or $\equiv3$ (mod. 4), and 2 is a residue or a non-residue of p according as $p\equiv1$ or 7, or $\equiv3$ or 5 (mod. 8). If, as definitions, $\left(\frac{p}{-1}\right)=+1$ and $\left(\frac{p}{2}\right)=+1$, these may be written

$$\left(\frac{-1}{p}\right)\left(\frac{p}{-1}\right)=(-1)^{\frac{1}{2}(p-1)}\text{ and }\left(\frac{2}{p}\right)\left(\frac{p}{2}\right)=(-1)^{\frac{1}{8}(p^2-1)}$$

We have also, what is in fact a theorem given at the end of No. 23,

$$\left(\frac{QQ'}{p}\right)=\left(\frac{Q}{p}\right)\left(\frac{Q'}{p}\right).$$

The further definition is sometimes convenient—

$$\left(\frac{Q}{p}\right)=0,\text{ when } p \text{ divides } Q.$$

The law of reciprocity as contained in the theorem

$$\left(\frac{p}{q}\right)\left(\frac{q}{p}\right)=(-1)^{\frac{1}{2}(p-1)(q-1)}$$

is a fundamental theorem in the whole theory; it was enunciated by Legendre, but first proved by Gauss, who gave no less than six demonstrations of it.

25. Jacobi's generalized symbol. Jacobi defined this as follows: the symbol $\left(\frac{Q}{\pm pp'p''\ldots}\right)$, where $p, p', p'',\ldots$ are positive odd primes equal or unequal, and Q is any positive or negative odd number prime to $pp'p''\ldots$, denotes $+1$ or -1 according to the definition

$$\left(\frac{Q}{\pm pp'p''\ldots}\right)=\left(\frac{Q}{p}\right)\left(\frac{Q}{p'}\right)\left(\frac{Q}{p''}\right)\ldots,$$

the symbols on the right-hand side being Legendre's symbols; but the definition may be regarded as extending to the case where Q is not prime to $pp'p''\ldots$, then we have Q divisible by some factor p, and by the definition of Legendre's symbol in this case we have $\left(\frac{Q}{p}\right)=0$; hence in the case in question of Q not being prime to $pp'p''\ldots$ the value of Jacobi's symbol is $=0$.

We may further extend the definition of the symbol to the case where the numerator and the denominator of the symbol are both or one of them even, and present the definition in the most general form, as follows: suppose that, $p, p', p'',\ldots$ being positive or negative even or odd primes, equal or unequal, and similarly $q, q', q'',\ldots$ being positive or negative even or odd primes, equal or unequal, we have $P=pp'p''\ldots$ and $Q=qq'q''\ldots$, then the symbol $\left(\frac{Q}{P}\right)$ will denote $+1$, -1, or 0, according to the definition

$$\left(\frac{Q}{P}\right)=\left(\frac{q}{p}\right)\left(\frac{q}{p'}\right)\left(\frac{q}{p''}\right)\ldots\left(\frac{q'}{p}\right)\left(\frac{q'}{p'}\right)\left(\frac{q'}{p''}\right)\ldots,$$

the symbols on the right hand being Legendre's symbols. If P and Q are not prime to each other, then for some pair of factors p and q we have $p=\pm q$, and the corresponding Legendrian symbol $\left(\frac{q}{p}\right)$ is $=0$, whence in this case $\left(\frac{Q}{P}\right)=0$.

It is important to remark that $\left(\frac{Q}{P}\right)=+1$ is not a sufficient condition in order that Q may be a residue of P; if $P=2^{a}pp'p''\ldots$, $p,p',p'',\ldots$ being positive odd primes, then, in order that Q may be a residue of P, it must be a residue of each of the prime factors $p, p', p'',\ldots$, that is, we must have $\left(\frac{Q}{p}\right)=+1$, $\left(\frac{Q}{p'}\right)=+1$, $\left(\frac{Q}{p''}\right)=+1,\ldots$ as many equations as there are unequal factors $p, p', p'',\ldots$ of the modulus P.

Ordinary Theory, Second Part,—Theory of Forms.

26. Binary quadratic (or quadric) forms—transformation and equivalence. We consider a form

$$ax^2+2bxy+cy^2,=(a,\ b,\ c)(x,\ y)^2,$$

or when, as usual, only the coefficients are attended to, $=(a,\ b,\ c)$. The coefficients $(a,\ b,\ c)$ and the variables $(x,\ y)$ are taken to be positive or negative integers, not excluding zero. The discriminant $ac-b^2$ taken negatively, that is, b^2-ac, is said to be the determinant of the form, and we thus distinguish between forms of a positive and of a negative determinant.

Considering new variables, $\alpha x+\beta y$, $\gamma x+\delta y$, where α, β, γ, δ, are positive or negative integers, not excluding zero, we have identically

$$(a,\ b,\ c)(\alpha x+\beta y,\ \gamma x+\delta y)^2=(a',\ b',\ c')(x,\ y)^2,$$

$$\begin{array}{lll}\text{where} & a'=(a,\ b.\ c)(\alpha,\ \gamma)^2, & =a\alpha^2+2b\alpha\gamma+c\gamma^2, \\ & b'=(a,\ b,\ c)(\alpha,\ \gamma)(\beta,\ \delta), & =a\alpha\beta+b(\alpha\delta+\beta\gamma)+c\gamma\delta, \\ & c'=(a,\ b,\ c)(\beta,\ \delta)^2, & =a\beta^2+2b\beta\delta+c\delta^2: \\ \text{and thence} & b'^2-a'c'=(\alpha\delta-\beta\gamma)^2\,(b^2-ac). & \end{array}$$

The form $(a',\ b',\ c')$ is in this case said to be contained in the form $(a,\ b,\ c)$; and a condition for this is obviously that the determinant D' of the contained form shall be equal to the determinant D of the containing form multiplied by a square number; in particular, the determinants must be of the same sign. If the determinants are equal, then $(\alpha\delta-\beta\gamma)^2=1$, that is, $\alpha\delta-\beta\gamma=\pm1$. Assuming in this case that the transformation exists, and writing $\alpha\delta-\beta\gamma=\epsilon$, and writing also suppose,

$$\left.\begin{aligned} x' &= \alpha x+\beta y,\\ y' &= \gamma x+\delta y \end{aligned}\right. \quad \text{then conversely} \quad \begin{aligned} x &= \frac{1}{e}(\delta x'-\beta y'),=\alpha' x'+\beta' y',\\ y &= \frac{1}{e}(-\gamma x'+\alpha y'),=\gamma' x'+\delta' y', \end{aligned}$$

where α', β', γ', δ' are integers; and we have, moreover,

$$\alpha'\delta'-\beta'\gamma'=\frac{1}{e^2}(\alpha\delta-\beta\gamma),=\frac{1}{e},=e,$$

that is, $\alpha'\delta'-\beta'\gamma'=+1$ or -1 according as $\alpha\delta-\beta\gamma$ is $=+1$ or -1. The two forms (a, b, c), (a', b', c') are in this case said to be equivalent, and to be, in regard to the particular transformation, equivalent properly or improperly according as $\alpha\delta-\beta\gamma(=\alpha'\delta'-\beta'\gamma')$ is $=+1$ or $=-1$. We have, therefore, as a condition for the equivalence of two forms, that their determinants shall be equal; but this is not a sufficient condition. It is to be remarked also that two forms of the same determinant may be equivalent properly and also improperly; there may exist a transformation for which $\alpha\delta-\beta\gamma$ is $=+1$, and also a transformation for which $\alpha\delta-\beta\gamma$ is $=-1$. But this is only the case when each of the forms is improperly equivalent to itself; for instance, a form x^2-Dy^2, which remains unaltered by the change x, y, into x, $-y$ (that is, $\alpha, \beta, \gamma, \delta=1, 0, 0, -1$, and therefore $\alpha\delta-\beta\gamma=-1$), is a form improperly equivalent to itself. A form improperly equivalent to itself is said to be an ambiguous form. In what follows, equivalent means always properly equivalent.

27. Forms for a given determinant—classes, &c. In the case where $D,=b^2-ac$, is a square the form $(a, b, c)(x, y)^2$ is a product of two rational factors; this case may be excluded from consideration, and we thus assume that the determinant D is either negative, or, being positive, that it is not a square. The forms (a, b, c) of a given positive or negative determinant are each of them equivalent to some one out of a finite number of non-equivalent forms which may be considered as representing so many distinct classes. For instance, every form of the determinant -1 is equivalent to $(1, 0, 1)$, that is, given any form (a, b, c) for which $b^2-ac=-1$, it is possible to find integer values α, β, γ, δ, such that $\alpha\delta-\beta\gamma=+1$, and $(a, b, c)(\alpha x+\beta y, \gamma x+\delta y)^2=(1, 0, 1)(x, y)^2$, that is, $=x^2+y^2$. Or, to take a less simple example, every form of the determinant -35 is equivalent to one of the following forms: $(1, 0, 35)$, $(5, 0, 7)$, $(3, \pm1, 12)$, $(4, \pm1, 18)$,—$(2, 1, 8)$, $(6, 1, 6)$; for the first six forms the numbers a, $2b$, c have no common factor, and these are said to be *properly primitive* forms, or to belong to the properly primitive order; for the last two forms the numbers a, b, c have no common factor, but, a and c being each even, the numbers a, $2b$, c have a common factor 2, and these are said to be *improperly primitive* forms, or to belong to the improperly primitive order. The properly primitive forms are thus the six forms $(1, 0, 35)$, $(5, 0, 7)$, $(3, \pm1, 12)$, $(4, \pm1, 18)$; or we may say that there are represented hereby six properly primitive classes. Derived forms, or forms which belong to a derived order, present themselves in the case of a determinant D having a square factor or factors, and it is not necessary to consider them here.

It is not proposed to give here the rules for the determination of the system of non-equivalent forms; it will be enough to state that this depends on the determination in the first instance of a system of *reduced* forms, that is, forms for which the coefficients a, b, c, taken positively satisfy certain numerical inequalities admitting only of a finite number of solutions. In the case of a negative determinant the reduced forms are no two of them equivalent, and we thus have the required system of non-equivalent forms; in the case of a positive determinant, the reduced forms group themselves together in *periods* in such wise that the forms belonging to a period are equivalent to each other, and the required system of non-equivalent forms is obtained by selecting one form out of each such period. The principal difference in the theory of the two cases of a positive and a negative determinant consists in these periods; the system of non-equivalent forms once arrived at, the two theories are nearly identical.

28. Characters of a form or class—division into genera. Attending only to the properly primitive forms—for instance, those mentioned above for the determinant -35—the form $(1, 0, 35)$ represents only numbers f which are residues of 5, and also residues of 7; we have, in fact, $f=x^2+35y^2, \equiv x^2 \pmod{5}$, and also $\equiv x^2 \pmod{7}$. Using the Legendrian symbols $\left(\frac{f}{5}\right)$ and $\left(\frac{f}{7}\right)$, we say that the form $(1, 0, 35)$ has the characters $\left(\frac{f}{5}\right), \left(\frac{f}{7}\right)=++$. Each of the other forms has in like manner a determinate character $+$ or $-$ in regard to $\left(\frac{f}{5}\right)$ and also in regard to $\left(\frac{f}{7}\right)$; and it is found that for each of them the characters are $++$ or else $--$ (that is, they are never $+-$ or $-+$). We, in fact, have

$$\begin{array}{l|cc} & \left(\frac{f}{5}\right) & \left(\frac{f}{7}\right) \\ \hline \left.\begin{matrix}(1, & 0, & 35)\\ (4, & \pm1, & 9)\end{matrix}\right. & + & + \\ \hline \left.\begin{matrix}(5, & 0, & 7)\\ (3, & \pm1, & 12)\end{matrix}\right. & - & - \end{array},$$

and we thus arrange the six forms into genera, viz., we have three forms belonging to the genus $\left(\frac{f}{5}\right), \left(\frac{f}{7}\right)=++$, and three to the genus $\left(\frac{f}{5}\right), \left(\frac{f}{7}\right)=--$, these characters $++$ and $--$ of genera being one-half of all the combinations $++$, $--$, $+-$, $-+$.

The like theory applies to any other negative or positive determinant; the several characters have reference in some cases not only to the odd prime factors of D but also to the numbers 4 and 8, that is, there is occasion to consider also the Legendrian symbols $\left(\frac{-1}{f}\right),=(-1)^{\frac{1}{2}(f-1)}$, and $\left(\frac{2}{f}\right),=(-1)^{\frac{1}{8}(f^2-1)}$, and there are various cases to be considered according to the form of D in regard to its simple and squared factors respectively; but in every case there are certain combinations of characters (in number one-half of all the combinations) which correspond to genera, and the properly primitive forms belong to different genera accordingly, the number of forms being the same in each genus.

The form $(1, 0, -D)$ has the characters all $+$, and this is said to be the principal form, and the genus containing it the principal genus. For a given determinant, the characters of two genera may be compounded together according to the ordinary rule of signs, giving the characters of a new genus; in particular, if the characters of a genus are compounded with themselves, then we have the characters of the principal genus.

29. Composition of quadratic forms. Considering X, Y, as given lineo-linear functions of (x, y), (x', y'), defined by the equations

$$\begin{aligned} X &= p_0xx'+p_1xy'+p_2yx'+p_3yy',\\ Y &= q_0xx'+q_1xy'+q_2yx'+q_3yy', \end{aligned}$$

the coefficients $p_0, p_1, p_2, p_3, q_0, q_1, q_2, q_3$ may be so connected with the coefficients (A, B, C), (a, b, c), (a', b', c'), of three quadratic forms as to give rise to the identity

$$(A, B, C)(X, Y)^2=(a, b, c)(x, y)^2 \cdot (a', b', c')(x', y')^2;$$

and, this being so, the form (A, B, C) is said to be compounded of the two forms (a, b, c) and (a', b', c'), the order of composition being indifferent.

The necessary and sufficient condition in order that it may be possible to compound together two given forms (a, b, c), (a', b', c'), is that their determinants shall be to each other in the proportion of two square numbers; in particular, the two forms may have the same determinant D; and when this is so the compound form (A, B, C) will also have the same determinant D. The rules for this composition of two forms of the same determinant have been (as part of the general theory) investigated and established. The forms compounded of equivalent forms are equivalent to each other; we thus in effect compound *classes*, viz., considering any two classes, the composition of their representative forms gives a form which is the representative of a new class, and the composition of any two forms belonging to the two classes respectively gives a form belonging to the new class. But this once understood, it is more simple to speak of the composition of forms, that is, of the forms belonging to the finite system of representative forms for a given determinant; and it will be enough to consider the properly primitive forms.

30. The principal form $(1, 0, D)$ compounded with any other form (a, b, c) gives rise to this same form (a, b, c); the principal form is on this account denoted by 1, viz., denoting the other form by ϕ, and expressing composition in like manner with multiplication, we have $1 . \phi = \phi$. The form ϕ may be compounded with itself, giving a form denoted by ϕ^2; compounding this again with ϕ, we have a form denoted by ϕ^3; and so on. Since the whole number of forms is finite we must in this manner arrive at the principal form, say we have $\phi^n = 1$, n being the least exponent for which this equation is satisfied. In particular, if the form ϕ belong to the principal genus, then the forms $\phi^2, \phi^3, \ldots \phi^{n-1}$ will all belong to the principal genus, or the principal genus will include the forms $1, \phi, \phi^2, \ldots \phi^{n-1}$ the powers of a form ϕ having the exponent n.

31. Regular and irregular determinants. The principal genus may consist of such a series of forms, and the determinant is then said to be *regular*; in particular, for a negative determinant $D, = -1$ to -1000, the determinant is always regular except in the thirteen cases $-D = 243$, 307, 339, 459, 576, 580, 675, 755, 820, 884, 891, 900, 974 (and, Perott, in Crelle, vol. xcv., 1883, except also for $-D = 468, 931$); the determinant is here said to be irregular. Thus for each of the values $-D = 576, 580, 820, 900$, the principal genus consists of four forms, not $1, \phi, \phi^2, \phi^3$, where $\phi^4 = 1$, but $1, \phi, \phi_1, \phi\phi_1$, where $\phi^2 = 1$, $\phi_1{}^2 = 1$, and therefore also $(\phi\phi_1)^2 = 1$.

Compounding together any two forms, we have a form with the characters compounded of the characters of the two forms; and in particular, combining a form with itself, we have a form with the characters of the principal form. Or, what is the same thing, any two genera compounded together give rise to a determinate genus, viz., the genus having the characters compounded of the characters of the two genera; and any genus compounded with itself gives rise to the principal genus.

Considering any regular determinant, suppose that there is more than one genus, and that the number of forms in each genus is $= n$; then, except in the case $n = 2$, it can be shown that there are always forms having the exponent $2n$. For instance, in the case $D = -35$ we have two genera each of three forms; there will be a form g having the exponent $6, - g^6 = 1$; and the forms are $1, g, g^2, g^3, g^4, g^5$, where $1, g^2, g^4$, belong to the principal genus, and g, g^3, g^5, to the other genus. The characters refer to $\left(\frac{f}{5}\right)$, $\left(\frac{f}{7}\right)$, and the forms are

$$\begin{array}{lrrrl|lrrrl} ++, & (1, & 0, & 35) & 1 & --, & (3, & -1, & 12) & g \\ & (4, & 1, & 9) & g^2 & & (5, & 0, & 7) & g^3 \\ & (4, & -1, & 9) & g^4 & & (3, & 1, & 12) & g^5. \end{array}$$

An instance of the case $n = 1$ is $D = -21$, there are here four genera each of a single form $1, c, c_1, cc_1$, where $c^2 = 1$, $c_1{}^2 = 1$; an instance of the case $n = 2$ is $D = -88$, there are here two genera each of two forms $1, c$, and c_1, cc_1, where $c^2 = 1$, $c_1{}^2 = 1$, thus there is here no form having the exponent $2n$. (See Cayley, *Tables, &c.*, in Crelle, vol. lx., 1862, pp. 357-372.) We may have 2^{k+1} genera each of n forms, viz., such a system may be represented by $(1, \phi^2, \ldots \phi^{2n-2}; \phi, \phi^3, \ldots \phi^{2n-1})(1, c)(1, c_1) \ldots (1, c_{k-1})$, where $\phi^{2n} = 1$, $c^2 = 1$, $c_1{}^2 = 1, \ldots c^2_{k-1} = 1$; there is no peculiarity in the form ϕ, we may instead of it take any form such as $c\phi$, $cc_1\phi$, &c., for each of these is like ϕ, a form belonging to the exponent $2n$, and such that the even powers give the principal genus.

32. Ternary and higher quadratic forms—cubic forms, &c. The theory of the ternary quadratic forms

$$(a, b, c, a', b', c')(x, y, z)^2, = ax^2 + by^2 + cz^2 + 2a'yz + 2b'zx + 2c'xy,$$

or when only the coefficients are attended to $\begin{pmatrix} a, & b, & c \\ a', & b', & c' \end{pmatrix}$, has been studied in a very complete manner; and those of the quaternary and higher quadratic forms have also been studied; in particular the forms $x^2 + y^2 + z^2$, $x^2 + y^2 + z^2 + w^2$ composed of three or four squares; and the like forms with five, six, seven, and eight squares. The binary cubic forms $(a, b, c, d)(x, y)^3, = ax^3 + 3bx^2y + 3cxy^2 + dy^3$, or when only the coefficients are attended to (a, b, c, d), have also been considered, though the higher binary forms have been scarcely considered at all. The special ternary cubic forms $ax^3 + by^3 + cz^3 + 6lxyz$ have been considered. Special forms of the degree n with n variables, the products of linear factors, present themselves in the theory of the division of the circle (the Kreistheilung) and of the complex numbers connected therewith; but it can hardly be said that these have been studied as a part of the general theory of forms

Complex Theories.

33. The complex theory which first presented itself is that of the numbers $a + bi$ composed with the imaginary $i, = \sqrt{-1}$; here if a and b are ordinary, or say simplex positive or negative integers, including zero, we regard $a + bi$ as an integer number, or say simply as a number in this complex theory. We have here a zero 0 ($a = 0$, $b = 0$) and the units $1, i, -1, -i$, or as these may be written $1, i, i^2, i^3$ ($i^4 = 1$); the numbers $a + bi$, $a - bi$, are said to be conjugate numbers, and their product $(a + bi)(a - bi), = a^2 + b^2$, is the norm of each of them. And so the norm of the real number a is $= a^2$, and that of the pure imaginary number bi is $= b^2$. Denoting the norm by the letter N, $N(a \pm bi) = a^2 + b^2$.

Any simplex prime number, $\equiv 1$ (mod. 4), is the sum of two squares $a^2 + b^2$, for instance $13 = 9 + 4$, and it is thus a product $(a + bi)(a - bi)$, that is, it is not a prime number in the present theory, but each of these factors (or say any number $a + bi$, where $a^2 + b^2$ is a prime number in the simplex theory) is a prime; and any simplex prime number, $\equiv 3$ (mod. 4), is also a prime in the present theory. The number $2, = (1 + i)(1 - i)$, is not a prime, but the factors $1 + i$, $1 - i$ are each of them prime; these last differ only by a unit factor i—$1 + i = i(1 - i)$—so that $2, = -i(1 + i)^2$, contains a square factor.

In the simplex theory we have numbers, for instance $5, -5$, differing from each other only by a unit factor, but we can out of these select one, say the positive number, and attend by preference to this number of the pair. It is in this way—viz., by restricting $a, b, c, \ldots$ to denote terms of the series 2, 3, 5, 7, ... of positive primes other than unity—that we are enabled to make the definite statement, a positive number N is, and that in one way only, $= a^\alpha b^\beta c^\gamma \ldots$; if N be a positive or negative number, then the theorem of course is, N is, and that in one way only, $= (-1)^m a^\alpha b^\beta c^\gamma \ldots$, where $m=0$, or 1, and $a, b, c, \ldots \alpha, \beta, \gamma, \ldots$ are as before. To obtain a like definite statement in the present theory we require to distinguish between the four numbers $a+bi, -a-bi, -b+ai, b-ai$, which differ from each other only by a unit factor $-1, \pm i$. Consider a number $a+bi$ where a and b are the one of them odd and the other even (a and b may be either of them $=0$, the other is then odd), every prime number $a+bi$ other than $\pm 1 \pm i$ is necessarily of this form, for if a and b were both even the number would be divisible by 2, or say by $(1+i)^2$, and if a and b were both odd it would be divisible by $1+i$; then of the four associated numbers $a+bi-a-bi, -b+ai, b-ai$, there is one and only one, $a+bi$, such that b is even and $a+b-1$ is evenly even; or say one and only one which is $\equiv 1$ (mod. $2(1+i)$). We distinguish such one of the four numbers from the other three and call it a *primary* number; the units $\pm 1, \pm i$, and the numbers $\pm 1 \pm i$ are none of them primary numbers. We have then the theorem, a number N is in one way only $=i^m(1+i)^n A^\alpha B^\beta \ldots$, where $m=0$, 1, 2, or 3, n is $=0$ or a positive integer, $A, B, \ldots$ are primary primes, $\alpha, \beta, \ldots$ positive integers. Here i is a unit of the theory, $1+i$ is a special prime having reference to the number 2, but which might, by an extension of the definition, be called a primary prime, and so reckoned as one of the numbers $A, B, \ldots$; the theorem stated broadly still is that the number N is, and that in one way only, a product of prime factors, but the foregoing complete statement shows the precise sense in which this theorem must be understood. A like explanation is required in other complex theories; we have to select out of each set of primes differing only by unit factors some one number as a primary prime, and the general theorem then is that every number N is, and that in one way only, $=P \,.\, A^\alpha B^\beta C^\gamma \ldots$, where P is a product of unities, and $A, B, C, \ldots$ are primary primes.

34. We have in the simplex theory (*ante*, No. 10) the theorem that, p being an odd prime, there exists a system of $p-1$ residues, that is, that any number not divisible by p is, to the modulus p, congruent to one, and only one, of the $p-1$ numbers $1, 2, 3, \ldots p-1$. The analogous theorem in the complex theory is that for any prime number p other than $\pm 1 \pm i$ there exists a system of $N(p)-1$ residues, that is, that every number not divisible by p is, to the modulus p, congruent to one of these $N(p)-1$ numbers.

But p may be a real prime such as 3, or a complex prime such as $3+2i$; and the system of residues presents itself naturally under very different forms in the two cases respectively. Thus in the case $p=3$, $N(3)=9$, the residues may be taken to be

$$\begin{array}{ccc} & 1\ , & 2 \\ i, & 1+i\ , & 2+i\ , \\ 2i, & 1+2i, & 2+2i, \end{array}$$

being in number $N(3)-1=8$. And for $p=3+2i$, $N(3+2i)=13$, they may be taken to be the system of residues of 13 in the simplex theory, viz., the real numbers $1, 2, 3, \ldots\ldots 12$. We have in fact $5+i=(2+3i)(1-i)$, that is, $5+i \equiv 0$ (mod. $2+3i$), and consequently $a+bi \equiv a-5b$, a real number which, when $a+bi$ is not divisible by $3+2i$, may have any one of the foregoing values $1, 2, 3, \ldots 12$.

Taking then any number x not divisible by p, the $N(p)-1$ residues each multiplied by x are, to the modulus p, congruent to the series of residues in a different order; and we thus have,—say this is Fermat's theorem for the complex theory—$x^{N(p)-1}-1 \equiv 0$ (mod. p), with all its consequences, in particular the theory of prime roots.

In the case of a complex modulus such as $3+2i$, the theory is hardly to be distinguished from its analogue in the ordinary theorem; a prime root is $=2$, and the series of powers is 2, 4, 8, 3, 6, 12, 11, 9, 5, 10, 7, 1, for the modulus $3+2i$ as for the modulus 13. But for a real prime such as 3 the prime root is a complex number: taking it to be $=2+i$, we have $(2+i)^8-1 \equiv 0$ (mod. 3), and the series of powers in fact is $2+i, i, 2+2i, 2, 1+2i, 2i, 1+i, 1$, viz., we thus have the system of residues (mod. 3).

We have in like manner a theory of quadratic residues; a Legendrian symbol $\left[\frac{p}{q}\right]$ (which, if p, q, are uneven primes not necessarily primary but subject to the condition that their imaginary parts are even, denotes $+1$ or -1 according as $p^{\frac{1}{2}(Nq-1)}$ is $\equiv 1$ or $\equiv -1$ (mod. q), so that $\left[\frac{p}{q}\right]=+1$ or -1 according as p is or is not a residue of q), a law of reciprocity expressed by the very simple form of equation $\left[\frac{p}{q}\right]=\left[\frac{q}{p}\right]$, and generally a system of properties such as that which exists in the simplex theory.

The theory of quadratic forms (a, b, c) has been studied in this complex theory; the results correspond to those of the simplex theory.

35. The complex theory with the imaginary cube root of unity has also been studied; the imaginary element is here $\gamma, =\frac{1}{2}(-1+\sqrt{-3})$, a root of the equation $\gamma^2+\gamma+1=0$; the form of the complex number is thus $a+b\gamma$, where a and b are any positive or negative integers, including zero. The conjugate number is $a+b\gamma^2, =a-b-b\gamma$, and the product $(a+b\gamma)(a+b\gamma^2), =a^2-ab+b^2$, is the norm of each of the factors $a+b\gamma$, $a+b\gamma^2$. The whole theory corresponds very closely to, but is somewhat more simple than, that of the complex numbers $a+bi$.

36. The last-mentioned theory is a particular case of the complex theory for the imaginary λth roots of unity, λ being an odd prime. Here α is determined by the equation $\frac{\alpha^\lambda-1}{\alpha-1}=0$, that is, $\alpha^{\lambda-1}+\alpha^{\lambda-2}+\ldots+\alpha+1=0$, and the form of the complex number is $f(\alpha), =a+b\alpha+c\alpha^2\ldots+k\alpha^{\lambda-2}$, where $a, b, c, \ldots k$, are any positive or negative integers, including zero. We have $\lambda-1$ conjugate forms, viz., $f(\alpha), f(\alpha^2), \ldots f(\alpha^{\lambda-1})$, and the product of these is the norm of each of the factors $Nf(\alpha), =Nf(\alpha^2), \ldots =Nf(\alpha^{\lambda-1})$. Taking g any prime root of λ, $g^{\lambda-1}-1 \equiv 0$ (mod. λ), the roots $\alpha, \alpha^2, \ldots \alpha^{\lambda-1}$, may be arranged in the order $\alpha, \alpha^g, \alpha^{g^2}, \ldots \alpha^{g^{\lambda-2}}$; and we have thence a grouping of the roots in periods, viz., if $\lambda-1$ be in any manner whatever expressed as a product of two factors, $\lambda-1=ef$, we may with the $\lambda-1$ roots form e periods $\eta_0, \eta_1, \ldots \eta_{e-1}$, each of f roots. For instance $\lambda=13$; a prime root is $g=2$, and $\lambda-1=ef=3.4$; then the three periods each of four roots are

$$\begin{aligned} \eta_0 &= \alpha\ +\alpha^8+\alpha^{12}+\alpha^5, \\ \eta_1 &= \alpha^2+\alpha^3+\alpha^{11}+\alpha^{10}, \\ \eta_2 &= \alpha^4+\alpha^6+\alpha^9\ +\alpha^7. \end{aligned}$$

So also if $ef=2.6$ then the 2 periods each of 6 roots are

$$\begin{aligned} \eta_0 &= \alpha\ +\alpha^4+\alpha^3+\alpha^{12}+\alpha^9+\alpha^{10}, \\ \eta_1 &= \alpha^2+\alpha^8+\alpha^6+\alpha^{11}+\alpha^5+\alpha^7; \end{aligned}$$

and so in other cases. In particular, if $f=1$ and consequently $e=\lambda-1$, the e periods each of f roots are in fact the single roots $\alpha, \alpha^g, \ldots \alpha^{g^{\lambda-2}}$. We may in place of the original form of the complex number

$$f(\alpha)=a+b\alpha+c\alpha^2\ldots+k\alpha^{\lambda-2},$$

consider the new form $f(\eta)=a\eta+b\eta_1\ldots+l\eta_{e-1}$, which when $f=1$ is equivalent to the original form, but in any other case denotes a special form of complex number; instead of $\lambda-1$, we have only e conjugate numbers, and the product of these e numbers may be regarded as the norm of $f(\eta)$.

37. The theory for the roots α includes as part of itself the theory for the periods corresponding to every decomposition whatever $\lambda-1=ef$ of $\lambda-1$ into two factors, but

each of these may be treated apart from the others as a theory complete in itself. In particular, a simple case is that of the half-periods $e=2, f=\frac{1}{2}(\lambda-1)$; and, inasmuch as the characteristic phenomenon of ideal numbers presents itself in this theory of the half-periods (first for the value $\lambda=23$), it will be sufficient, by way of illustration of the general theory, to consider only this more special and far easier theory; we may even assume $\lambda=23$.[1]

For the case in question, $\lambda-1=ef=2.\frac{1}{2}(\lambda-1)$, we have the two periods η_0, η_1, each of $\frac{1}{2}(\lambda-1)$ roots; from the expressions for η_0, η_1, in terms of the roots we obtain at once $\eta_0+\eta_1=-1$, and with a little more difficulty $\eta_0\eta_1=-\frac{1}{4}(\lambda-1)$ or $\frac{1}{4}(\lambda+1)$ according as λ is $\equiv 1$ or 3 (mod. 4), that is, in the two cases respectively η_0, η_1, are the roots of the equation $\eta^2+\eta-\frac{1}{4}(\lambda-1)=0$, and $\eta^2+\eta+\frac{1}{4}(\lambda+1)=0$. And this equation once obtained there is no longer any occasion to consider the original equation of the order $\lambda-1$, but the theory is that of the complex numbers $a\eta_0+b\eta_1$, or if we please $a+b\eta$, composed with the roots of this quadric equation,—say the complex numbers $a+b\eta$, where a and b are any positive or negative integer numbers, including zero. In the case $\lambda=23$ the quadric equation is $\eta^2+\eta+6=0$. We have $N(a+b\eta)=(a+b\eta_0)(a+b\eta_1)=a^2-ab+\frac{1}{4}(\lambda+1)b^2$; and for $\lambda=23$ this is $N(a+b\eta)=a^2-ab+6b^2$. It may be remarked that there is a connexion with the theory of the quadratic forms of the determinant -23, viz., there are here the three improperly primitive forms $(2, 1, 12)$, $(4, 1, 6)$, $(4, -1, 6)$, 23 being the smallest prime number for which there exists more than one improperly primitive form.

38. Considering then the case $\lambda=23$, we have η_0, η_1, the roots of the equation $\eta^2+\eta+6=0$; and a real number P is composite when it is $=(a+b\eta_0)(a+b\eta_1), =a^2-ab+6b^2$, viz., if $4P=(2a-b)^2+23b^2$. Hence no number, and in particular no positive real prime P, can be composite unless it is a (quadratic) residue of 23; the residues of 23 are 1, 2, 3, 4, 6, 8, 9, 12, 13, 16, 18; and we have thus, for instance, 5, 7, 11, as numbers which are *not* composite, while 2, 3, 13, are numbers which are not by the condition precluded from being composite: they are not, according to the foregoing signification of the word, composite (for 8, 12, 52, are none of them of the form x^2+23y^2), but *some* such numbers, residues that is of 23, are composite, for instance $59, =(5-2\eta_0)(5-2\eta_1)$. And we have an indication, so to speak, of the composite nature of *all* such numbers; take for instance 13, we have $(\eta-4)(\eta+5)=-2.13$, where 13 does not divide either $\eta-4$ or $\eta+5$, and we are led to conceive it as the product of two ideal factors, one of them dividing $\eta-4$, the other dividing $\eta+5$. It appears, moreover, that a power 13^3 is in fact composite, viz., we have

$$13^3=(31-12\eta_0)(31-12\eta_1),\ (2197=961+372+864);$$

and writing $13=\sqrt[3]{31-12\eta_0}\,.\,\sqrt[3]{31-12\eta_1}$ we have 13 as the product of two ideal numbers each represented as a cube root; it is to be observed that, 13 being in the simplex theory a prime number, these are regarded as prime ideal numbers. We have in like manner

$$2=\sqrt[3]{1-\eta_0}\,.\,\sqrt[3]{1-\eta_1},\ 3=\sqrt[3]{1-2\eta_0}\,.\,\sqrt[3]{1-2\eta_1}\ \&c.;$$

every positive real prime which is a residue of 23 is thus a product of two factors ideal or actual. And, reverting to the equation $(\eta-4)(\eta+5)=-2.13$, or as this may be written

$$(\eta_1-4)(\eta_1+5)=-\sqrt[3]{1-\eta_0}\ \sqrt[3]{1-\eta_1}\ \sqrt[3]{31-12\eta_0}\ \sqrt[3]{31-12\eta_1},$$

we have $(\eta_1-4)^3$ and $(1-\eta_0)(31-12\eta_0)$ each $=14+55\eta_1$, or say

$$\eta_1-4=\sqrt[3]{1-\eta_0}\ \sqrt[3]{31-12\eta_0},$$

and similarly

$$\eta_1+5=-\sqrt[3]{1-\eta_1}\ \sqrt[3]{31-12\eta_1},$$

so that we verify that η_1-4, η_1+5, do thus in fact each of them contain an ideal factor of 13.

39. We have $2=\sqrt[3]{1-\eta_0}\,\sqrt[3]{1-\eta_1}$, viz., the ideal multiplier $\sqrt[3]{1-\eta_0}$ renders actual one of the ideal factors $\sqrt[3]{1-\eta_1}$ of 2, and it is found that this same ideal multiplier $\sqrt[3]{1-\eta_0}$ renders actual one of the two ideal factors of any other decomposable number 3, 13, &c.,

$$\sqrt[3]{1-2\eta_0}\ \sqrt[3]{1-\eta_0}=1+\eta_0,\ \sqrt[3]{31-12\eta_0}\ \sqrt[3]{1-\eta_0}=-5-\eta_0,\ \&c.$$

Similarly the conjugate multiplier $\sqrt[3]{1-\eta_1}$ renders actual the other ideal factor of any number 2, 3, 13, &c. We have thus two classes, or, reckoning also actual numbers, three classes of prime numbers, viz., (1) ideal primes rendered actual by the multiplier $\sqrt[3]{1-\eta_0}$, (2) ideal primes rendered actual by the multiplier $\sqrt[3]{1-\eta_1}$, (3) actual primes. This is a general property in the several complex theories; there is always a finite number of classes of ideal numbers, distinguished according to the multipliers by which they are rendered actual; the actual numbers form a "principal" class.

40. General theory of congruences—irreducible functions. In the complex theory relating to the roots of the equation $\eta^2+\eta+6=0$ there has just been occasion to consider the equation $(\eta-4)(\eta+5)=-2.13$, or say the congruence $(\eta-4)(\eta+5)\equiv 0$ (mod. 13); in this form the relation $\eta^2+\eta+6=0$ is presupposed, but if, dropping this equation, η be regarded as arbitrary, then there is the congruence $\eta^2+\eta+6\equiv(\eta-4)(\eta+5)$ (mod. 13). For a different modulus, for instance 11, there is not any such congruence exhibiting a decomposition of $\eta^2+\eta+6$ into factors. The function $\eta^2+\eta+6$ is irreducible, that is, it is not a product of factors with integer coefficients; in respect of the modulus 13 it becomes reducible, that is, it breaks up into factors having integer coefficients, while for the modulus 11 it continues irreducible. And there is a like general theory in regard to any rational and integral function $F(x)$ with integer coefficients; such function, assumed to be irreducible, may for a given prime modulus p continue irreducible, that is, it may not admit of any decomposition into factors with integer coefficients; or it may become reducible, that is, admit of a decomposition $F(x)\equiv\phi(x)\psi(x)\chi(x)\,..$ (mod. p). And, when this is so, it is thus a product, in one way only, of factors $\phi(x)$, $\psi(x)$, $\chi(x)$, .., which are each of them irreducible in regard to the same modulus p; any such factor may be a linear function of x, and as such irreducible; or it may be an irreducible function of the second or any higher degree. It is hardly necessary to remark that in this theory functions which are congruent to the modulus p are regarded as identical, and that in the expression of $F(x)$ an irreducible function $\phi(x)$ may present itself either as a simple factor, or as a multiple factor, with any exponent. The decomposition is analogous to that of a number into its prime factors; and the whole theory of the rational and integral function $F(x)$ in regard to the modulus p is in many respects analogous to that of a prime number regarded as a modulus. The theory has also been studied where the modulus is a power p^ν.

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[1] In the theory of the roots a, ideal numbers do not present themselves for the values $\lambda=3$, 5, or 7; they do for the value $\lambda=23$. It is stated in Smith's "Report on the Theory of Numbers," *Brit. Assoc. Report* for 1860, p. 136, that "for the intermediate cases $\lambda=11$, 13, 17, and 19, it is uncertain whether they do or do not present themselves." The writer is not aware whether this question has been settled; but in Reuschle's *Tafeln*, 1875, no ideal factors present themselves for these values of λ; and it is easy to see that in the theory of the half-periods the ideal factors first present themselves for the value $\lambda=23$. It may be remarked that the solution of the question depends on the determination of a system of fundamental units for the values in question $\lambda=11$, 13, 17, and 19; the theory of the units in the several complex theories is an important and difficult part of the theory, not presenting itself in the theory of the half-periods, which is alone attended to in the text.

41. The congruence-imaginaries of Galois. If $F(x)$ be an irreducible function to a given prime modulus p, this implies that there is no integer value of x satisfying the congruence $F(x) \equiv 0 \pmod{p}$; we assume such a value and call it i, that is, we assume $F(i) \equiv 0 \pmod{p}$; the step is exactly analogous to that by which, starting from the notion of a real root, we introduce into algebra the ordinary imaginary $i = \sqrt{-1}$. For instance, $x^2 - x + 3$ is an irreducible function to the modulus 7, there is no integer solution of the congruence $x^2 - x + 3 \equiv 0 \pmod{7}$. Assuming a solution i such that $i^2 - i + 3 \equiv 0 \pmod{7}$, we have, always to this modulus, $i^2 = i - 3$, and thence i^3, i^4, &c., each of them equal to a linear function of i. We consider the numbers of the form $a + bi$, where a and b are ordinary integers which may be regarded as having each of them the values 0, 1, 2, 3, 4, 5, or 6; there are thus $7^2, = 49$, such numbers, or, excluding zero, 48 numbers; and it is easy to verify that these are in fact the numbers $i, i^2, \ldots . i^{47}, i^{48}, = 1$, that is, we have i a prime root of the congruence $x^{48} - 1 \equiv 0 \pmod{7}$. The irreducible function may be of the third or any higher degree; thus for the same modulus 7 there is the cubic function $x^3 - x + 2$, giving rise to a theory of the numbers of the form $a + bi + ci^2$, where i is a congruence-imaginary such that $i^3 - i + 2 \equiv 0 \pmod{7}$; and instead of 7 the modulus may be any other odd prime p.

Ordinary Theory, Third Part.

42. In what precedes no mention has been made of the so-called Pellian equation $x^2 - Dy^2 = 1$ (where D is a given positive number), and of the allied equations $x^2 - Dy^2 = -1$, or $= \pm 4$. The equations with the sign + have always a series of solutions, those with the sign − only for certain values of D; in every case where the solutions exist a least solution is obtainable by a process depending on the expression of $\sqrt{D}$ as a continued fraction, and from this least solution the whole series of solutions can be obtained without difficulty. The equations are very interesting, as well for their own sakes as in connexion with the theory of the binary quadratic forms of a positive non-square determinant.

43. The theory of the expression of a number as a sum of squares or polygonal numbers has been developed apart from the general theory of the binary, ternary, and other quadratic forms to which it might be considered as belonging. The theorem for two squares, that every prime number of the form $4n + 1$ is, and that in one way only, a sum of two squares, is a fundamental theorem in relation to the complex numbers $a + bi$. A sum of two squares multiplied by a sum of two squares is always a sum of two squares, and hence it appears that every number of the form $2^{\alpha}(4n + 1)$ is (in general in a variety of ways) a sum of two squares.

Every number of the form $4n + 2$ or $8n + 3$ is a sum of three squares; even in the case of a prime number $8n + 3$ there is in general more than one decomposition, thus $59 = 25 + 25 + 9$ and $= 49 + 9 + 1$. Since a sum of three squares into a sum of three squares is not a sum of three squares, it is not enough to prove the theorem in regard to the primes of the form $8n + 3$.

Every prime number is (in general in more than one way) a sum of four squares; and therefore every number is (in general in more than one way) a sum of four squares, for a sum of four squares into a sum of four squares is always a sum of four squares.

Every number is (in general in several ways) a sum of $m + 2$ $(m + 2)$gonal numbers, that is, of numbers of the form $\frac{1}{2}m(x^2 - x) + x$; and of these $m - 2$ may be at pleasure equal to 0 or 1; in particular, every number is a sum of three triangular numbers (a theorem of Fermat's).

The theorems in regard to three triangular numbers and to four square numbers are exhibited by certain remarkable identities in the Theory of Elliptic Functions; and generally there is in this subject a great mass of formulæ connected with the theory of the representation of numbers by quadratic forms. The various theorems in regard to the number of representations of a number as the sum of a definite number of squares cannot be here referred to.

44. The equation $x^{\lambda} + y^{\lambda} = z^{\lambda}$, where λ is any positive integer greater than 2, is not resoluble in whole numbers (a theorem of Fermat's). The general proof depends on the theory of the complex numbers composed of the λth roots of unity, and presents very great difficulty; in particular, distinctions arise according as the number λ does or does not divide certain of Bernoulli's numbers.

45. Lejeune-Dirichlet employs for the determination of the number of quadratic forms of a given positive or negative determinant a remarkable method depending on the summation of a series Σf^{-s}, where the index s is greater than but indefinitely near to unity.

46. Very remarkable formulæ have been given by Legendre, Tchebycheff, and Riemann for the approximate determination of the number of prime numbers less than a given large number x. Factor tables have been formed for the first nine million numbers, and the number of primes counted for successive intervals of 50,000; and these are found to agree very closely with the numbers calculated from the approximate formulæ. Legendre's expression is of the form $\dfrac{x}{\log x - A}$, where A is a constant not very different from unity; Tchebycheff's depends on the logarithm-integral $\text{li}(x)$; and Riemann's, which is the most accurate, but is of a much more complicated form, contains a series of terms depending on the same integral.

The classical works on the Theory of Numbers are Legendre, *Théorie des Nombres*, 1st ed. 1798, 3d ed. 1830; Gauss, *Disquisitiones Arithmeticæ*, Brunswick, 1801 (reprinted in the collected works, vol. i., Göttingen, 1863; French trans., under the title *Recherches Arithmétiques*, by Poullet-Delisle, Paris, 1807); and Lejeune-Dirichlet, *Vorlesungen über Zahlentheorie*, 3d ed., with extensive and valuable additions by Dedekind, Brunswick, 1879-81. We have by the late Prof. H. J. S. Smith the extremely valuable series of "Reports on the Theory of Numbers," Parts I. to VI., *British Association Reports*, 1859-62, 1864-65, which, with his own original researches, will be printed in the collected works now in course of publication by the Clarendon Press. See also Cayley, "Report of the Mathematical Tables Committee," *Brit. Assoc. Report*, 1875, pp. 305-306, for list of tables relating to the Theory of Numbers, and Mr. J. W. L. Glaisher's introduction to the *Factor Table for the Sixth Million*, London, 1883, in regard to the approximate formulæ for the number of prime numbers. (A. C.)

NUMENIUS, one of the so-called Neo-Pythagoreans, and a forerunner of the Neo-Platonists, was a native of Apamea in Syria, and flourished during the latter half of the second Christian century. He was a somewhat voluminous writer in philosophy and philosophical biography, but all that is known of his opinions is found in passing references by Clement of Alexandria, Origen, Eusebius, and one or two of the Neo-Platonists. He seems to have taken Pythagoras as his highest authority, and at the same time to have been unaware of any discrepancy between his own views and those of Plato, whom he further described as an "Atticizing Moses," and as deriving all his knowledge, like Pythagoras, from the East. He held a kind of trinity, the members of which he designated as *πάππος*, *ἔκγονος*, and *ἀπόγονος* respectively,—the first being the supreme deity, or pure *νοῦς*, the second the demiurge, and the third the world.

NUMERALS. The use of visible signs to represent numbers and aid reckoning is not only older than writing but older than the development of numerical language on the denary system; we count by tens because our ancestors counted on their fingers and named numbers accordingly. So used, the fingers are really numerals, that is, visible numerical signs; and in antiquity the practice of counting by these natural signs prevailed in all classes of society. Even at this day if a Wallachian peasant wants to multiply 8 by 9 he effects this by making the fingers of each hand, counting from the thumb, represent the numbers from 6 to 10 consecutively. He therefore sets his question by stretching out the ring finger of the right hand and the middle finger of the left. He then counts that in the direction from the thumb there is one more finger on the right hand and two on the left. Multiplying 1 by 2 he gets 2 as the units of the product sought. Again the outstretched fingers are respectively the third and fourth from the thumb; adding 3 and 4 he gets 7 for the tens of the product. By this rule he does not need to know the multiplication table above 4 times 4. In the later times of antiquity the finger symbols were developed into a system capable of expressing all numbers below 10,000. The left hand was held up flat with the fingers together. The units from 1 to 9 were expressed by various positions of the third, fourth, and fifth fingers alone, one or more of these being either closed on the palm or simply bent at the middle joint, according to the number meant. The thumb and index were thus left free to express the tens by a variety of relative positions, *e.g.*, for 30 their points were brought together and stretched forward; for 50 the thumb was bent like the Greek Γ and brought against the ball of the index. The same set of signs if executed with the thumb and index of the right hand meant hundreds instead of tens, and the unit signs if performed on the right hand meant thousands.[1]

The fingers serve to express numbers, but to make a permanent note of numbers some kind of mark or tally is needed. Thus the Romans kept count of years by yearly driving a nail into the temple of Minerva. The nail in this case is a sort of hieroglyphic, and in all systems of hieroglyphics signs for numbers naturally occur. A single stroke is the obvious representation of unity; higher numbers are indicated by groups of strokes. But when the strokes become many they are confusing, and so a new sign must be introduced, perhaps for 5, at any rate for 10, 100, 1000, and so forth. Intermediate numbers are expressed by the addition of symbols, as in the Roman system ccxxxvi = 236. This simplest way of writing numbers is well seen in the Babylonian inscriptions, where all numbers from 1 to 99 are got by repetition of the vertical arrowhead 𒁹 = 1, and a barbed sign 𒌋 = 10. But the most interesting case is the Egyptian, because from its hieratic form sprang the Phœnician numerals, and from them in turn those of Palmyra and the Syrians, as illustrated in table 1. Two things are to be noted in this table—first, the way in which groups of units come to be joined by a cross line, and then run together into a single symbol, and, further, the substitution in the hundreds of a principle of multiplication for the mere addition of symbols. The same thing appears in Babylonia, where a smaller number put to the right of the sign for 100 (𒁹–) is to be added to it, but put to the left gives the number of hundreds. Thus 𒌋𒁹– = 1000, but 𒁹–𒌋 = 110. The Egyptians had hieroglyphics for a thousand, a myriad, 100,000 (a frog), a million (a man with arms stretched out in admiration), and even for ten millions.

Alphabetic writing did not do away with the use of numerical symbols, which were more perspicuous and compendious than words written at length. But the letters of the alphabet themselves came to be used as numerals. One way of doing this was to use the initial letter of the name of a number as its sign. This was the old Greek notation, said to go back to the time of Solon, and usually named after the grammarian Herodian, who described it about 200 A.D. Ι stood for 1, Π for 5, Δ for 10, Η for 100, Χ for 1000, and Μ for 10,000; Π with Δ in its bosom was 50, with Η in its bosom it was 500. Another way of using the alphabet depended on the fixed order of its letters. The simplest application of this principle is to use consecutive letters for consecutive numbers. Thus the 24 letters of the Ionic alphabet stood for the numbers 1 to 24, as we still see in the letters attached to the books of the *Iliad*. Another way common to the Greeks, Hebrews, and Syrians, and which in Greece gradually displaced the Herodian numbers, was to make the first nine letters stand for the units and the rest for the tens and hundreds. With the old Semitic alphabet of 22 letters this system broke down at ת = 400, and the higher hundreds had to be got by juxtaposition; but when the Hebrew square character got the distinct final forms ך, ם, ן, ף, ץ these served for the hundreds from 500 to 900. The Greeks with their larger alphabet required but three supplemental signs, which they got by keeping for this purpose two old Phœnician letters which were not used in writing (Ϝ or ϛ = ו = 6, and Ϙ = צ = 90), and by adding sampi ϡ for 900.[2]

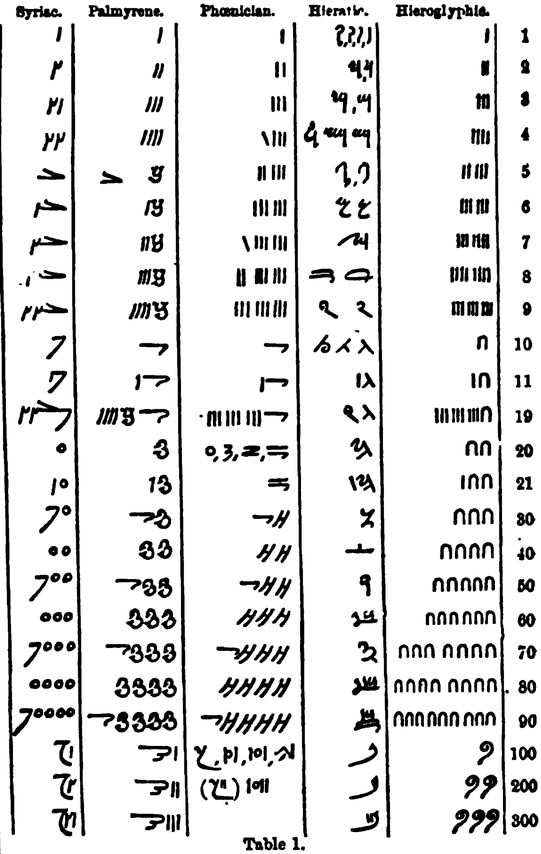
Syriac.
Palmyrene.
Phœnician.
Hieratic.
Hieroglyphic.
1
2
3
4
5
6
7
8
9
10
11
19
20
21
30
40
50
60
70
80
90
100
200
300

Table 1.

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[1] The system is described by Nicolaus Rhabda of Smyrna (8th century A.D.), ap. N. Caussinus, *De eloquentia sacra et humana*, Paris, 1636. Bede gives essentially the same system, and it has survived in the East to the present day; see especially Rödiger, "Ueber die im Orient gebräuchliche Fingersprache, &c.," *D. M. G.*, 1845, and Palmer in *Journ. of Philology*, ii. 247 *sqq.*

[2] The Arabs, who quite changed the order of the alphabet and extended it to twenty-eight letters, kept the original values of the old letters (putting ص for ס and ش for ש), while the hundreds from 500 to 1000 were expressed by the new letters in order from ث to غ. In the time of Caliph Walid (705-715 A.D.) the Arabs had as yet no signs of numeration.

Among the Greeks the first certain use of this system seems to be on coins of Ptolemy II. The first trace of it on Semitic ground is on Jewish coins of the Hasmoneans. It is the foundation of gematria as we find it in Jewish books and in the apocalyptic number of the beast (נרון קסר = 666). But we do not know how old gematria is; the name is borrowed from the Greek.

The most familiar case of the use of letters as numerals is the Roman system. Here C is the initial of centum and M of mille; but instead of these signs we find older forms, consisting of a circle divided vertically for 1000 and horizontally, Θ, or in the cognate Etruscan system divided into quadrants, ⊕, for 100. From the sign for 1000, still sometimes roughly shown in print as CIƆ, comes D, the half of the symbol for half the number; and the older forms of L, viz., ⊥ or ⅃, suggest that this also was once half of the hundred symbol. So V (Etruscan Λ) is half of X, which itself is not a true Roman letter. The system, therefore, is hardly alphabetic in origin, though the idea has been thrown out that the signs for 10, 50, and 100 were originally the Greek X, Ψ, Φ, which were not used in writing Latin.[1]

When high numbers had to be expressed systems such as we have described became very cumbrous, and in alphabetic systems it became inevitable to introduce a principle of periodicity, by which, for example, the signs for 1, 2, 3, &c., might be used with a difference to express the same number of thousands. Language itself suggested this principle, and so we find in Hebrew א̈ or in Greek $͵\alpha = 1000$. So further $\beta M\upsilon$, $\beta M.$, or simply $\beta. = 20{,}000$ (2 myriads). If now the larger were always written to the left of the smaller elements of a number the diacritic mark could be dispensed with in such a case as $\overline{\beta\omega\lambda\alpha}$ (instead of $\overline{͵\beta\omega\lambda\alpha}$) = 2831, for here it was plain that $\beta = 2000$, not $= 2$, since otherwise it would not have preceded $\omega = 800$. We have here the germ of the very important notion that the value of a symbol may be periodic and defined by its position. The same idea had appeared much earlier among the Babylonians, who reckoned by powers of 60, calling 60 a *soss* and 60 sixties a *sar*. On the tablets of Senkerah a list of squares and cubes is given on this principle, and here the square of 59 is written 58·1—that is, $58 \times 60 + 1$; and the cube of 30 is 7·30—that is, 7 sar + 30 soss $= 7 \times 60^2 + 30 \times 60$. Here again we have value by position; but, as there is no zero, it is left to the judgment of the reader to know which power of 60 is meant in each case. The sexagesimal system, long specially associated with astronomy, has left a trace in our division of the hour and of the circle, but as language goes by powers of 10 it is practically very inconvenient for most purposes of reckoning. The Greek mathematicians used a sort of decimal system; thus Archimedes was able to solve his problem of stating a number greater than that of the grains of sand which would fill the sphere of the fixed stars by dividing numbers into octades, the unit of the second octade being 10^8 and of the third 10^{16}. So too Apollonius of Perga teaches multiplication by regarding 7 as the *pythmen* of 70, 700, and so forth. One must then find successively the product of the several pythmens of the multiplier and the multiplicand, noticing in each case what are tens, what hundreds, and so on, and adding the results. The want of a sign for zero made it impossible mechanically to distinguish the tens, hundreds, &c., as we now do.

Very early, however, a mechanical contrivance, the abacus, had been introduced for keeping numbers of different denominations apart. This was a table with compartments or columns for counters, each column representing a different value to be given to a counter placed on it. This might be used either for concrete arithmetic—say with columns for pence, shillings, and pounds; or for abstract reckoning—say with the Babylonian sexagesimal system. An old Greek abacus found at Salamis has columns which, taken from right to left, give a counter the value of 1, 10, 100, 1000 drachms, and finally of 1 talent (6000 drachms) respectively. An abacus on the decimal system might be ruled on paper or on a board strewed with fine sand, and was then a first step to the decimal system. Two important steps, however, were still lacking: the first was to use instead of counters distinctive marks (ciphers) for the digits from one to nine; the second and more important was to get a sign for zero, so that the columns might be dispensed with, and the denomination of each cipher seen at once by counting the number of digits following it. These two steps taken, we have at once the modern so-called Arabic numerals and the possibility of modern arithmetic; but the invention of the ciphers and zero came but slowly, and their history is a most obscure problem.

What is quite certain is that our present decimal system, in its complete form, with the zero which enables us to do without the ruled columns of the abacus, is of Indian origin. From the Indians it passed to the Arabians, probably along with the astronomical tables brought to Baghdad by an Indian ambassador in 773 A.D. At all events the system was explained in Arabic in the early part of the 9th century by the famous Abû Jaʿfar Moḥammed al-Khárizmí, and from that time continued to spread, though at first slowly, through the Arabian world.

In Europe the complete system with the zero was derived from the Arabs in the 12th century, and the arithmetic based on this system was known by the name of algoritmus, algorithm. This barbarous word is nothing more than a transcription of Al-Khárizmí, as was conjectured by Reinaud, and has become plain since the publication of a unique Cambridge MS. containing a Latin translation—perhaps by Adelhard of Bath—of the lost arithmetical treatise of the Arabian mathematician.[2] The arithmetical methods of Khárizmí were simplified by later Eastern writers, and these simpler methods were introduced to Europe by Leonardo of Pisa in the West and Maximus Planudes in the East. The term zero appears to come from the Arabic ṣifr through the form zephyro used by Leonardo.

Thus far recent inquirers are agreed. The disputed points are—(1) the origin and age of the Indian system, and (2) whether or not a less developed Indian system, without the zero but with the nine other ciphers used on an abacus, entered Europe before the rise of Islam, and prepared the way for a complete decimal notation.

(1) The use of numerals in India can be followed back to the Náná Ghát inscriptions, supposed to date from the early part of the 3d century B.C. These are signs for units, tens, and hundreds, as in the other old systems we have dealt with. Like the Indian alphabet, they are probably derived from abroad, but, as in the case

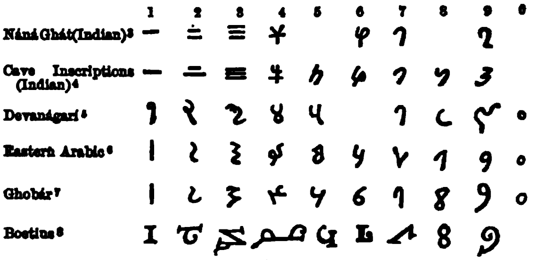
1
2
3
4
5
6
7
8
9
0
Náná Ghát (Indian)³
Cave Inscriptions (Indian)⁴
Devanágarí⁵
Eastern Arabic⁶
Ghobár⁷
Boetius⁸

Table 2.

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[1] See further Fabretti, *Paläographische Studien*.

[2] Published by Boncompagni in *Trattati d' Aritmetica*, Rome, 1857.

[3] From Sir E. C. Bayley's paper in *J. R. A. S.*, 1882.

[4] From Burnell's *South Indian Palæography*, 1874.

[5] Of the 10th century. (From Burnell, *op. cit.*)

[6] Of the 10th century; from a MS. written at Shiráz. (From Woepcke, *Mémoire sur la propagation des chiffres Indiens.*)

[7] From a MS. at Paris. (From Woepcke, *op. cit.*)

[8] Erlangen (Altdorf) MS. (From Woepcke, *op. cit.*)

of the alphabet, their origin is obscure. The forms of the later Indian numerals for the nine digits appear to be clearly derived from the earlier system. In table 2 the first two lines give forms earlier than the introduction of the system of position, while the Devanágari in the third line was used with a zero and position value. The "cave" numerals were employed during the first centuries of the Christian era. The earliest known example of a date written on the modern system is of 738 A.D., while the old system is found in use as late as the early part of the 7th century (Bayley). On the other hand, there is some evidence that a system of value by position was known to Sanskrit writers on arithmetic in the 6th Christian century. These writers, however, do not use ciphers, but symbolical words and letters, so that it is not quite clear whether they refer to a system which had a zero, or to a system worked on an abacus, where the zero is represented by a blank column. There is no proof as yet for the use of any system of position in India before the 6th century, and nothing beyond conjecture can be offered as to its origin.

(2) In Europe, before the introduction of the algorithm or full Indo-Arabic system with the zero, we find a transition system in which calculations were made on the decimal system with an abacus, but instead of unit counters there were placed in the columns ciphers, with values from one to nine, and of forms that are at bottom the Indian forms and agree most nearly with the numerals used by the Arabs of Africa and Spain. For among the Arabs themselves there were varieties in the forms of the Indian numeral, and in particular an eastern and a western type. The latter is called ghobár (dust), a name which seems to connect it with the use of a sand-spread tablet for calculation. The abacus with ciphers instead of counters was used at Rheims about 970-980 by Gerbert, who afterwards was pope under the title of Sylvester II., and it became well known in the 11th century. Where did Gerbert learn the use of the abacus with ciphers? There is no direct evidence as to this, for the story in William of Malmesbury, that he stole it from an Arab in Spain, is generally given up as fabulous. On the other hand, no evidence is offered for an earlier use of the abacus with ciphers, except a passage describing the system in the *Geometria* ascribed to Boetius. If this book is genuine the Indian numerals were known in Europe and applied to the abacus in the 5th century, and Gerbert only revived the long-forgotten system. On this view we have to explain how Boetius got the ciphers. The *Geometria* ascribes the system to the "Pythagorici"—*i.e.*, the Neo-Pythagoreans—and it has been thought possible that the Indian forms for the numerals reached Alexandria, along with the cruder form of value by position involved in the use of the abacus without a zero, before direct communication between Europe and India ceased, which it did about the 4th century A.D. It is then further conjectured by Woepcke that the ghobár numerals of the western Arabs were by them borrowed from the system of Boetius before the full Indian method with the zero reached them; and thus the resemblance between these forms and those in MSS. of Boetius, which are essentially the same as in other MSS. of the 11th century, would be explained. This view, however, presents great difficulties, of which the total disappearance of all trace of the system between Boetius and Gerbert is only one. We have no proof that the Indians ever used such an abacus, or that they had value by position at so early a date as is required, and the ghobár numerals are too similar to those of the eastern Arabs to make it very credible that the two systems had been separated for centuries. The genuineness of the *Geometria* is still ably maintained by Cantor, but it has been attacked on other grounds than that of the passage about the abacus; and on the whole it is still an open question whether the abacus with ciphers is not the outcome of an early imperfect knowledge of the Arabic system, Gerbert or some other having got the signs and a general idea of value by position without having an explanation of the zero.

See Cantor, *Geschichte der Mathematik*, vol. i., Leipsic, 1880, as the most recent general account of the subject; also Chasles, papers in the *Comptes Rendus*, 1843; Friedlein, *Die Zahlzeichen und das elementare Rechnen der Griechen und Römer*, &c., 1869; Woepcke, *Sur l'introduction de l'arithmétique Indienne en occident*, Rome, 1859, and *Mémoire sur la propagation des chiffres Indiens*, Paris, 1863. For the palæography of the Indian numerals see Burnell, *Elements of S. Indian Palæography*, 1874; and Sir E. C. Bayley in *J. R. A. S.*, 1882, 1883. For Boetius compare Friedlein's edition of his arithmetic and geometry, Leipsic, 1867, and Weissenborn in *Zeitsch. Math. Phys.*, xxiv. Other references to the copious literature will be found in Cantor and Friedlein, who also discuss the subject of the notation for fractions, which cannot be entered on here. For systems passed over here, see Pihan, *Exposé des signes de numération usités chez les peuples orientaux*, Paris, 1860. (W. R. S.)

NUMERIANUS, M. AURELIUS, Roman emperor, accompanied his father, the emperor Carus, on the Persian expedition beyond the Tigris, and along with his absent brother, Carinus, was proclaimed emperor on the death of the former (December 283). Having resolved to abandon the campaign, he was returning towards Europe when he mysteriously died before Chalcedon was reached, eight months afterwards. Arrius Aper, prefect of the pretorians, his father-in-law, suspected of having murdered him, was hastily stabbed by Diocletian, his successor. Numerianus is represented as having been a man of considerable literary attainments, as well as of singular gentleness, amiability, and purity.

NUMIDIA was the name given to a large tract of country in the north of Africa, extending along the Mediterranean Sea from the confines of Mauretania to those of the Roman province of Africa. The term was, however, employed in very different senses, and within very different limits, at different periods of time. When Carthage was at the height of its power, and the Romans first came into contact with the nations of northern Africa, the name of Numidia was applied to the whole country from the river Mulucha (now called the Mulúya), about 100 miles west of Oran, to the frontier of the Carthaginian territory, which nearly coincided with the modern regency of Tunis. It is in this sense that the term is employed by Polybius, and all succeeding historians down to the close of the Roman republic. The Numidians, as thus defined, were divided into two great tribes, the Massyli on the east, and the Massæsyli on the west,—the limit between the two territories being the river Ampsaga, which enters the sea to the west of the remarkable promontory called Tretum, now known as the Seven Capes. At the time of the Second Punic War the eastern tribe was under the government of Masinissa, who took part with the Romans in the contest, while his rival Syphax, king of the Massæsylians, supported the cause of the Carthaginians. In consequence of this, after the close of the war, Syphax's dominions were forfeited, and united with those of Masinissa, who now ruled the whole Numidian people from the frontier of Mauretania to the boundary of the Carthaginian territory. That monarch, who attained to a great age, retained the whole of these extensive dominions till his death in 148 B.C., as was the case also with his son and successor Micipsa: but after the death of the latter in 118, the ambition of his nephew JUGURTHA (*q.v.*) involved him in a war with Rome, which ended in his defeat and death in 106.

Numidia was not, however, incorporated with the Roman empire until a later period. After the death of Jugurtha the western portion of his dominions was added to those of Bocchus, king of Mauretania, while the remainder continued to be governed by native princes until the civil war between Cæsar and Pompey, in which Juba, then king of Numidia, having espoused the cause of the latter, and supported Scipio and Cato in Africa, was defeated by Cæsar, and put an end to his own life (46 B.C.). Numidia, in the more restricted sense which it had now acquired, became for a short time a Roman province, but in the settlement of affairs after the battle of Actium (30) it was restored to Juba II., son of the preceding monarch, who had acquired the favour of Augustus. A few years later, however, Juba was transferred to the throne of Mauretania, including the whole western portion of the ancient Numidian monarchy as far as the river Ampsaga, while the Roman province of Numidia, which was now definitely constituted, comprised only the tract between that river and the Tusca, which formed the western limit of the Roman province of Africa. But though thus restricted in extent—so as nearly to correspond with the modern French province of Constantine, while the kingdom of Numidia in the wider sense had included the whole of Algeria—the Roman province of Numidia attained a high degree of prosperity and civilization, and was studded with numerous towns, the importance of which is attested by inscriptions still extant, as well as by the massive remains of their ancient monuments and works of public utility. This period of prosperity continued to be favoured by unbroken peace for more than four centuries, until the invasion of the Vandals in 428 A.D. reduced it to a condition of gradual decay; and the invasion of the Arabs in the 8th century again brought desolation upon the land, which was aggravated by continual misgovernment until the conquest of Algeria by the French within the present century.

The physical character of the country has been already described in the article ALGERIA. It may be briefly observed that the whole tract of northern Africa from the river Mulucha to the frontiers of the regency of Tunis may be divided into three parallel zones or regions: the Tell, or fertile district near the sea, the broad inland plateaus beyond it, and the Sahara, or barren region to the south of these uplands, sloping thence down to the great desert which is generally known by that name. The central upland tract assumes a more rugged and mountainous character in the eastern district, which formed the Roman province of Numidia, and now constitutes the French province of Constantine. But this elevated region breaks down abruptly towards the east, where it sends out only a few offshoots into the plains of Tunis, as well as to the south where it faces the wide expanse of the Sahara. It is here that is situated the mountain group called the Aures (the Mons Aurasius of Procopius), of which the highest summit, called by the Arabs Jebel Chellia, attains to an elevation of 7580 feet.

The name of the Numidians appears to have been nothing more than a Latinized form of the Greek term Nomades, vaguely applied by them to the wandering tribes of northern Africa. It could never have had any ethnographical signification; and there can be no doubt that the people thus designated were merely a portion of the great Berber race, which extended in ancient times from the shores of the Atlantic to the confines of Egypt, and which still, under the name of Kabyles, forms a portion of the population of both Algeria and Tunis. The Gætulians, who at the same period occupied the southern slopes of the mountains towards the Sahara, appear to have stood in much the same relation to the Numidians that the tribes called Tuaricks or Tuareg do at the present day to the comparatively civilized Kabyles of Algeria. But the Roman authority over these wanderers of the desert was of a very precarious character, and a line of outposts near the foot of the mountain range formed the limit of their practical dominion towards the south.

The chief towns of Numidia under the Romans were:—Cirta, the capital, in the interior, subsequently called Constantina, which name it still retains; Rusicada, on the coast, serving as its port, on the site now occupied by Philippeville; and east of it the more important city of Hippo Regius (well known as the see of the celebrated Augustine), near the modern Bona. South of Cirta, in the interior, were Theveste (now Tebessa) and Lambæsa (now Lambessa), with extensive Roman remains. But there were not less than ten towns with the title of "coloniæ," and in the 5th century the *Notitia* enumerates no less than 123 episcopal sees.

For details concerning the condition of Numidia as a Roman province, see *Corp. Inscr. Lat.*, vol. viii. (1881). A more popular account will be found in the *Algérie Romaine* of G. Boissière (2 vols 8vo, Paris, 1883). (E. H. B.)

NUMISMATICS

THE science of numismatics treats of coins and medals. It acquaints us with the metals used in their composition, their various inscriptions and devices, their mechanical execution and artistic merit. It tells us of the different denominations of coins, their relation to one another, and the laws by which they were regulated.

The earliest known coins were issued by the Greeks in the 7th century before the Christian era. By the 4th century the whole civilized world used money, each state generally having its proper coinage. This has continued to be the case to the present time; so that now there are few nations without a metal currency of their own, and of these but a small proportion are wholly unacquainted with the use of coins. The number of varieties of coins and medals of which specimens are preserved in collections may be estimated at not less than several hundred thousand; and future discoveries will probably greatly increase this sum. A series of monuments of such length and completeness affords, as might be expected, very important illustration to history and to kindred branches of knowledge. This is, indeed, the real value of numismatics, and the student will do well to keep it constantly before him.

Coins, although they confirm history, rarely correct it, and never very greatly. The earliest belong to a time and to nations as to which we are not otherwise wholly ignorant, and they do not afford us that precise information which would fill in any important details of the meagre sketch of contemporary history. We gain from them scarcely any direct historical information, except that certain cities or princes issued money. When in later times the devices and inscriptions of the coins give more detailed information, history is far fuller and clearer, so that the numismatic evidence is rarely more than corroborative. There are, indeed, some remarkable exceptions to this rule, as in the case of the Bactrian coins, which have supplied the outlines of a portion of history which was otherwise almost wholly lost. The value of the corroborative evidence afforded by coins must not, however, be overlooked. It chiefly relates to chronology, although it also adds to our knowledge of the pedigrees of royal houses. But perhaps the most interesting manner in which coins and medals illustrate history is in their bearing contemporary, or nearly contemporary, portraits of the most famous kings and captains, from the time of the first successors of Alexander the Great to the present age, whereas pictures do not afford portraits in any number before the latter part of the Middle Ages; and works of sculpture, although occupying in this respect the same place as coins in the last-mentioned period and under the Roman empire, are neither so numerous nor so authentic. There is no more delightful companion in historical reading than a cabinet of coins and medals. The strength and energy of Alexander, the ferocity of Mithradates, the philosophic calmness of Antoninus, the obstinate ferocity of Nero, and the brutality of Caracalla are as plain on the coins as in the pages of history. The numismatic portraits of the time following the founding of Constantinople have less individuality; but after the revival of art they recover that quality, and maintain it to our own day, although executed in very different styles from those of antiquity. From this last class we can form a series of portraits more complete and not less interesting than that of the ancient period.

While coins and medals thus illustrate the events of history, they have an equally direct bearing on the belief of the nations by which they were issued; and in this reference lies no small part of their value in connexion with history. The mythology of the Greeks, not having been fixed in sacred writings, nor regulated by a dominant priesthood, but having grown out of the different beliefs of various tribes and isolated settlements, and having been allowed to form itself comparatively without check, can scarcely be learned from ancient books. Their writers give us but a partial or special view of it, and modern authors, in their attempts to systematize, have often but increased the confusion. The Greek coins, whether of kings or cities, until the death of Alexander, bear sacred subjects only. Afterwards, on the regal coins, the king's head usually occupies the obverse and a sacred subject is placed on the reverse. The coins of Greek cities under the empire have usually an imperial portrait and a reverse type usually mythological. The whole class thus affords us invaluable evidence for the reconstruction of Greek mythology. We have nowhere else so complete a series of the different types under which the divinities were represented. There are in modern galleries very few statues of Greek divinities, including such as were intended for architectural decoration, which are in good style, fairly preserved, and untouched by modern restorers. If to these we add reliefs of the same class, and the best Græco-Roman copies, we can scarcely form a complete series of the various representations of these divinities. The coins, however, supply us with the series we desire, and we may select types which are not merely of good work, but of the finest. The mythology of ancient Italy, as distinct from that of the Greek colonies of Italy, is not so fully illustrated by the coins of the country, because these are for the most part of Greek design. There are, however, some remarkable exceptions, especially in the money of the Roman commonwealth, the greater number of the types of which are of a local character, including many that refer to the myths and traditions of the earliest days of the city. The coins of the empire are especially important, as bearing representations of those personifications of an allegorical character to which the influence of philosophy gave great prominence in Roman mythology.

Coins are scarcely less valuable in relation to geography than to history. The position of towns on the sea or on rivers, the race of their inhabitants, and many similar particulars are positively fixed on numismatic evidence. The information that coins convey as to the details of the history of towns and countries has a necessary connexion with geography, as has also their illustration of local forms of worship. The representations of natural productions on ancient money are of special importance, and afford assistance to the lexicographer. This is particularly the case with the Greek coins, on which these objects are frequently portrayed with great fidelity. We must recollect, however, that the nomenclature of the ancients was vague, and frequently comprised very different objects under one appellation, and that therefore we may find very different representations corresponding to the same name.

The art of sculpture, of which coin-engraving is the offspring, receives the greatest illustration from numismatics. Not only is the memory of lost statues preserved to us in the designs of ancient coins, but those of Greece afford admirable examples of that skill by which her sculptors attained their great renown. The excellence of the designs of very many Greek coins struck during the period of the best art is indeed so great that, were it not for their smallness, they would form the finest series of art-studies in the world. The Roman coins, though at no time to be compared to the purest Greek, yet represent worthily the Græco-Roman art of the empire. From the accession of Augustus to the death of Commodus they are often fully equal to the best Græco-Roman statues. This may be said, for instance, of the dupondii struck in honour of Livia by Tiberius and by the younger Drusus, of the sestertii of Agrippina, and of the gold coins of Antoninus Pius and the two Faustinas, all which present portraits of remarkable beauty and excellence. The mediæval Italian medals are scarcely less useful as records of the progress and characteristics of art, and, placed by the side of the Greek and Roman coins, complete the most remarkable comparative series of monuments illustrating the history of the great schools of art that can be brought together. Ancient coins throw as great light upon the architecture as upon the sculpture of the nations by which they were struck. Under the empire, the Roman coins issued at the city very frequently bear representations of important edifices. The Greek imperial coins struck in the provinces present similar types, representing the most famous temples and other structures of their cities, of the form of some of which we should otherwise have been wholly ignorant. The little-known art of painting among the ancients does not receive so much illustration from the coins. The best Greek pieces are of too severe a style to admit of an approach to pictorial treatment, although we perceive such a tendency in the works of important schools, and during the period of decline. The Roman coins sometimes present groups which have a very pictorial character, traceable to the tendency of the sculpture of the period; this is principally about the time of the Antonines. They are, however, never so pictorial in treatment as the mediæval Italian medals. The art of gem-engraving among the ancients is perhaps most nearly connected with their coinage. The subjects of coins and gems are so similar and so similarly treated that the authenticity of gems, that most difficult of archæological questions, receives the greatest aid from the study of coins.

After what has been said it is not necessary to do more than mention how greatly the study of coins tends to illustrate the contemporary literature of the nations which issued them. Not only the historians, but the philosophers and the poets, are constantly illustrated by the money of their times. This was perceived at the revival of letters; and during the last two centuries coins were very frequently engraved in the larger editions of the classics. A want of technical numismatic knowledge in the editors, and the carelessness of the artists, combined to deprive these illustrations of much of their value. Probably in part on this account, but chiefly in consequence of the change from historical to textual criticism, ancient coins have been little used in this manner by the new school. This neglect is being remedied, although the full value of coins and medals in illustration of the literature of modern as well as of ancient times is not as yet sufficiently perceived.

The science of numismatics is of comparatively recent origin. The ancients do not seem to have formed collections, although they appear to have occasionally preserved individual specimens for their beauty. Petrarch has the credit of having been the first collector; but it is probable that in his time ancient coins were already attracting no little notice. The importance of the study of all coins has since been by degrees more and more recognized, and at present no branch of the pursuit is left wholly unexplored.

Besides its bearing upon the history, the religion, the manners, and the arts of the nations which have used money, the science of numismatics has a special modern use in relation to art. Displaying the various styles of art prevalent in different ages, coins supply us with abundant means for promoting the advancement of art among ourselves. If the study of many schools be at all times of advantage, it is especially so when there is little originality in the world. Its least value is to point out the want of artistic merit and historical commemoration in modern coins, and to suggest that modern medals should be executed after some study of the rules which controlled the great works of former times.

Definitions.—The following are the most necessary numismatic definitions.

1. A *coin* is a piece of metal of a fixed weight, stamped by authority of government, and employed as a circulating medium.[1]

2. A *medal* is a piece, having no place in the currency, struck to commemorate some event or person. Medals are frequently comprised with coins in descriptions that apply to both equally; thus, in the subsequent definitions, by the term coins, coins and medals must generally be understood.

3. The coinage of a country is usually divided into the classes of gold, silver, and bronze (copper), for which the abbreviations *AV*, *AR*, and *Æ* are employed in catalogues. In each class are comprised, not only the coins of the metal from which it takes its name, with no more than a necessary or inseparable proportion of alloy, but coins of other metallic substances, usually base, and always compound, which were generally struck in the place of the purer pieces. The principal metallic substances thus used were electrum for gold, billon for silver, brass for copper, and potin for silver and copper.

4. *Electrum* (ἤλεκτρον, ἤλεκτρος), a compound metallic substance, consisting of gold with a considerable alloy of silver. Pliny makes the proportion to have been four parts of gold to one of silver.[2] The material of early coins of Asia Minor struck in the cities of the western coast is the ancient electrum. It appears here to have at first consisted of three parts of gold to one of silver;[3] but afterwards the proportion of silver was increased, though perhaps not everywhere. Gold largely alloyed with silver, not struck by the ancient Greeks or their neighbours, should be termed *pale gold*, as in the case of some of the late Byzantine coins.

5. *Billon*, a term applied to the base metal of some Roman coins, and also to that of some mediæval and modern coins. It is silver with a great proportion of alloy. When the base silver coins are replaced by copper washed with silver the term billon becomes inappropriate.

6. *Brass*, a compound metallic substance employed for coins. It may be used as an equivalent to the orichalcum of the Romans, a fine kind of brass of which the sestertii and dupondii were struck, but it is commonly applied indiscriminately to the whole of their copper currency.

7. *Potin*, a term applied to the base metal of which some ancient coins are composed. It is softer than billon.

8. Various other metallic substances have been used in coinage. The so-called "glass coins" of the Arabs are merely coin-weights.

9. The *forms* of coins have greatly varied in different countries and at different periods. The usual form in both ancient and modern times has been circular, and generally of no great thickness.

10. Coins are usually measured by *Mionnet's scale*, from which the greatest dimension is taken, or, when they are square, the greatest dimension in two directions. This is, however, a very unsatisfactory scale, as its divisions are of an arbitrary character, and the instruments for applying it are such as make exactness scarcely possible. A gauge graduated to inches and decimal parts of an inch or to millimètres is far more satisfactory.

11. The *weight* of a coin is of great importance, both in determining its genuineness and in distinguishing its identity. To ascertain exact weight even to the tenth of a grain is therefore necessary, and this can only be done by the careful use of excellent scales.

12. The *specific gravity* of a coin may be of use in determining the metals in its composition.

13. Whatever representations or characters are borne by a coin constitute its *type*. The subject of each side is also called a type, and, when there is not only a device but an inscription, the latter may be excluded from the term. This last is the general use. No distinct rule has been laid down as to what makes a difference of type, but it may be considered to be an essential difference, however slight.

14. A difference too small to constitute a new type makes a *variety*.

15. A coin is a *duplicate* of another when it agrees with it in all particulars but those of exact size and weight. Strictly speaking, ancient coins are rarely, if ever, duplicates, except when struck from the same die.

16. Of the two sides of a coin, that is called the *obverse* which bears the more important device or inscription. In early Greek coins it is the convex side; in Greek and Roman imperial it is the side bearing the head; in mediæval and modern that bearing the royal effigy, or the king's name, or the name of the city; and in Oriental that on which the inscription begins. The other side is called the *reverse*.

17. The *field* of a coin is the space unoccupied by the principal devices or inscriptions. Any detached independent device or character is said to be in the field, except when it occupies the exergue.

18. The *exergue* is that part of the reverse of a coin which is below the main device, and distinctly separated from it; it often bears a secondary inscription. Thus, the well-known inscription CONOB occupies the exergue of the late Roman and early Byzantine gold coins.

19. The *edge* of a coin is the surface of its thickness.

20. By the *inscription* or *inscriptions* of a coin all the letters it bears are intended; an inscription is either principal or secondary.

21. In describing coins the terms *right* and *left* mean the right and left of the spectator, not the heraldic and military right and left, or those of the coin.

22. A *bust* is the representation of the head and neck; it is commonly used of such as show at least the collar-bone, other busts being called heads.

23. A *head* properly means the representation of a head alone, without any part of the neck, but it is also commonly used when any part of the neck above the collar-bone is shown. The present article follows custom in the use of the terms *bust* and *head*.

24. A bust or head is either facing, usually three-quarter face, or in profile, in which latter case it is described as *to right* or *to left*. Two busts may be placed in various relative positions which cannot be described in English without circumlocution.

25. A bust wearing a laurel-wreath is said to be *laureate*.

26. A bust bound with a regal fillet (diadem) is called *diademed*.

27. A bust of which the neck is clothed is said to be *draped*.

28. An object in the field of a coin which is neither a letter nor a monogram is usually called a *symbol*. This term is, however, only applicable when such an object is evidently the badge of a town or individual. The term *adjunct*, which is sometimes employed instead of symbol, is manifestly incorrect.

29. A *mint-mark* is a difference placed by the authorities of the mint upon all money struck by them, or upon each new die or separate issue.

30. A coin is said to be *surfrappé* when it has been struck on an older coin, of which the types are not altogether obliterated.

31. A *double-struck* coin is one in which the die or dies have shifted so as to cause a double impression.

32. A coin which presents two obverse types, or two reverse types, or of which the types of the obverse and reverse do not correspond, is called a *mule*; it is the result of mistake or caprice.

Arrangement of Coins.—No uniform system has as yet been applied to the arrangement of all coins. It is usual to separate them into the three great classes of ancient coins (comprising Greek and Roman), mediæval and modern, and Oriental coins. The details of these classes have been differently treated, both generally and specially. The arrangement of the Greek series has been first geographical, under countries and towns, and then chronological, for a further division; that of the Roman series, chronological, without reference to geography; that of the mediæval and modern, the same as the Greek; and that of the Oriental, like the Greek, but unsystematically,—a treatment inadmissible except in the case of a single empire. Then, again, some numismatists have separated each denomination or each metal, or have separated the denominations of one metal and not of another. There has been no general and comprehensive system, constructed upon reasonable principles, and applicable to every branch of this complicated science. Without laying down a system of rules, or criticizing former modes of arrangement, we offer the following as a classification which is uniform without being servile.

1. *Greek Coins.*—All coins of Greeks, or barbarians who adopted Greek money, struck before the Roman rule or under it, but without imperial effigies. The countries and their provinces are placed in a geographical order from west to east, according to the system of Eckhel, with the cities in alphabetical order under the provinces, and the kings in chronological order. The civic coins usually precede the regal, as being the more important. The coins are further

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[1] This definition excludes, on the one hand, paper currencies and their equivalents among barbarous nations, such as cowries, because they are neither of metal nor of fixed weight, although either stamped or sanctioned by authority, and, on the other hand, modes of keeping metal in weight, like the so-called Celtic "ring-money," because they are not stamped, although perhaps sanctioned by authority. The latter has attracted so much attention that it must not be passed by without some further notice. There seems to be no reasonable doubt that the Celtic gold rings all weigh multiples of the same unit, but very seldom multiples of one another. From their form it is probable that most of them were used as ornaments, and as such they would probably have been generally made to weigh an exact weight without fractions, on the same principle that the ancients frequently avoided fractions of their measures in architecture. They belong to a time anterior to the introduction of money among the Celts, or before its general use, and one, therefore, at which precious metal must have been weighed when employed in barter. Hence an additional reason, and probably the main one, why their weight is always some multiple of the same unit. In a primitive state of society in the present day a woman often wears her dowry in coins as ornaments; and thus these Celtic rings may have been both ornaments and substitutes for money.

[2] *Hist. Nat.*, xxxiii. 23; comp. xxxvii. 11. Pliny distinguishes two kinds of "electron,"—amber, and this metallic substance. In Greek poetry the name seems to apply to both, but it is generally difficult to decide which is meant in any particular case. Sophocles, however, where he mentions τἀπὸ Σάρδεων ἤλεκτρον, . . . καὶ τὸν Ἰνδικὸν χρυσόν (*Ant.* 1037-39), can scarcely be doubted to refer to the metallic electrum.

arranged chronologically, the civic commencing with the oldest and ending with those bearing the effigies of Roman emperors. The gold coins of each period take precedence of the silver and the silver of the copper. The larger denominations in each metal are placed before the smaller. Coins of the same denomination and period are arranged in the alphabetical order of the magistrates' names, or the letters, &c., that they bear.

2. *Roman Coins.*—All coins issued by the Roman commonwealth and empire, whether struck at Rome or in the provinces. The arrangement is chronological, or, where this is better, under geographical divisions.

3. *Mediæval and Modern Coins of Europe.*—All coins issued by Christian European states, their branches and colonies, from the fall of the empire of the West to the present day. This class is arranged in a geographical and chronological order, as similar as possible to that of the Greek class, with the important exception of the Byzantine coins and the coins following Byzantine systems, which occupy the first place. The reason for this deviation is that the Byzantine money may be regarded not only as the principal source of mediæval coinage but as the most complete and important mediæval series, extending as it does without a break throughout the Middle Ages. The regal coins usually precede the civic ones, as being the more important; and the medals of each sovereign or city follow the coins.

4. *Oriental Coins.*—All coins bearing inscriptions in Eastern languages, excepting those of the Jews, Phœnicians, and Carthaginians, which are classed with the Greek coins from their close connexion with them. These coins should be arranged under the following divisions: Ancient Persian, Arab, Modern Persian, Indian, Chinese, and coins of the far East.

This method of arrangement will be found to be as uniform as it can be made, without being absolutely mechanical. It differs in some important particulars from most or all of those which have previously obtained; but these very differences are the result of the consideration of a complete collection, and have therefore an inductive origin. A general uniformity is no slight gain, and may well reconcile us to some partial defects. These defects may be remedied in large collections by the use of "cross-references" from one cabinet to another, and by the formation of independent series to illustrate the general one. A series illustrative of Greek art, and another of Græco-Roman, might be formed. A series of portraits, and another of reverse types, would be equally valuable. Others might be made to show the changes of the coinage in relation to the condition of a state, with careful indications of the weight and composition of the examples, and others to illustrate the history of a particular country or city. Thus, the Byzantine copper coinage exhibits the success or disaster of the imperial arms, and the financial state of the empire in its fluctuations, while nothing can be more interesting than to see at one view the numismatic history of a great city. We have coins of Rome under the commonwealth and the empire, under the Ostrogoths, the Byzantines, the mediæval senate, and the popes. The series of London would be not the least curious. It would begin with the Roman coins issued by the mint of Londinium at the time of Diocletian and his colleagues, comprising those of the usurpers Carausius and Allectus; then, having not long after ceased for a time, it would recommence with the Saxon pennies, including a specimen of those of King Alfred, which have for their reverse type the monogram of the city's name; and, continuing through the mediæval period, it would conclude with modern tokens and medals, among the latter of which might be placed a copy of that famous one of the first Napoleon, with the inscription "Frappée à Londres," which was intended to commemorate the success of the Boulogne expedition.

I.—GREEK COINS.

There are some matters relating to Greek coins in general which may be properly considered before they are described in geographical order. These are their general character, the chief denominations, with the different talents of which they were the divisions, their devices and inscriptions, their art, and the mode of striking.

The period during which Greek coins were issued was probably not much less than a thousand years, commencing about the beginning of the 7th century B.C. and generally ending at the death of Gallienus (268 A.D.). If classed with reference only to their form, fabric, and general appearance they are of three principal types,—the archaic Greek, the ordinary Greek, and the Græco-Roman. The coins of the first class are of silver, electrum, and sometimes gold. They are thick lumps of an irregular round form, bearing on the obverse a device, with in some cases an accompanying inscription, and on the reverse a square or oblong incuse stamp (*quadratum incusum*), usually divided in a rude manner. The coins of the second class are of gold, electrum, silver, and bronze. They are much thinner than those of the preceding class, and usually have a convex obverse and a slightly concave or flat reverse. The obverse ordinarily bears a head in bold relief. The coins of the third class are, with very few exceptions, of bronze. They are flat and broad, but thin, and generally have on the obverse the portrait of a Roman emperor. It may be observed that the common division of Greek coins is into autonomous and imperial, the former comprising all except those of the Roman period which have the effigies of emperors.

The different monetary systems of the Greeks grew out of the use of different standards of weight; in other words, their coins were divisions of various talents. To investigate the origin of these monetary systems would demand a complete examination of Greek metrology, which could not be attempted in the present article. It will be well, however, to state in a few words the theory of Dr Brandis, at once the latest and the most satisfactory, though it cannot be said to completely solve the hard series of problems which the documents set before us.

The source of the Greek systems of weight has been referred to Babylonia, no link having been established with the different metrology of Egypt, a circumstance which may make us pause before finally accepting the results of the inquiry. The Babylonian weights had a twofold form,—the heavy talent, sometimes called the Assyrian, and the light talent, sometimes called the Babylonian. The heavy talent is the double of the light. Their weights and those of their divisions are thus stated by Dr Brandis on the evidence of the inscribed weights found at Nimrûd, the ancient Calah, in Assyria (see NINEVEH), which are now in the British Museum. The result is approximately true, but it has been shown by a careful reweighing of the objects that the maximum weights rise somewhat higher and the minimum fall somewhat lower than is indicated in the table.

	Grammes.	Grains.					
Heavy Talent	60,600	– 936,000;	known	range	62,400	to	57,600 grammes.
Mina	1,010	– 15,600;	,,	,,	1,040	,,	960 ,,
1/60 Mina	16·83	– 260;	,,	,,	17·33	,,	16 ,,
Light Talent	30,300	– 468,000;	,,	,,	31,200	,,	27,600 ,,
Mina	505	– 7,800;	,,	,,	520	,,	460 ,,
1/60 Mina	8·415	– 130;	,,	,,	8·66	,,	7·66 ,,

The heavy talent is supposed to have found its way to Greece by sea from the Phœnician coast-towns, the light talent by land through Lydia. In adopting the Babylonian weights the Phœnicians and Greeks made an important deviation. They accepted the sixtieth of the mina as their shekel or stater, but allowed only fifty instead of sixty of these units to their mina, retaining the sexagesimal division in counting sixty minæ to the talent. Thus the Phœnician and Greek talents contained 3000 shekels or staters, not 3600 sixtieths of the mina.

Two talents thus arose,—that by which the earliest Phocaic gold money was struck, derived from the heavy Babylonian, with a stater having a maximum weight of 256 grains, and the Euboic talent, derived from the light Babylonian, with a stater of 130 grains or a little more. The Phocaic was a modification of the Babylonian heavy talent, the Euboic of the light, each having the same stater as the parent weight, but a lower talent. The relation of gold to silver in the earliest days of coined money, about 700 B.C., and for long after, was 13⅓ to 1; consequently it was inconvenient to use the same standard for the two metals. Two systems for silver money are supposed to have arisen from this necessity, and it is here that the most brilliant but least conclusive part of the theory of Dr Brandis begins. The sixtieth of the heavy Babylonian mina weighed 260 grains, its sixtieth again weighed 4·3; this multiplied by 13·3 gives us the Phœnician drachm of 57 grains, introduced into Greece, and the basis of the so-called Græco-Asiatic or Phœnician silver standard. Four of these drachms produced the Phœnician stater at its maximum of 230 grains. Thus fifteen staters were equal to one gold sixtieth (230 × 15 ÷ 13⅓ = 258¾, nearly 260). Dr Brandis therefore calls this the fifteen-stater system. The Lydians, on the other hand, are supposed to have originated a silver stater by multiplying the sixtieth of the light mina, 130 grains, by 13·3 and dividing this by ten, so as to obtain a silver stater of about 170 grains, current long after in Asia Minor. Ten of these staters would thus be equal to one gold sixtieth. This, therefore, is called the ten-stater system.

The monetary standards of the Greeks (expressed in grains) may be referred to the two original talents in the following manner:—

HEAVY TALENT.

	Normal.	Actual.		
Phocaic talent	780,000	768,000;	used for	gold in Asia Minor.
Phœnician	690,000	660,000;	,,	gold and silver.
Macedonian	,,	,,;	,,	silver.
Ptolemaic	,,	,,;	,,	gold and silver.
Æginetic		582,000;	,,	silver.

LIGHT TALENT.

Persic	518,000;	,,	silver.
Euboic	405,000;	,,	gold and silver.
Attic	405,000;	,,	gold and silver.
Corinthian	270,000;	,,	silver.

The following table exhibits the weights of the principal denominations of the Greek systems. The Corinthian talent is excluded as simply a differently divided variety of the Attic, the Rhodian as a degraded Attic. In the subsequent account of Greek money the metrology of each class will be carefully noted.

	Attic.	Æginetic.	Phœnician.	Persic.
	Grains.	Grains.	Grains.	Grains.
Distater or Tetradrachm....	270	..	224	354
Stater or Didrachm	135	194	112	177
Hemistater or Drachm	67·5	97	56	88
Third or Tetrobol	45·	..	37	59
Fourth or Triobol	33·75	48	28	44
Sixth or Diobol	22·5	32	18	29
Eighth or Trihemiobol......	16·8	24	14	22
Twelfth or Obol	11·25	16	9	14

The Rhodian drachm weighed 60 grains. The Babylonian weight is somewhat lower than the Persic, and it wants the distater. The term stater is usually applied to the didrachm, but also to the tetradrachm, and at Cyrene to the drachm.[1]

The bronze standards have been less fully discussed. Some notice of them will be given under different geographical heads.

In the types of Greek coins (using the term in its restricted sense) the first intention of the designers was to indicate the city or state by which the money was issued. The necessity for distinctive devices was most strongly felt in the earlier days of the art, when the obverse of a coin alone bore a design, and, if any inscription, only the first letter, or the first few letters, of the name of the people by whom it was issued. The motive which dictated the kind of type to be selected was undoubtedly a religious one.[2] There are some isolated instances in which the religious character of a type is doubtful; but these, if proved, would be only exceptions to a general rule. The piety of that age adopted religious devices, and for a long time it was held to be impious to substitute any other representations for them. To the same cause may, perhaps, be partly ascribed the preference on the most ancient coins for devices of a symbolical character to actual representations of divinities, although the difficulty of portraying the human form in the infancy of art must have had considerable influence in this direction.

Greek coins, if arranged according to their types, fall into three classes: (1) civic coins, and regal without portraits of sovereigns; (2) regal coins bearing portraits; and (3) Græco-Roman coins, whether with imperial heads or not. The coins of the first class have either a device on the obverse and the *quadratum incusum* on the reverse, or two devices; and these last are again either independent of each other, though connected by being both local, or—and this is more common—that on the reverse is a kind of complement of that on the obverse. It will be best first to describe the character of the principal kinds of types of the first class, and then to notice their relation. It must be noted that a head or bust is usually an obverse type, and a figure or group a reverse one, and that, when there is a head on both obverse and reverse, that on the former is usually larger than the other, and represents the personage locally considered to be the more important of the two. We must constantly bear in mind that these types are religious and local if we would understand their meaning. "I do not believe," Burgon says, "that the types of coins are, on any occasion, original compositions, but always copied (from the earliest to the lowest times) from some sacred public monument. Thus, when we find what is called a Bœotian buckler on coins, we are not to look upon the representation as *a Bœotian buckler*, but as *the buckler* of some Bœotian hero well known to the ancient inhabitants of that country, and accounted to be sacred by them. In like manner, when we find Minerva represented on coins we are not to understand the type as *a Minerva*, but *the Minerva of that place*; and, in some cases which might be brought forward, the individual statues which are represented on coins, or ancient copies, will be found to exist. The only example of originality of composition apparent on coins is where types have been *doubled* or *halved*, to express similar modifications of value."

In the following list the types of Greek coins of cities, and of kings, not having regal portraits, are classed in a systematic order, without reference to their relative antiquity.

1. Head or figure of a divinity worshipped at the town, or by the people, which issued the coin, as the head of Pallas on coins of Athens, and the figure of Heracles on coins of Bœotian Thebes. Groups are rare until the period of Græco-Roman coinage.

2. Sacred natural or artificial objects,—(*a*) animal sacred to a divinity of the place, as the owl (Athens) and the tortoise (Ægina); (*b*) sacred tree or plant, as the silphium (Cyrene) and the olive-branch (Athens); (*c*) arms or implements of divinities, as the arms of Heracles (Erythræ), the tongs of Vulcan (Æsernia).

It is difficult to connect many objects comprised in this class with local divinities. The reason of this appears to be that the Hellenes, wherever they colonized, and nowhere more than in Greece, found an earlier system of low nature-worship, and endeavoured to incorporate it into their own more intellectual mythology, sometimes with but partial success.

3. Head or figure of a local genius,—(*a*) river-god, as the Gelas (Gela); (*b*) nymph of a lake, as Camarina (Camarina); (*c*) nymph of a fountain, as Arethusa (Syracuse).

4. Head or figure of a fabulous personage or half-human monster, as a Gorgon (Neapolis Macedoniæ), the Minotaur (Cnossus).

5. Fabulous animal, as Pegasus (Corinth), a griffin (Panticapæum), the Chimæra (Sicyon).

6. Head or figure of a hero or founder, as Ulysses (Ithaca), the Lesser Ajax (Locri Opuntii), Taras, founder of Tarentum (Tarentum).

7. Objects connected with heroes,—animal connected with local hero, as the Calydonian boar or his jaw-bone (Ætolians). Arms of heroes also occur as types, but their attribution to particular personages is difficult or impossible.

8. Celebrated real or traditional sacred localities, as mountains on which divinities are seated, the labyrinth (Cnossus).

9. Representations connected with the public religious festivals and contests, as a chariot victorious at the Olympic games (Syracuse).

The relation of the types of the obverse and reverse of a coin is a matter requiring careful consideration, since they frequently illustrate one another. As we have before observed, this relation is either that of two independent objects, which are connected only by their reference to the same place, or the one is a kind of complement of the other. Among coins illustrating the former class we may instance the beautiful silver didrachms of Camarina, having on the obverse the head of the river-god Hipparis and on the reverse the nymph of the lake carried over its waters by a swan, and those of Sicyon, having on the obverse the Chimæra and on the reverse a dove. The latter class is capable of being separated into several divisions. When the head of a divinity occurs on the obverse of a coin, the reverse is occupied by an object or objects sacred to that divinity. Thus the common Athenian tetradrachms have on the one side the head of Pallas and on the other an owl and an olive-branch; the tetradrachms of the Chalcidians in Macedonia have the head of Apollo and the lyre; and the copper coins of Erythræ have the head of Heracles and his weapons. The same is the case with subjects relating to the heroes: thus there are drachms of the Ætolian League which have on the obverse the head of Atalanta and on the reverse the Calydonian boar, or his jaw-bone and the spear-head with which he was killed. In the same manner the coins of Cnossus, with the Minotaur on the obverse, have on the reverse a plan of the Labyrinth. Besides the two principal devices there are often others of less importance, which, although always sacred, and sometimes symbols of local divinities, are generally indicative of the position of the town, or have some reference to the families of magistrates who used them as badges. Thus, for example, besides such representations as the olive-branch sacred to Pallas on the Athenian tetradrachms, as a kind of second device dolphins are frequently seen on coins of maritime places; and almost every series exhibits many symbols which can only be the badges of the magistrates with whose names they occur. Regal coins of this class, except Alexander's, usually bear types of a local character, owing to the small extent of most of the kingdoms, which were rather the territories of a city than considerable states at the period when these coins were issued.

The second great class—that of coins of kings bearing portraits—is necessarily separate from the first. Religious feeling affords the clue to the long exclusion of regal portraits,—the feeling that it would be profane for a mortal to take a place always assigned hitherto to the immortals. Were there any doubt of this, it would be removed by the character of the earliest Greek regal portrait, that of Alexander, which occurs on coins of Lysimachus. This is not the representation of a living personage, but of one who was not only dead but had received a kind of apotheosis, and who, having been already called the son of Zeus Ammon while living, had been treated as a divinity after his death. He is therefore portrayed as a young Zeus Ammon. Probably, however, Alexander would not have been able, even when dead, thus to usurp the place of a divinity upon the coins, had not the Greeks become accustomed to the Oriental "worship" of the sovereign, which he adopted. This innovation rapidly produced a complete change; every king of the houses which were raised on the ruins of the Greek empire could place his portrait on the money which he issued, and few neglected to do so, while the sovereigns of Egypt and Syria even assumed divine titles.

The reign of Alexander produced another great change in Greek coinage, very different from that we have noticed. He suppressed the local types almost throughout his empire, and compelled the towns to issue his own money, with some slight difference for mutual distinction. His successors followed the same policy; and thus the coins of this period have a new character. The obverses of regal coins with portraits have the head of the sovereign, which in some few instances gives place to that of his own or his country's tutelary divinity, while figures of the latter sort almost exclusively occupy the reverses. Small symbols, letters, and monograms on the reverses distinguish the towns in this class.

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[1] This information on Greek weights and coinages is wholly derived from Mr B. V. Head's published statements of Dr Brandis's results (*Numismata Orientalia*, "Lydia," 1877, pp. 1 *sq.*; *Num. Chron.*, 1875, pp. 245 *sq.*; *Proceedings of Institute of Bankers*, 1879; *Guide to the Coins of the Ancients*, 1881). The writer is, however, responsible for the doubts expressed as to Dr Brandis's theory.

[2] See Burgon, in *Numismatic Journal*, vol. i. pp. 97 *sq.*

The Græco-Roman coins begin, at different periods, with the seizure by Rome of the territories of the Greek states. They are almost all bronze; and those in that metal are the most characteristic and important. In their types we see a further departure from the religious intention of those of earlier times in the rare admission of representations, not only of eminent persons who had received some kind of apotheosis, such as great poets, but also of others who, although famous, were not, and in some cases probably could not have been, so honoured. We also observe on these coins many types of an allegorical character.

The following principal kinds of types may be specified, in addition to those of the two previous classes. (1) Head or figure of a famous personage who either had received a kind of apotheosis, as Homer (Smyrna), or had not been so honoured, as Herodotus (Halicarnassus) and Lais (Corinth). (2) Pictorial representations, always of a sacred character, although occasionally bordering on caricature. We may instance, as of the latter sort, a very remarkable type representing Pallas playing on the double pipe and seeing her distorted face reflected in the water, while Marsyas gazes at her from a rock,—a subject illustrating the myth of the invention of that instrument (Apamea Phrygiæ). (3) Allegorical types, as Hope, &c., on the coins of Alexandria of Egypt, and many other towns. These were of Greek origin, and owed their popularity to the sculpture executed by Greeks under the empire; but the feeling which rendered such subjects prominent was not that of true Greek art, and they are essentially characteristic of the New Attic school which attained its height at Rome under the early emperors. Of this kind of type we must again speak in noticing the Roman coinage.

Those types which were common to this and the older classes were also much developed in their subjects. Thus, for instance, groups frequently took the place of single figures; and the representations of sacred localities acquired a great prominence, the most common being of buildings, which are generally temples. In the architectural types a tendency to pictorial representation is evident in the constant endeavours to depict edifices in perspective.

There is a class of coins which is always considered as part of the Græco-Roman, although in some respects distinct. This is the colonial series, struck in Roman coloniæ, and having almost always Latin inscriptions. As, however, these coloniæ were towns in all parts of the empire, from Emerita in Spain (Merida) to Niniva Claudiopolis (Nineveh) in Assyria, in the midst of a Greek population and often of Greek origin, their coins help to complete the series of civic money, and, as we might expect, do not very markedly differ from the proper Greek imperial coins except in having Latin inscriptions and showing a preference for Roman types.

We have now to speak of the meaning of the inscriptions of Greek coins. These are either principal or secondary; but the former are always intended when inscriptions are mentioned without qualification, since the secondary ones are non-essential. The inscription of civic money is almost always the name of the people by which it was issued, in the genitive plural, as **ΑΘΗΝΑΙΩΝ** on coins of the Athenians, **ΣΥΡΑΚΟΣΙΩΝ** on coins of the Syracusans. The inscription of regal money is the name, or name and title, of the sovereign in the genitive, as **ΑΛΕΞΑΝΔΡΟΥ**, or **ΒΑΣΙΛΕΩΣ ΑΛΕΞΑΝΔΡΟΥ**, on coins of Alexander the Great. This genitive form implies a nominative understood, which has been generally supposed to be *νόμισμα*, "money." There are four instances in which a nominative of this kind occurs in coins,—**ΦΑΝΟΣ ΕΜΙ ΣΗΜΑ**, "I am the badge of Phanes," on an archaic coin of Halicarnassus; **ΓΟΡΤΥΝΟΣ ΤΟ ΠΑΙΜΑ**, "the struck" money of Gortys, if the form suggested by M. François Lenormant be admissible, on an archaic coin of Gortys; and **ΣΕΥΘΑ ΚΟΜΜΑ**, "the stamp" or "coin of Seuthes," as well as **ΣΕΥΘΑ ΑΡΓΥΡΙΟΝ**, the "silver piece" or "money of Seuthes." The balance preponderates in favour of the idea that such a word as *νόμισμα*, or the more definite term for a piece of gold (*χρυσοῦς*), silver (*ἀργύριον*), or copper (*χαλκοῦς*), was intended. Yet the instances are not sufficient to establish the case. Besides their disagreement, it must be remembered that the coins of Phanes and Gortys belong to the infancy of money in Asia Minor and Crete, and that Seuthes was a semi-barbarous chieftain. Any one familiar with Greek epigraphy will see the danger of resting on such evidence. In the eighth edition of the *Encyclopædia Britannica* a different explanation was offered on the authority of the late Mr Burgon, who generously communicated it to the writer. He supposed the inscription to relate to the type, and that the nominative understood is the name of that type. It should be remarked that the type of the reverse of a civic coin is usually a complement of that of the obverse, and that the converse may be inferred of regal coins; there is thus in general virtually but one type, that of the tutelary divinity or sacred symbol of the city or sovereign. Athenian coins with the inscription **ΑΘΗ[ΝΑΙΩΝ]** have as their obverse type the head of Athene; the meaning of the inscription, according to Burgon's explanation, would be, not "the money of the Athenians," but "Athene of the Athenians." When the name of the divinity represented is written, the nominative understood is supplied. Thus on coins of Syracuse, with the head of Arethusa as the obverse type, we read **ΑΡΕΘΟΣΑ**—(rev.) **ΣΥΡΑΚΟΣΙΩΝ**, "Arethusa of the Syracusans," and on others with the head of Zeus, **ΖΕΥΣ ΕΛΕΥΘΕΡΙΟΣ—ΣΥΡΑΚΟΣΙΩΝ**, "Zeus the giver of liberty of the Syracusans." There are instances in which the names of the divinity and of the people occur together, as **ΕΙΡΗΝΗ ΛΟΚΡΩΝ**, "Irene of the Locrians," on a coin of the Locri Epizephyrii, the obverse having the head and name of **ΖΕΥΣ**, as though the sense were Zeus (and) Irene of the Locrians. In the case of regal coins Burgon's theory cannot be applied in strictness. In most cases we could supply the name of the divinity represented on the reverse, as, for the gold staters of Alexander, **[ΝΙΚΗ] ΑΛΕΞΑΝΔΡΟΥ**, and for the silver, **[ΖΕΥΣ] ΑΛΕΞΑΝΔΡΟΥ**; but when the type, as of almost all the Ptolemaic coins, is a symbol, in this case the eagle, some modification is needed. If we suppose that the nominative, understood when none is expressed, or implied when a divinity is named, is some word expressing the idea conveyed by the badge, as Zeus by the eagle, we shall probably be not far from the truth. The secondary inscriptions either describe secondary types, as **ΑΘΛΑ**, "rewards," accompanying the representation of the arms given to the victor in the exergues of Syracusan decadrachms,[1] or are the names of magistrates or other officers, or in regal coins those of cities, or are those of the engravers of the dies, of whom sometimes two were employed, one for the obverse and the other for the reverse, or are dates. These inscriptions are often but abbreviations or monograms, especially when they indicate cities on the regal coins.

The importance of Greek coins as illustrating the character of contemporary art cannot be easily overrated. They are beyond all other monuments the grammar of Greek art. Their geographical and historical range is only limited by Greek history and the Greek world; as a series they may be called complete; in quality they are usually worthy of a place beside contemporary sculpture, having indeed a more uniform merit; they are sometimes the work of great artists, and there is no question of their authenticity, nor have they suffered from the injurious hand of the restorer. Thus they tell us what other monuments leave untold, filling up gaps in the sequence of works of art, and revealing local schools known from them alone.

The art of coins belongs to the province of relief, which lies between the domains of sculpture and of painting, partaking of the character of both, but most influenced by that which was dominant in each age. Thus in antiquity relief mainly shows the rule of sculpture, in the Renaissance that of painting.

Sculpture best represents character (*ἦθος*), painting expression (*τὰ πάθη*). Character is the permanent aspect of the face and figure as denoting the dominant quality. Thus a great statue may be not unfairly described by a single epithet. Expression is the transient but intense effect of some sudden feeling. A single figure in a painting requires a fuller description than a statue; the character is seen beneath the expression. Sculpture aims at embodying the ideal, and when it represents the real it must show the fulness of all qualities and even of all potentialities. Repose is the condition of sculpture. Painting having for its purpose the representation of light (colour), and the effects of light in bodies, can only deal with the circumstances of the moment. Movement is implied in painting.[2] Sculpture that is pictorial and painting that is sculpturesque belong to the decline of art. Expression of a supreme kind is, however, found in sculpture of high quality, especially in that kind of relief which lies nearest to sculpture, alto-rilievo; and character is seen in noble portraits which endeavour to represent the man in his completeness. But such sculpture is properly in groups and such painting in the single form. The group suggests the treatment of painting, the single form in pictorial art that of sculpture. Relief, as intermediate between sculpture and painting, admits separately of movement and the momentary action, but the movement must be of the most dignified and rhythmical kind, otherwise it will need colour to counteract confusion by a higher harmony, and the momentary action must be of supreme importance. Observe the dignity and rhythm of the Panathenaic frieze of the Parthenon, the want of colour in the Amazon frieze of the Mausoleum, contrasting it with the noble fragmentary chariot frieze, and the supreme moment chosen in the metopes of the Parthenon.

Relief is usually divided into three kinds, low, middle, and high (basso-, mezzo-, and alto-rilievo), and it is convenient to retain these terms while admitting that they are only roughly correct. Work to be viewed in a feeble light and from a distance must have clearness in the most necessary outlines, and that simplicity which equally marks the Panathenaic frieze. It admits of simple and general movement. This is low relief, and must not be too much raised from the background. High relief differs from sculpture in the round in that it is not necessarily detached from the background, nor usually of the full depth of true proportion, and in consisting of groups to be seen from a distance, so simply treated as to be free from confusion due to the shadows upon them, and not to cast shadows. It should thus be simple in the forms. It admits of expression of the highest kind, which is almost suggested by the relation of the figures which constitute a group, but it does not allow movement. Middle relief, inasmuch as it is used for objects to be seen near, is delicate in its outlines and may be elaborate in its details. The sculptured columns of the temple of Artemis at Ephesus show the delicacy of the method and coins and gems its delight in elaboration. All coins should be treated in this manner, and it is usual in the entire range of those of the Greeks, although the influence of sculpture on relief of other kinds is constantly traceable.

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[1] It is scarcely to be doubted that the arms on the Syracusan decadrachms represent a reward given to an Olympic competitor or competitors on returning home.

[2] On the whole subject cf. C. O. Muller, *Archäologie der Kunst*, §§ 25-27.

It may be expected that Greek coins will bear the impress of the sister arts of sculpture and painting, filling up the gaps in the sequence of examples of the art of which we have remains, telling us somewhat of that which has but a written tradition. Our first duty is to endeavour to place the documents in the best order, separating the geographical from the historical indications, first examining the evidence of local schools, then those of the succession of styles. It is from coins alone that we can discover the existence of great local schools, reflecting the character of the different branches of the Hellenic race. In tracing the changes in these schools we gain a great addition to our ideas of the successive styles, and can detect new examples of those which owe their fame to the leading masters. But in dealing with works in relief we have the advantage due to their intermediate character. In our larger geographical horizon we can trace the character of the successive styles, not of sculpture only, but also of sculpture and painting.

Greek coins clearly indicate three great schools, each with its subordinate groups. The school of central Greece holds the first place, including the northern group centred in Thrace and Macedonia, and the southern in the Peloponnesus, with the outlying special schools of Crete and Cyrene. The Ionian school has its northern group, Ionia, Mysia, and Æolis, and its southern, Rhodes and Caria. Beyond these are certain barbarous and semi-barbarous groups, of which the most important is that of eastern Asia Minor, Persia, and Phœnicia, with Cyprus. The school of the West comprises the two groups of Italy and Sicily.

The whole duration of the schools is limited, by the repulse of the Persians and the accession of Alexander, from 480 to 332 B.C. Before this age all is archaic, and it is hard to trace local characteristics. After it, the centralizing policy of the sovereigns and the fall of the free cities destroyed local art. In certain cultivated centres under enlightened kings a local art arose, but it speedily became general, and we have thus to think of a succession of styles during the rest of the life of Greek art. The century and a half of the local schools is significantly the great age of this art.

In the study of each school we have first to determine its character, and then to look in its successive phases for the influence of the great masters of style. Two dangers must be avoided. We must not too sharply divide the sculptors and the painters as if they always were true to the special functions of their arts. It is well to bear in mind that the earliest great painter, Polygnotus, was a portrayer of character, καλὸς ἠθογράφος, ἠθικὸς, as Aristotle calls him, whereas the latest great sculptors represented expression. Thus sculpture first weighed down the balance, afterwards painting; but it must be remembered that relief can be truer to painting than sculpture in the round, which is more limited by the conditions of the material and mechanical necessities. Our second danger is due to the ease with which local qualities may be ascribed to the influence of a leading style. It is also to be borne in mind that the movement of art in coins was during one period slower than in sculpture,—hence an influence more general than particular. Phidias and Myron do not make their mark so much as Polyclitus. In all cases the direct influence of great masters is to be looked for later than their age. The style of their time is prevalent in the coins, their actual works do not produce imitations till later, and as this is so we must regard the reflexions as influenced by the atmosphere in which they were produced. A Hera of the age of Polyclitus may be truer to the style of this artist than a later one which was produced under the influence of his famous statue.

The school of central Greece in its southern group, comprehending Attica, is remarkable for its widespread extent. It has its colonies in Magna Græcia at Thurium, an Athenian foundation, probably at Terina, and in Macedonia at Amphipolis and Chalcidice under Athenian rule. It alone shows instances comparable to the works of Phidias, though its most numerous fine works are of the age of Polyclitus and that of Praxiteles and Scopas. Its qualities may be seen by comparison of the same subjects as treated by the other schools and groups. The earliest works are marked more than any others by the qualities of high promise which characterized the Æginetan marbles,—the same dignified self-restraint and calm simplicity. Next we perceive a series strong in style, and showing that lofty dignity, that reposeful embodiment of character, which are the stamp of the works of Phidias and his contemporaries. The subjects are more remarkable for fidelity, breadth, and boldness than for delicacy of execution or elaboration of ornament. Every subject is ideal, even the portrayal of animal form. Thus the character shows us what divinity is intended and the ideality what is intended by the representation of beast or bird. From these works we pass to those which reflect the style of the time of Praxiteles and Scopas, when the influence of painting began to be felt, and art inclined towards feeling and descended to sentiment. Still, to the last, character rules these coins, and the chief difference we see is in the increased love of beauty for its own sake and the fondness for representing movement, not to the exclusion of repose, but by its side. In other respects there is little change except in the finer execution and more ornamental quality of the work. Even when the greatest achievement of the Sicilian school, the head of Persephone on the decadrachms of Syracuse, is copied by the Locrians and the Messenians, the superior quality of the school of Greece asserts itself, and the copy is better than the original: there is less artifice and more breadth. The northern group is at first ruder, in the age of Phidias severer, and afterwards it merges into the greater softness of its southern rival. If it copies, as Larissa may copy Syracuse and Neapolis in Campania, it again asserts its superior simplicity, and we prefer the copy to the original.

The Ionian school lacks the sequence which the rest of the Greek world affords. It is broken by the baneful influence of the Persian dominion, and consequently the best works belong to the earliest and latest part of the period. The earliest coins, of the Æginetan age, present nothing special; the later, of the time of Praxiteles and Scopas, comprise works not inferior to those of central Greece, and remarkable, like the Western and the Cretan, as the sole records of a school otherwise unknown. They are markedly characterized by the qualities of the style of feeling, that of Praxiteles and Scopas; but more than this, they are the expression of that style in pictorial form. They represent expression, and they treat it as it could not be treated in sculpture in the round, portraying locks streaming in the air and flowing draperies. At the same time, they are true to the highest qualities of art. Each divinity is at once recognized. Persephone has not the maidenly sweetness she wears in Hellas, but the melancholy foresight of her fate; she has not the character but the expression of the goddess. It must be remembered that, while Hellas produced the great sculptors, western Asia Minor bred the great painters after Polygnotus, himself a sculptor in painting rather than a painter. In the native land of Zeuxis, Parrhasius, and Apelles we see the evidence of the rule of painting. The execution of even the smallest works of this school is marked by the subtlest modulations of form, and here again we see the quality of the painter, who, having to represent solid objects on a plane, must have the highest knowledge of anatomy. The power of expression and the knowledge of what underlies the surface of the face are carried even in the smallest works just alluded to, as the Cyzicene hectæ, to a degree of excellence which baffles modern critical power. The technical skill is inferior to that of the West, yet the skill in modelling is far greater, and has no parallel in the medallic work of any other time or country.

The school of the West, if we except such outlying examples of the art of Hellas as those of Thurium and Terina, has its highest expression in Italy, its most characteristic in Sicily. It has distinctive qualities throughout the age. Even in the earlier period we trace a striving after beauty and a delicacy of finish, with a weakness of purpose, that mark the school with an influence increasing to a time long after the extinction of its rivals. We trace neither clearness of character nor force of expression. The Persephone of Syracuse is merely a beautiful girl. More than this, her beauty is shown off by the portrayal of the artifices of civilized life, emphasized by tricks of style. At the same time there is a knowledge of the capacity of the materials and the form of the coin, and a masterly power of finish, on the whole a completeness of technical skill which is unequalled. The result in the lower subjects is splendid, if wanting in variety, but in the higher we miss the noble achievements of the greater schools. So far there is a general agreement in the northern and southern groups. Yet the Italian shows a nobler and simpler style, with some affinity to that of central Greece, which we look for in vain in Sicily, though we are dazzled by the rich beauty of the magnificent series of coins which marks her wealthiest age. Sicilian art has this apparent advantage, that the great cities, save Syracuse, perished in the Carthaginian invasion, or under the tyranny of the elder Dionysius. Thus we have no important works save of Syracuse during the second half of our period, and cannot judge fully to what this school would have fallen. The key to this exceptional development of Greek art is found in the absence of sculptors or painters in the West, except only Pythagoras of Rhegium at the very beginning of the age, whose influence is thought to be traceable on the money of his native town. The Western art is that of engravers accustomed to minute and decorative work, uninfluenced by sculpture or painting. Their designs will not bear enlargement, which only enhances the charm of those of the other leading schools. Those of the great Syracusan decadrachms are small; those of the minute hectæ of Cyzicus are large.

The most important of the lesser schools is the Cretan. Crete, retaining the primitive life of older Hellas, was never truly civilized, but enjoyed to the last the privileges and exhibited the faults of an undeveloped condition. Producing in the age of high art neither sculptor nor painter of renown, the Cretans, to judge from their coins, were copyists of nature or art. At first rude, their work acquires excellence in design, but never in execution. While we see their poor reproductions of the designs of the Peloponnesus, we are amazed by their skill in portraying nature. Their gods are seated in trees with a background of foliage. Their bulls are sketched as they wandered in the meadows. All fitness for the mode of relief, as well as for the material and the shape of the coin, is entirely ignored. Hence a delight in foreshortening, and a free choice of subject with no reference to the circle in which it must be figured. In spite, however, of their skill, the Cretans never attempted the three-quarter face, which is at once the best suited to the surface of a coin and the most trying to the skill of the artist. Yet their work is delightfully fresh, as if done in the open air. There is no idealism, but much life and movement. In a word, the school is naturalistic and picturesque. Its works are of the highest value in the study of Greek art, but as examples of the application of that art to coins they are to be used with caution. Nowhere else do we see the artist so freely copying nature and art, nowhere so unshackled by academic rules, nowhere so little aware of the limitation of his province.

It is important to study the mode in which Greek money was coined, because the forms of the pieces thus receive explanation, and true coins are discriminated from such modern falsifications as have been struck, and in some degree from those which have been cast. Our direct information on the subject is extremely scanty, but we are enabled by careful inference to obtain a very near approximation to the truth on all the most important points.

The only single ancient Greek die of the authenticity of which we are persuaded was seen by Burgon in the East. He described it, from recollection, as a piece of copper or bell-metal, in the shape of a truncated cone, flat at the top and bottom, about 3½ inches in height, and from about 3 inches in diameter at the bottom to 2 at the top. In the upper surface was cut the die for the reverse of a tetradrachm of a Seleucid king of Syria, with the type of Apollo seated on the omphalos. There appears to have been no trace of any method of fitting this to the die of the obverse. From the appearance which the coins present, it may be inferred that the Greeks placed a ball of metal, carefully adjusted to the proper weight, and cold, between two dies, and then struck the upper die a powerful blow with a very heavy hammer. There was no collar to give the coins an exactly circular form. The dies must have been of hard metal, though softer than modern ones. Some Greek coins have been found of the same die, but such as the writer has seen did not present any evidence as to the wear to which their dies had been subjected. The Roman coins appear to have been struck in the same manner, but with a more careful adjustment of the two sides, yet without a collar. Their dies, although hard, must have been, like the Greek dies, softer than those of the moderns, since, in the case of coins from the same die, we can trace the increase of imperfections through wear, and this notwithstanding the short period for which each die was used and the relatively few coins struck from it. In the case of Greek coins, there is similar evidence, in the great number which have bad or imperfect impressions, although not worn, since all these can scarcely owe their inferiority to insufficient force having been used in striking them. Some few Greek and Roman coins were cast and not struck; others were first cast to give them their general form, and then struck. Both cases, however, form very rare exceptions, and are confined to particular groups of coins and not to isolated examples.

We may now pass on to notice the Greek coinage of each country, following Eckhel's arrangement. The series begins with Spain, Gaul, and Britain, constituting the only great class of barbarous Greek coinage. It must not be supposed that the money of the whole class is of one general character; on the contrary, it has very many divisions, distinguished by marked peculiarities; it has, however, everywhere one common characteristic,—its devices are corrupt copies of those of Greek or Roman coins. The earliest of these barbarous coinages begin with the best imitations of the gold and silver money of Philip II. of Macedon. They probably first appeared to the north of his kingdom, but the gold soon spread as far as Gaul, and even found their way into southern Britain, by which time the original types had almost disappeared through successive degradations. Next in order of time are the silver imitations of Roman family coins, the victoriati and denarii of the commonwealth, which began in Spain and passed into Gaul and Britain, being current in those countries with the gold money of Greek origin. The copper money of Spain follows the imitated silver types; that of Gaul and Britain, though showing Roman influence, is more original. It is useless to attempt a very minute classification of the subjects of these barbarous types, since the artists by whom they were executed did not properly understand them.

Side by side with these large coinages we find Greek money of colonies in Gaul and Spain, and a far ampler issue of Phœnician coins by the Carthaginian kings and cities of the Peninsula. The coinage of Hispania, corresponding to the modern Spain and Portugal, was issued during a period of about four centuries, closing in 41 A.D. There are four classes of money, which in the order of their relative antiquity are Greek, of two groups, Carthaginian, Romano-Iberian, and Latin. The first or older group of Greek money belongs to the widespread currency which reveals the maritime power of the Ionians of Phocæa. It consists of fractions of the drachm of the Phocæan standard, from the diobol or third downwards. Its later pieces are of the Phocæan colony of Emporiæ, founded by the earlier settlement of Massilia. Next in order and in part contemporary, beginning before the middle of the 4th century B.C., come the drachms of Emporiæ, which betray the influence of Siculo-Punic art. Their standard is probably Carthaginian. Of the neighbouring Rhoda, a Rhodian colony, there is similar money. Carthaginian coins of Spain begin in the same period with the issues of the great colony of Gades, following the same weights as the Emporian drachms. These are followed by the issues of the Barcides from 234 to 210 B.C., with Carthaginian types and of Phœnician weight, struck of six denominations, from the hexadrachm to the hemidrachm. Señor Zobel de Zangróniz has classed them to Spain, on the grounds of provenance and the possession of the silver mines by the Barcide kings, against Muller, who attributes them to Africa. The types are Carthaginian, and present some interesting subjects. The true Iberian currency begins not long after the Punic. The later drachms of Emporiæ, ultimately following the weight of the contemporary Roman denarius, have Iberian legends, and form the centre of a group of imitations issued by neighbouring native tribes with their distinctive inscriptions. This coinage ceased when the Roman province was formed in 206 B.C. A little before this date the Romans had begun to introduce Latin money; about this time, however, they took the backward step of permitting native coinages of Latin weight. Probably they found that native legends and types were more welcome to their subjects than those of Rome. Consequently this coinage of Spain under the republic, which lasted until 133 B.C., may be almost considered national. The two provinces Hispania Citerior and Hispania Ulterior have this marked difference: the coins of the nearer province, of silver and bronze, have always Iberian inscriptions on the reverse, and are clearly under distinct Roman regulation; those of the farther are apparently of independent origin, and consequently bear Iberian, Phœnician, Libyo-Phœnician, and Latin legends, but they are of bronze alone. The interest of these coins lies mainly in their historical and geographical information. They bear the names of tribes, often the same as those of the town of mintage. The art is poor, and lacks the quaint originality and decorative quality of that of Gaul. Ultimately the native money was wholly Latinized (133 B.C.), though political circumstances for a time renewed it under Sertorius (80-72 B.C.) in the modified form of a bilingual currency. The purely Latin issues of the two provinces, and under the empire more largely (from 27 B.C.) of the three, Tarraconensis, Bætica, and Lusitania, present little of interest. They closed in the reign of Caligula (37-41 A.D.), though in later times purely Roman money in gold and silver was issued at different times in Hispania down to the establishment of the Visigothic kingdom.

The imperial money of Hispania introduces us to one of the two great classes of provincial coins under the empire; the larger of these was the Greek imperial, bearing Greek inscriptions, the smaller the Roman colonial, with Latin inscriptions, deriving its name from the circumstance that among Greek-speaking nations the coloniæ were distinguished by the use of the Latin language on their money. In the coinage of Hispania, issued by a nation adopting Latin for official use, the aspect of the coinage is colonial, though it was not wholly issued by colonies. Many of the Spanish towns belong to the kindred class of municipia; others are neither coloniæ nor municipia. In Hispania the obverse of the coin bears, as usual in the colonial class, the head of the emperor or of some imperial personage, the reverse a subject proper to the town. The priest guiding a plough drawn by a yoke of oxen is peculiarly proper to a colonia, as portraying the ceremony of describing the walls of the city, so also an ox, with the same reference, the altar of the imperial founder, or, as connected with his cultus, a temple, probably in some cases that of Roma and Augustus. Other types, however, portray the old temples in restored Roman shapes, or indicate directly by fishes, ears of corn, and more rarely bunches of grapes, the products of the country, not, as in Greek cities, those products in relation to religion. Some original and grotesque types have a markedly local character. The money of Augusta Emerita (Merida) in Lusitania, a colony of pensioners (emeriti), is specially interesting, including as it does the silver issues of P. Carisius, the legatus of Augustus.

The coinage commonly called that of Gaul belongs to the people more properly than to the country; for it comprehends pieces issued by the Gauls or other barbarians from the borders of Macedonia and Illyricum to the English Channel and the Bay of Biscay, through Pannonia, part of Germany, Helvetia, and Gaul. It is fluenced the money of northern Italy, and, crossing the Channel, produced that of Britain, which has its own distinctive features. Four classes of coinage are found in these vast limits. Arranging them by date, they are the money of the Greek colony of Massilia and her dependencies, that of the Gauls and other barbarians of central and western Europe, those which can be classed to the tribes and chiefs of Gaul, and the imperial coinage of that country. The coins here attributed to the Gauls and other barbarians are by some numismatists classed to Pannonia. It is quite true that the silver money of this class is not found in Gaul, but in the case of the gold it is impossible to draw a distinct geographical line. Further, no nation is so likely to have struck the bulk of these pieces as the plunderers of the Greek cities; at the same time, there are Thracian and other barbarous mintages which are not Gaulish. The gold money cannot be limited to any one country; it is common to all, having evidently spread as a safe commercial medium; the silver, on the other hand, remained limited to the neighbourhood of the Macedonian territory. Thus, though we may separate certain eastern issues, the general designation of the whole group as issued by the Gauls and other barbarians is safest, so long as the great class of gold remains common to the whole region, and even in some varieties to Britain apart from the true British coinage—unless, indeed, its presence there is due to commerce.

The great mart of Massilia (Marseilles), founded about 600 B.C. by the Phocæans, was the centre of the Greek settlements of Gaul and northern Spain. Emporiæ was her colony, with other nearer towns of inferior fame. Yet Massilia always held the first place, as is proved by the abundance of her money. At first it consisted of Phocæan obols, part of the widespread Western currency already noticed in speaking of Emporiæ. These were succeeded by Attic drachms, some of which, about Philip of Macedon's time, are beautiful in style and execution. Their obverse type is the head of Artemis, crowned with olive, at once marking the sacred tree, which had grown from a branch carried by the colonists, so tradition said, with a statue of the goddess, from Ephesus, and proclaiming the value of the olive-groves of Massilia. On the reverse we note the Asiatic lion, common to it and the last colony of Phocæa, the Italian Velia in Lucania.

The coinage of the Gauls clearly had its origin in their predatory incursions into Greece. They there found the money of Philip and Alexander still the great currency. Civilized enough to convert their spoil from metal into money, they speedily coined gold and silver, of which the earliest examples imitate, often with no small intelligence, the gold staters or didrachms of Philip and the silver staters or tetradrachms of Alexander. From the greater rarity of Alexandrine types in silver and their absence in gold, it may be conjectured that the earliest issues were struck in Philip's reign, though the mass of the coinage must be later. The money of Gallia before the complete Roman conquest, to which it may be anterior in its commencement by half a century, belongs in the gold to degraded types of the earlier widespread currency. The undoubted gold and electrum of this class, identified as bearing regal or geographical names, are extremely limited. By far the most interesting coin of the group is the gold coin which bears the name at full length of the brave and unfortunate Vercingetorix. The silver money is comparatively common. The name of the Helvetian prince Orgetorix is likewise traced on Gaulish coins, on which it appears allied with those of native chiefs, and in a special coinage of his own, remarkable for the characteristic Swiss type of the bear. The bronze money of Gaul is still more abundant than the silver, and has a special interest from its characteristic types. The Roman coins recall those of Hispania, but are limited to a few coloniæ. They range in date from Antony and Augustus to Claudius. The principal issues are the well-known money of Lugdunum (Lyons) and Nemausus (Nimes). Those of Lugdunum may have been struck in a district around the city; the type of the famous altar of Lyons, that of Roma and Augustus, is worthy of note. The type of Nemausus, commemorating the conquest of Egypt in the crocodile and palm, is further remarkable as sometimes struck in the shape of the hind-leg of a deer, and is therefore called the *pied de biche*.

The ancient coinage of Britain is the child of that of Gaul, retaining the marks of its parentage, yet with characters of its own due to independent growth. Money first came in trade by the easiest sea-passage, and, once established in Kent, gradually spread north and west, until the age of the earlier Roman wars, when it was issued in Yorkshire, probably in Lincolnshire, and in a territory of which the northern limits are marked by the counties of Norfolk, Cambridge, Huntingdon, Bedford, Buckingham, Oxford, Gloucester, and Somerset. The oldest coins are gold imitations of Philip's staters, which, whether struck in Gaul or Britain, had a circulation on the British side of the Channel. They are the prototypes of all later money. From a careful comparison of their weights with those of later coins, and from a study of the gradual degradation of the types, Evans places the origin of the coinage between 200 and 150 B.C. Its close may be placed about the middle of the 1st century A.D. The inscribed coins occupy the last century of this period, being contemporary with uninscribed ones. The uninscribed coins are of gold, silver, bronze, and tin, the gold being by far the most common. There is small variety in the types, nearly all in gold and silver, and some in copper, presenting in more or less degraded form the original Gaulish type for gold. It may be suspected that all new types and the extremely barbarous descendant of the tin series are of the age of the inscribed coins, or but little earlier. The Channel Islands are remarkable for a peculiar coinage of billon, a very base silver, presenting the usual types modified by Gaulish grotesqueness. The place of this group in the British series is merely accidental; in character as in geography it is Gaulish.

The inscribed coins are evidently in most cases of chiefs, though it is certain that one town (Verulamium) and some tribes had the right of striking money. The most interesting coins are those of known chiefs and their families—of Commius, probably the active prince mentioned by Cæsar, of Dubnovellaunus, mentioned in the famous Ancyra inscription, which has been called the will of Augustus, and most of all the large and interesting series of Cunobelinus, Shakespeare's Cymbeline, his brother Epaticcus, and his father Tasciovanus. It is evident from the coins and historical evidence collected by Evans that Tasciovanus had a long reign. His chief town, as we learn from his money, was Verulamium. His coins are in three metals, repeat the traditional types, and present new ones, some showing a distinctly Roman influence. The money of Epaticcus is scanty, but that of Cunobelinus, with Camulodunum (Colchester) for his chief town, is even more abundant than his father's, indicating a second long reign, and having the same general characteristics. The gold shows a modification of the traditional type, the silver and bronze the free action of Roman influence and a remarkable progress in art. With the death of this prince not long before 48 A.D. British coinage probably ceases, none being known of his sons, Adminius, Togodumnus, and the more famous Caractacus, though the coins of the Iceni may have continued as late as 50 A.D.[1]

The ancient coins of Italy occupy the next place. They appear to have been struck during a period of more than 500 years, the oldest being probably of the beginning of the 6th century B.C., and the latest somewhat anterior to the time of Julius Cæsar. The larger number, however, are of the age before the great extension of Roman power, which soon led to the use of Roman money almost throughout Italy. There are two great classes, which may be called the proper Italian and the Græco-Italian; but many coins cannot be referred to either, since they present peculiarities of both. The proper Italian coins are of gold, silver, and bronze. Of these, the gold coins are extremely rare, and can never have been struck in any large numbers. The silver are comparatively common, but the bronze are very numerous and characteristic. Some of the silver coins have an incuse device on the reverse, which is almost always a repetition of that on the obverse; they are of Greek cities, but their fabric is peculiar to Italy. There are also a few with a design on the obverse and a perfectly plain reverse. The most remarkable bronze coins of this class are of the kind called æs grave, some of which were the early proper coinage of Rome, although others are known to have been struck by other Italian cities. These are very thick coins, some of which are of great size, while most have a rude appearance. The designs of the Italian coins are generally, if not always, of Greek origin, although the influence of the native mythology may be sometimes traced. The inscriptions are in Latin, Oscan, or Etruscan, and follow a native orthography; sometimes on the earlier coins they are retrograde. The art of this class is generally poor, or even barbarous. The denominations are common to Greek money, except in the case of the bronze, which follows a native system. Of this system the early proper Roman coins afford the best known examples. The Græco-Italian coins are of gold, silver, and bronze. The silver and bronze are very common, and the gold comparatively so, although struck by few states or cities. In form the silver and bronze coins are thicker than those of Greece of the same period, but there is not the same difference in the gold. The designs are of Greek origin, although here, as in the proper Italian coins, but less markedly, native influence can be detected. This influence is evident in the frequent occurrence of types symbolically representing rivers, showing a bias towards the old nature-worship, and still more in the use of Latin inscriptions, with half-Italian forms of the letters on coins otherwise Greek. Of the best art of ancient Italian money we have already spoken, and we shall have occasion to mention some of its most beautiful examples. The denominations of the gold and silver coins are unquestionably derived from those of Greece, according to the weight of the Attic talent, the heaviest gold piece being the stater or 3000th part of that talent; in silver there are few tetradrachms, the didrachms are extremely common, and smaller denominations are usually not rare. We thus learn that the silver currency was chiefly of didrachms, smaller pieces being less used, and larger ones scarcely used at all. It is important here to notice that the interchange of the native or Italian bronze coinage with the Greek silver coinage led to a double standard, silver and bronze. The bronze standard, as might be suspected, was of Italian origin, the silver of foreign introduction.

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[1] This summary is from Evans's *Coins of the Ancient Britons*, London, 1864.

The peculiarity of the Italian bronze is that in its oldest cast form it was of such weight as to show the absence in some parts of the country of silver equivalents. It was long after silver had been introduced everywhere, with struck bronze equivalents, before the heavy coinage (æs grave) went out of circulation. The silver money is at first remarkable for the evidence it affords of its extraneous character in presenting two standards. Afterwards it becomes equivalent to the bronze, or supplies equivalent pieces, and is quite regular. The original condition of the Italian currencies is best illustrated by the money of Etruria about 300 B.C. Etruria, be it remembered, was an early goal of Oriental commerce by sea. At the great mart of Populonia, and in the country round, we find not only silver coins of two different foreign standards, the Attic and the so-called Persic, but also cast æs grave and later struck bronze pieces issued before the cast money had fallen into disuse. Without discussing the origin of these various currencies it is enough to note that they bear witness to the effects of a widely-spread commerce, and show that here was the meeting-point of the native system and of foreign ones.

In Italy the æs grave long ruled. Originally it was libral, the principal coin being the as, nominally of the weight of a Roman libra or pound. In the coinage of Rome the as does not seem to have ever exceeded the weight of ten ounces, or ten-twelfths of its proper weight. On the other hand, the æs grave of Etruria is occasionally heavier. The Romans made the quarter denarius, called the sestertius, the silver equivalent of the libral as; the earliest weight of this coin was about 17·156 grs.; and, the value of silver to bronze being as 1 to 250, we thus obtain 4290, or about ten libral ounces, as the original weight of the libral as. The successive reductions of the as belong to Roman numismatics, and it is only necessary here to add that they affected the local bronze coinages as Italy fell under the rule of the republic. The silver coinages, on the other hand, survived for a longer time throughout the Greek cities. Their coin corresponding to the sestertius, as the equivalent of the libral as, was the Attic diobolon, which, originally of 22·5 grs., was at once reduced to about 18, and of course reduced the didrachm at the same time, which, really Attic, became apparently Phœnician; it was the principal silver coin of the cities of Magna Græcia. The purely Italian currency rules in northern and middle Italy. The great Greek coinages are of the wealthy marts which dotted the coasts of Campania, Calabria, Lucania, and the Bruttii. Similarly we find Etruscan inscriptions on the coins of Etruria, and Oscan on those of middle and lower Italy, where they are eclipsed in number and style by the Greek issues.

Beginning in the north of Italy, the first coins that strike us are those of Populonia in Etruria. The silver money of this place is generally of the peculiar fabric in which the reverse is left perfectly plain. The æs grave of upper and middle Italy is of great importance. It presents the great oblong masses of uncertain weight, multiples of the as, which wear an aspect of great antiquity, though the elephant on one shows us that they were cast after the wars of Pyrrhus. Latium is particularly rich, even when we exclude the coinage of Rome (to be treated later). Samnium shows us a curious revival of native silver money after the local coinage of the Italian towns had been almost abolished by Rome. It was the result of the Social or Marsic War of the confederate tribes, who struck for Italy against the Roman supremacy during the years between 90 and 88 B.C. The coins present the head of Italia, and reverse types of which the most striking are warriors, varying in number, taking an oath over a sacrificial pig, and a bull for Italy goring the prostrate wolf of Rome. The inscriptions are Oscan or Latin.

Certain of the Greek towns of Italy deserve special mention for the splendour of their coinage,—beautiful in style and delicate in execution. In Campania (leaving the Romano-Campanian for later notice) the two most interesting currencies are of Cumæ and Neapolis, the modern Naples. Cumæ presents silver money of the archaic and the early fine style, in which last we first observe the peculiar naiveté of western Greek art before it had attained elaboration. The abundant silver coins of Neapolis are of the early and the late fine periods and of the decline. The types are usually the head of the siren Parthenope, more rarely Hera and Pallas, favourite goddesses of the Greeks of Italy; the reverse presents the man-headed bull common on Campanian money, here not a river-god as in Sicily, but the tauromorphous Dionysus. The bronze money is of good style, and age has beautified it with the rich blue or green patina due to the sulphurous soil. When we reach Calabria the Greek money startles us in astonishing wealth of beauty in the currency of the opulent and luxurious mart of Tarentum, second only to Syracuse in the whole West, of all the main periods of art, and including in the age of its greatest prosperity and its fall (the time of the contest with Rome) the most abundant gold issues of any Greek city. The gold money of Tarentum is a delight to the eye, with the varied beauty of its gem-like types, which, while they show the gem-engraver's art, prove the medallist's knowledge of the rich but opaque metallic material. Several heads of divinities adorn these coins, and the chief reverse types relate to the legendary founder, Taras, son of Poseidon. Always a youth, he appears as a charioteer, perhaps as a horseman, and riding on a dolphin,—the familiar Tarentine type. The most remarkable subject represents him with outstretched arms running to Poseidon seated on a chair. The silver coinage is chiefly of Attic didrachms, of low weight to admit the interchange of their sixth, the diobol, with the Roman libral as. The prevalent type is Taras seated on a dolphin; in earlier money the type is single, and repeated incuse on the reverse; afterwards this subject occupies the reverse, and, itself a charming composition, is delightfully varied. On the early fine coins the people or demos, personified generally as a youth, often holding a spindle, occupies the obverse, but gives place to a horseman in various attitudes, giving great scope to the engraver's skill; probably he is Taras himself, save when he is a full-grown warrior. These representations illustrate the famed horsemanship of the Tarentines, and refer to contests and games which were probably local. Heraclea in Lucania shows us didrachms of the fine age, with heads of Pallas and subjects connected with Heracles: the contest with the Nemean lion is most skilfully treated, and the series is very characteristic of the gem-engraver's art. The powerful city of Metapontum begins with early coins having the incuse reverse, and then displays a long series stretching down to the decline of art. The constant type, which recurs with the heraldic instinct of the West, is the ear of bearded wheat, reminding us of the "golden harvest" (*χρυσοῦν θέρος*) which the Metapontines dedicated at Delphi. Like the Tarentine badge, it first occupies the obverse, then the reverse, balanced by a charming series of heads of divinities. Persephone is the most appropriate counterpart; we also note heads of Concordia (*Ὁμόνοια*) and Hygieia, marked by an ingenuous grace peculiar to the early fine work of the Western school, of Leucippus the founder as a helmeted warrior (occurring on a rare tetradrachm and the usual didrachms), and many other types of unusual variety and originality of conception.

The ancient Sybaris, famous for her luxury, has left archaic coins; she was destroyed by Croton in 510 B.C., restored for a time, and then became an Athenian colony, speedily receiving the name of Thurium about 443 B.C. The result of the support of Athens in the days of Pericles was the issue of a splendid series of coins. Not only is the face of the coin occupied by the head of Pallas, and the great currency, as at Athens, of tetradrachms, but the severe beauty of the style points to the direct influence of the art of central Greece. The head of Pallas is covered by a helmet adorned with a splendid figure of the sea-monster Scylla. The reverse shows a bull butting (*Θούριος*), in a strikingly ideal form. Probably the obverse type affords the nearest reflexion of the masterpiece of Phidias, or at least the closest following of his style. The finest coins are unsigned tetradrachms, but didrachms of cognate style give the beginning of the name of the engraver Φ. He reappears at Terina (of which town presently).

Velia, the last colony of Phocæa, whose citizens sailed away to the far west rather than submit to the Persian tyrant (544 B.C.), shows coins from its foundation. The pieces of fine work witness to an Asiatic origin in the types of the lion, devouring the stag or as a single device, while the obverse displays the head of Pallas so much in favour in Magna Græcia. The style, which lacks strength but not beauty, is Italian, and we see no trace of the pictorial qualities of Ionian art, which indeed had not taken its mature form when the exiles left the mother country.

The Bruttii are the first native Italians whom we find striking a fair Greek coinage. Their gold and silver is of late style, the gold presenting the head of Poseidon and Amphitrite on a sea-horse, the silver the head of Amphitrite and the figure of Poseidon, both with other subjects. Caulonia has early coins running down to the early fine period, mythologically interesting in type, and the later with a beautifully-designed stag on the reverse. For Croton the ruling type is the tripod. The eagle occurs on the obverse and the tripod on the reverse. The bird of Zeus is inferior to that at Agrigentum, as this again is inferior to the eagle of Elis. We note also beautiful types of Heracles seated, one of marvellously delicate work, on the reverse of which Apollo aims an arrow at the Python from behind his tripod,—a remarkable composition. The other Heracles types form a most interesting series of recollections, "memory sketches," of a famous statue, the pose of which recalls the so-called Theseus of the Parthenon, while the obverse presents the head of the Hera Lacinia worshipped on the promontory close by. The latest coins, like the parallel ones of Metapontum, are weak and pretty. The money of the Locri Epizephyrii affords two curious types of reverse; Eirene seated, of fine style, with the legend **ΕΙΡΗΝΗ ΛΟΚΡΩΝ**, and the later yet more remarkable subject of Roma seated while Pistis crowns her, the legend being **ΡΩΜΑ ΠΙΣΤΙΣ ΛΟΚΡΩΝ**. The historical reference is as yet undiscovered. There are beautiful coins of the little-known town of Pandosia, bearing the head of the nymph Pandosia (?); the reverse has the river Crathis, a splendid head of the Lacinian Hera, and Pan, being signed by an engraver who may be the same as the Φ of Thurium, though the style is different and the execution gem-like.

Rhegium was closely connected with Messene in Sicily opposite, and thus the great Sicilian currency of tetradrachms prevails.

Anaxilaus, tyrant of Rhegium from 494 to 476 B.C., early in his rule acquired Messene through Samian adventurers. The coins of both towns at first present Samian types, and then, the Samians having been expelled, Anaxilaus commemorates his Olympic victory in the mule-car. As this race only lasted from 500 to 448 B.C., its occurrence here, represented only in the style of the earliest quarter of the 5th century, is historically valuable. The same type appears at Messene and lasts longer. In both cases the reverse bears a running hare, a symbol of Pan.

The little-known town of Terina is illustrious as having produced a series of silver didrachms which, on the whole, is the most beautiful in Italy. The obverse has the head of a goddess, who is portrayed winged on the reverse,—a wonderfully fine subject, well conceived and most delicately executed in a variety of different attitudes, some recalling the Nices which adorn the balustrade of the temple of Wingless Victory at Athens. Very curiously, the money of Terina begins with an archaic coin which bears on the reverse the named figure of Wingless Victory, surrounded by the olive-wreath. Does all this indicate a religious connexion with Athens? Though the Athenian temple was not built till half a century or more after the date of the earlier coin, we may well think that the worship was of older date. The artist of the later coins, who signs Φ, is clearly the Φ of Thurium, Athenian in style if not in nationality, and perhaps he had seen the sculptures at Athens. At Terina he rules art; at Thurium he is one of several engravers; at Heraclea and Neapolis he merely introduces the stronger style; perhaps he appears once more executing a masterpiece at Pandosia. He must have had a long life and wide renown. It is significant that at Terina the later coins have a merit most unusual in the West.

The coinage of Sicily is Greek. The Hellenic and Carthaginian colonies of the coast left the barbarous natives undisturbed in the inland country, and both issued Greek money, the Punic with a tincture of Phœnician style. The coinage ranges from the 6th century B.C. until the subjugation of the island by the Romans, after which a few cities struck colonial or imperial coins for a short space. The marked periods are those of the preponderance of Syracuse from 480 to 212 B.C., interrupted by the great Carthaginian wars, which were fatal to the cities of the southern coast. The coinage is in gold, mainly issued at Syracuse, in silver, and in bronze. The standard is Attic, except the earliest money of the Chalcidian colonies Himera, Messene, and Naxos, which follows the Æginetan weight. The metrology of Sicily has a distinct relation to that of Italy. Here also there is a double standard, silver and bronze, and in consequence an intrusive silver coin, differing but little from the obol, weighing 13·5 instead of 11·25 grs., the silver equivalent of the bronze litra, whose name it borrows. The litra in bronze was the Sicilian pound, equal to half an Attic mina, and to two-thirds of the Roman libra or pound. So important was the litra in Sicily that the silver litra supplanted the obol, and the didrachm was sometimes called a stater of ten litræ, the decadrachm a piece of fifty litræ, pentecontalitron. The leading coin is the tetradrachm, not, as in Italy, the didrachm.

The Sicilian money is of extremely careful artistic work, not unfrequently even in the case of bronze allowing for a more rapid execution of the die; and the highest technical excellence is attained. The art is that of the southern branch of the great Western school, generally more skilful than the art of southern Italy, but less varied. The earlier fine work has a naive beauty peculiar to the West and almost confined to Sicily; all that follows is evidently gem-engravers' work. These coins are remarkable for the frequency of artists' signatures, which for the short period of highest skill are almost universal on the larger silver money of Syracuse, and occur less frequently on that of the other great cities. As in Italy, the decline is more rapid than elsewhere in the Greek world, in consequence of the inherent weakness of the style; but it is in part due to the calamities of the island, as of lower Italy.

The fame won by the tyranni and other leading aristocrats of Sicily in the great national contests of Hellas, in the race with the quadriga, the mule-car, and the horse, led to the introduction and supremacy of types commemorating these victories, probably in most cases those achieved at Olympia. That these victories are intended is shown principally by the mode in which a chariot is portrayed at the critical moment of passing the turning-post, by the occurrence of the turning-post itself, by the correspondence of the cities issuing the type with those commemorated by Pindar, in whose *Olympic Odes* the six victories in the chariot-race are all won by Sicilians, and by the direct evidence of Aristotle (ap. Poll., v. 75) that Anaxilaus of Rhegium recorded on his coins his Olympic victory with the mule-car. It is obvious that no success could be so appropriately figured on the coinage. The religious idea was maintained; the charioteer or the horseman was not the victor, but at the same time the renown of the city was indissolubly connected with the citizen who won it. Hence these types are confined to states ruled by tyranni or oligarchies; outside Sicily they are only found at Rhegium when it was closely connected with Sicily, at Cyrene, and in the money of Philip II. of Macedon. The horseman is not a frequent type; the mule-car is limited to Messene (and Rhegium); but the quadriga becomes the stereotyped subject for the reverse of the great Sicilian tetradrachms,—the bulk of the coinage,—and only escapes heraldic sameness by a charming variety in the details. In the age of finest art a divinity of the city takes, in Homeric guise, the place of the charioteer, or Nice herself so wins the victory; commonly she hovers above about to crown the charioteer. Yet more interesting are the types connected with nature-worship, especially those portraying river-gods in the form of a man-headed bull, or a youth with the budding horns of a calf, or in the shape of a dog, where Phœnician influence is found, and also the subjects of the nymphs of fountains. These types occur on either side of the coin. The obverse of all is usually held by the head of a divinity, Persephone and Pallas taking the first place.

The leading position which Syracuse held in the island makes it proper to notice her splendid currency first, the finest for knowledge of the materials, for skill in suitably filling the space, and for delicacy of execution in the whole range of Greek money, though we miss the noble simplicity of Greece, the strong feeling of western Asia Minor, and the simple picturesqueness of Crete. These larger qualities are sacrificed to an excess of richness and even to tricks of art. Yet the beauty of the coins and their completeness,—the artist having satisfied his intention,—command our admiration; and our interest is raised by the story they tell of the vicissitudes of the great city of the West, the mother of liberty and the slave of tyrants, great in commerce, rich, luxurious, loving the arts, yet able to defend herself even under base rulers against all the power of Carthage and of Athens. Syracuse was founded in 734 B.C. by Archias of Corinth, an origin which, remembered on both sides, served her well in later history. In the 6th century, under the oligarchy of the Geomori, she issued her most archaic silver money, which, primitive as it is, gives promise of the care of the later coinage, and begins the agonistic types, thus indicating some early victory at a great Hellenic contest. Gelon, tyrant of Gela, won the chariot race at Olympia in 488 B.C., secured Syracuse in 485 B.C., and, when the Carthaginians, probably by agreement with Xerxes, invaded Sicily, utterly routed them at the great battle of Himera (480 B.C.), the Salamis of the West. These events find their record in the issue and subjects of his Syracusan money, which, however, was struck, as usual in that age, in the name of the people. The chariot type is varied, for Nice appears hovering above the victorious charioteer, about to crown the horses, and the coins issued after the great battle show the lion of Libya beneath the car in the exergue (Head, *Syracuse*, 9). These last pieces are fixed in date by the famous story how Gelon's wife Demarete, having gained favourable terms for the vanquished Carthaginians, was presented by them with a hundred talents of gold, by means of which she coined the great silver pieces of fifty litræ or ten drachms, which were called after her demaretia. They bear the head of Nice, or it may be Pallas, crowned with olive, and the quadriga and lion. The battle of Himera and the death of Gelon (478 B.C.) fix the date of these remarkable coins, which close the archaic series of Syracuse and give us a fixed point in Greek art, at about 479 B.C. There is a touch of Egyptian in their style which makes us think that Syracuse may have been influenced through Naucratis.

Hieron (478-467 B.C.), the brother and successor of Gelon, continues the same types, alluding, as Head well remarks (*loc. cit.*), to his great victory over the Etruscans off Cumæ (474 B.C.), by the marine monster in the exergue of the reverse which denotes the vanquished maritime power. It is to be noted that as Gelon introduces the Nice in the chariot type, so in the horseman type we now first see Nice crowning the rider. Gelon had won an Olympic victory in the four-horse contest, Hieron in the horse-race, though he also won with the four horses in the Pythian games. With Hieron's money we say farewell to archaic art. The female heads on the obverse now have the eye in profile and show beauty and variety, and the horses are even exceptionally represented in rapid action. With the short rule of Thrasybulus, the last brother of the house, it came to an end, and the age of the democracy (466-406 B.C.) began. The victories by land and sea of Gelon and Hieron had established the power of the city on a sure basis, and fifty years of prosperity followed. To the earlier part of this age belong the beautiful transitional coins in which the female heads are marked by a youthful simplicity of beauty combined with fanciful and even fantastic treatment of the hair; the reverses remain extremely severe. Towards the close of this age there are very fine works, the first signed coins, with the old dignity yet with greater freedom of style, the horses of the quadriga in rapid movement. The contest with Athens and the victory of Syracuse (415-412 B.C.) seem to have given the impulse of which we here see the effect. To the democracy also belong the earliest gold and bronze pieces.

The tyranny of Dionysius and his successors (406-345 B.C.) is the age of the most splendid Syracusan coins, and that which shows the distinct beginning of decline. The wealth and prosperity of Dionysius led to the issue of the magnificent decadrachms, commonly but erroneously called medallions, with the heads of Persephone and Arethusa and the victorious chariot, as well as a variety of signed tetradrachms. The tyrant, defeated at Olympia by a combination, seems to commemorate on these coins the victory he could have won, and this explanation appears to be confirmed by such indications, never all combined, as the fallen turning-post, the broken rein, and the affrighted charioteer. The Dionysian dynasty closed in nine years of anarchy, until Syracuse appealed to Corinth, and Timoleon was sent to restore order (344 B.C.). The triumph of this public-spirited statesman is witnessed by various changes in the coinage. The chief silver piece is now a didrachm of Corinthian type, corresponding in weight to the tridrachm of Corinth, and with the same types, the head of Pallas and the Pegasus; the smaller coins present some Corinthian subjects. The democracy was overthrown in 317 B.C. and the city seized by Agathocles (317-289 B.C.), the worst of the tyrants of Syracuse. In the course of his reign he adopted the royal style, and his coins, a reflexion of earlier work, give his name first without and then with the title king,—a double innovation. The tyrant Hicetas (287-278 B.C.), and the next ruler, Pyrrhus king of Epirus (278-276 B.C.), continue the coinage, Pyrrhus issuing money in the name of the Syracusans and also striking his own pieces. The departure of Pyrrhus led to the establishment by a native, the second Hieron, of a dynasty which, so long as he ruled (276-216 B.C.), restored the ancient prosperity and preponderance of the rule of his namesake. At first content with inscribing his name alone, he soon not only takes the title of king, conferred on him in the early years of his reign, but also places his portrait on the money. Of his time is the beautiful portrait of Queen Philistis, supposed to be his consort. The heads have merit, but the reverse has become merely heraldic. The money of the short reign of Hieronymus (216-215 B.C.) and of the brief democracy which fell before the Romans (215-212 B.C.) close the independent series of this great city. But her name still appears in bronze money issued after the conquest.

Taking the rest of the money of Sicily in alphabetical order, we first note a very fine bronze coin bearing a beautiful female head, perhaps that of Sicilia, crowned with myrtle, and a lyre, the date of which is later than Timoleon's Syracusan issues, on one of which it is restruck. This coin is conjecturally attributed to Adranum. Ætna, better known as Catana, is represented by a unique tetradrachm, with a wonderful head of Silenus, and Zeus as the god of the volcano hard by enthroned and hurling a thunderbolt. The first great town is Agrigentum, represented by archaic, transitional, and fine coins, the fine series ending with the overthrow of the city by the Carthaginians in 406 B.C.,—a blow from which it never recovered. The usual types are the eagle and the crab, but in the age of finest art we see two eagles devouring a hare, and a victorious chariot; these occur in the rare decadrachm and the tetradrachms. The eagle is superior to that of Croton, inferior to that of Elis. Is it a sea-eagle, while the Olympian bird is the golden eagle? Many of the bronze coins are of good work. The type most worthy of note is the head of a river-god, with the name Acragas, which was that of the stream of the town, and on the reverse an eagle standing on an Ionic capital, the Olympic turning-post. The success of Agrigentum at the games is attested by Pindar, while Virgil (*Æn.*, iii. 704), Gratius (*Cyneg.*, 526), and Silius Italicus mention its ancient renown for horses. The lofty site (arduus Acragas), overlooking the sea and on the bank of the stream of the same name, makes the eagles, the crab, and the river appropriate devices, showing that Greek types have a local fitness, while chosen with a religious intention.

The money of Camarina is of especial beauty and interest. The fifth of Pindar's *Olympic Odes*, to Psaumis the Camarinæan, affords an excellent commentary upon it. The earliest coin we know is a didrachm of about this time, whereas there are many pieces of from fifty to a hundred years earlier of most of the other important cities of Sicily. Camarina, however, was then but lately inhabited (*νέοικον ἕδραν*), having been recently twice devastated by the Syracusans. This piece has on the obverse a helmet upon a round shield and on the reverse a pair of greaves, between which is a dwarf palm (*Chamærops humilis*). The arms are those of some divinity or hero; the palm may represent the sacred grove (*ἄλσος ἁγνὸν*) in which the temple of the chief divinity probably stood. This piece is followed by tetradrachms and didrachms of the best period, most beautiful in style, and varying a little from difference of age. The tetradrachms bear on the obverse the head of Heracles in the lion's skin, and on the reverse Pallas as a victor at the Olympic games in a quadriga. It was Pallas, protector of the city (*πολιάοχε Παλλάς*), whose sacred grove was made more illustrious by the success of Psaumis. The didrachms have on the obverse the head of a river-god, portrayed as a young man with small horns and with wet hair. Of the two rivers of Camarina, the Oanus and the Hipparis, the Hipparis is here represented, for in one case the name is given on the coin. Pindar seems to show the same preference, for, while he merely mentions the Oanus (*ποταμὸν . . . Ὤανον*), he speaks of the sacred channels by which the Hipparis watered the city (*σεμνοὺς ὀχετούς, Ἵππαρις οἷσιν ἄρδει στρατόν*). On the reverse the nymph Camarina (*Ὠκεανοῦ θύγατερ . . . Καμαρίνα*) is seen carried across her lake (*ἐγχωρίαν . . . λίμναν*) by a swan swimming with expanded wings, while she aids it by spreading her veil in the manner of a sail. Some of these didrachms have on either side, around the chief device, fresh-water fishes. The series of Catana comprises fine archaic tetradrachms and others of the time of the best art. The archaic tetradrachms have the types of a river in the form of a man-headed bull and of the figure of Nice. The head of Apollo succeeds, with for reverse the victorious quadriga, in one case passing the turning-post, an Ionic column.

Gela is represented by coins of which the archaic tetradrachms must be especially mentioned. They have on the obverse the forepart of the river-god Gelas, whence the city took its name. The Gelas is represented as a bull, having the face of a bearded man. On the reverse is a victorious quadriga at the Olympic games, in some examples represented passing an Ionic column, as on coins of Catana. A tetradrachm of the later period of the age of good art has types of the head of the Gelas as a young man horned, surrounded by three fishes, and on the reverse Nice in a biga with a wreath above. The money of Himera is of great interest. The oldest didrachms of Himera, which probably began in the 6th century B.C., bear on the obverse a cock and on the reverse an incuse pattern. They are succeeded by transitional tetradrachms, which bear on the one side a victorious quadriga and on the other a nymph sacrificing, near whom a little Silenus stands under the stream of a fountain issuing from a lion's head in a wall. Leontini is represented by tetradrachms with the head of Apollo and the victorious car, which gives place to a lion's head. The series of Messene begins, when the town was called Zancle, or, as it is written upon the coins, Dancle, with early drachms or smaller pieces of the Æginetan weight, and of very archaic work. On the obverse is a dolphin, and around it a sickle, and on the reverse is a shell in the midst of an incuse pattern. The place is said to have received its name on account of the resemblance of the harbour to a sickle (*ζάγκλον* or *ζάγκλη*). Next to these first coins of Zancle may be placed, as the oldest piece of the Attic weight, a tetradrachm with the Samian types, a lion's scalp on one side and on the other the head of a bull, and bearing the inscription ΜΕΣΣΕΝΙΟΝ. This coin was doubtless struck during the rule of the Samians, who took the place about 494 B.C., at the instigation of Anaxilaus tyrant of Rhegium, by whom they were subsequently expelled (Thucyd., vi. 4). The next pieces are the earliest of those which have on the obverse the mule-car and on the reverse a running hare, like the contemporary coins of Rhegium, with the same devices and equally of the rule of Anaxilaus. These types cease at Rhegium, though they continue at Messene, some of the tetradrachms bearing them being of the age of fine art. When the town had been seized by the Mamertini, money was struck with their name, thus borne by the later coins, which are of bronze. They are good, but not of the best style. Naxos is represented by handsome transitional tetradrachms and others of the fine period, and by smaller silver pieces, chiefly of the earlier time.

There are some coins of the city of Panormus, but most of those which have been classed to it are of the Carthaginians, issued both in Sicily and in Africa. Nothing is more probable than that many of these pieces were struck at Panormus, but there is no sure means of distinguishing any such, and, if there were, the mere fact of their having been issued at the place would not justify us in classing them to it. Segesta is represented by coins of the archaic and of the good period. We first notice the head of the nymph Segesta and a hound, probably a river-god, then the same type for obverse associated with a young hunter accompanied by two hounds,—a charming composition. Another interesting type is a victorious car driven by Persephone, who carries ears of corn.

In the series of the city of Selinus the first coins are didrachms, bearing on the obverse a leaf and on the reverse an incuse square. The city and the river of the same name no doubt derived their name from the plant *σέλινον*, the leaf of which must be here intended. There is some difficulty as to its identification; the plant sacred at Selinus appears to be, as Colonel Leake supposes, wild celery (*Apium graveolens*); but it does not follow that the "selinon" with which the victors at the Isthmian and Nemean games were crowned was really the same species. Tetradrachms and didrachms of transitional and of good art have devices of more than usual interest. The obverse exhibits a river-god, sometimes the Selinus, sometimes the Hypsas, sacrificing at the altar of Æsculapius, while on the didrachm a wading-bird is sometimes seen behind him, as if departing. This subject appears to allude to the draining of the pestiferous marshes. The reverse of the tetradrachms generally shows a quadriga in which Apollo stands drawing his bow, while Artemis is charioteer. The reference must be equally to the driving away of the pestilence.

We have still to mention the main characteristics of the true Siculo-Punic coins, that is, those actually struck by the Carthaginians in Sicily. A careful examination shows that the Punic money must be separated into three distinct divisions—the coinage of the Carthaginians in Africa, in Sicily, and in Spain. The Sicilian coins are adjusted to the Attic talent, like those of the Greek cities of the island, and show Greek style modified by barbarian influence. The known towns are Solus, Motya, Panormus (?), and Heraclea

Minoa. The leading types are imitated from Syracusan money. This series must not be confounded with the large Attic issues of Carthage, which are distinguished by special types not found in Sicilian money, such as the horse's head and the palm-tree; the head of Persephone links these coins with the true Siculo-Punic.

The islands near Sicily issued coins which belong to the Carthaginian series, except Lipara, of which there is heavy bronze money on the Sicilian system, having on the obverse a head of Hephæstus, or sometimes a figure of the same divinity seated, holding a hammer and a vase, which he seems to have just formed.

In the Tauric Chersonese there are interesting coins, in the three metals, of the city of Panticapæum, the modern Kertch. Their obverse usually bears the head of Pan and their reverse a griffin and other subjects; some are of fine Greek style. The money of Sarmatia, of Dacia, and of upper and lower Mœsia is chiefly bronze of the Græco-Roman class. In Sarmatia we may notice the autonomous and imperial pieces of Olbia, and in Dacia the series bearing the name of the province. The Roman colonia Viminacium in upper Mœsia is represented by numerous coins of a late time. Of Istrus, in lower Mœsia, there are drachms having a strange type on the obverse, representing two beardless heads, those of the Dioscuri, side by side, the one upright and the other upside down; on the reverse is an eagle devouring a fish. The style of these coins, it may be noticed, is in general fair, though it sometimes approaches to barbarism. There are abundant Greek imperial coins of Marcianopolis and Nicopolis, while Tomi is represented in this class as well as by autonomous money.

The coins of Thrace are of high interest. Here and in Macedonia we observe the early efforts of barbarous tribes to coin the produce of their silver mines, and the splendid issues of the Greek colonies; and we see in the weights the influence of the Asiatic Greeks, the Athenians, and the Persians. The oldest coins are of the 5th century B.C., and there are others of all subsequent times, both while the country was independent and while it was subject to the Romans, until the cessation of Greek coinage. Some of the best period are of the highest artistic merit. So long as they maintain any general distinctive peculiarities of fabric and design, that is, from their commencement until the age of Philip, the Thracian coins resemble those of Macedonia. The money of Abdera comprises tetradrachms and smaller coins of the periods of archaic and fine art, all but the latest of the Phœnician standard, ultimately superseded by the Persic. The principal type is a seated griffin. The reverse type, an incuse square, has at first four divisions, but in the age of the finest art contains a variety of beautiful subjects. Ænus is remarkable for the great beauty of some of its coins. These are tetradrachms of Attic weight, of the late archaic and best ages. The interesting turning-point from growth to maturity is seen in a vigorous head of Hermes in profile, wearing the petasus. A little later is the splendid series of facing heads, the broad, severe, and sculptural treatment of which is truly admirable, and far superior to the more showy handling of the same subject in later drachms. A goat is the reverse type of the larger coins. The money of the city of Byzantium begins with coins on the Persic standard of good style, having on the obverse a bull above a dolphin and on the reverse an incuse square of four divisions, and closes with the series of bronze coins issued under the empire. The Roman colonia of Deultum and the city of Hadrianopolis deserve a passing notice. Of Maronea, anciently famous for its wine, there is an interesting series beginning with small archaic coins. After these we notice fine tetradrachms of Phœnician weight, having on the obverse a prancing horse and on the reverse a vine within a square. The standard changes to Persic, of which there is a beautiful series of didrachms. Then the series is interrupted by the rule of the Macedonian kings, and resumed in a barbarous coinage of the native Thracians, issued in the second and first centuries before the Christian era, consisting of spread Attic tetradrachms with the types of the head of beardless Dionysus crowned with ivy and on the other side his figure. The Greek imperial coins of Pautalia and Perinthus are worthy of notice. Among those of the latter town we may mention fine pieces of Antoninus Pius and Severus, and large coins, commonly called medallions, of Caracalla and other emperors. The money of the imperial class issued by Philippopolis, Serdica, and Trajanopolis should also be noticed. In the Thracian Chersonese the most important series is one of small autonomous silver pieces, probably of the town of Cardia. There is a limited but highly interesting group of coins of Thracian kings and dynasts. The earliest are of kings of the Odrysæ, including Seuthes I., who began to reign in 424 B.C., and whose money bears the two remarkable inscriptions **ΣΕΥΘΑ ΚΟΜΜΑ** and **ΣΕΥΘΑ ΑΡΓΥΡΙΟΝ**. It closes with the issues of Roman vassals; they begin with Coson, who puts on his gold staters the type of the Junia family, the first consul between his lictors, marking his allegiance to Brutus, and an eagle. Lysimachus, commonly classed as king of Thrace, belongs to the group of Alexander's western successors. Among the islands of Thrace, Imbros with its trace of Pelasgic worship, and, equally with Lemnos, showing evidence of Athenian dominion, and Samothrace with the Asiatic worship of Cybele yield in interest to Thasos. Here a long and remarkable currency begins with very early Persic didrachms, the obverse type a centaur carrying a nymph, the reverse an incuse square of four divisions. Under the Athenian supremacy we see a decline of weight, and in style the attainment of high excellence. The design of the obverse now reminds us of the work of Alcamenes at Olympia, grand in spite of careless execution. After this we observe coins of Phœnician weight, bearing for their obverse types the head of Dionysus. These are of the best period of art, and some tetradrachms are among the very finest Greek coins. The head of Dionysus is treated in a sculptural style that is remarkably broad and grand. The massive, powerful features, and the formal hair, nearly falling to the neck in regular curls like those of the full beard, are relieved by a broad wreath of ivy-leaves, designed with great delicacy and simplicity. The reverse bears a Heracles kneeling on one knee and discharging his bow,—a subject powerfully treated. Of a far later period there are large tetradrachms, much resembling those of Maronea, with the same type of the beardless Dionysus, but on the reverse Heracles. There are coins of Pæonian kings, which are chiefly silver, and have a resemblance to those of the Macedonian sovereigns, although they are somewhat barbarous. They range from 359 to 286 B.C.

The money of Macedonia both civic and regal is of great variety and interest. It begins at an early time, probably towards the end of the 6th century B.C. The old pieces are of silver, bronze having come into use a century later, and gold about the middle of the 4th century B.C. The character of the coinage resembles that of Thrace; the earliest pieces are of the Phœnician, Babylonic, and Attic standards, the heavier form of the Babylonic, the Persic, appearing later. The most remarkable denominations are the Phœnician octadrachms and dodecadrachms. The largest coins are of the time of Alexander I. and somewhat earlier, and indicate the metallic wealth of the country more than its commercial activity. Philip II. adopted for gold money, which he was the first Macedonian king to issue, the Attic weight, striking staters on that system, while he maintained the Phœnician standard for his silver coinage. Alexander the Great made the weight of the gold and silver money the same by employing the Attic system for both; and from his time no coins of kings of Macedonia in these metals were struck on any other system. The series of Roman Macedonia begins with coins of the "regions" issued by permission of the senate and bearing the name of the Macedonians, from 158 to 146 B.C.; others follow of the Roman province. The coinage of Acanthus comprises fine archaic tetradrachms of Attic weight and others of Phœnician weight and very vigorous in style, of the commencement of the period of good art. The type of their obverse is a lion seizing a bull. The money of Æneia is chiefly interesting from its bearing the head of the hero Æneas; and on one extraordinary coin of archaic fabric, an Attic tetradrachm, the subject is the hero carrying Anchises from Troy, preceded by Creusa carrying Ascanius; this is in date before 500 B.C., and is preserved in the Berlin Museum. The town of Amphipolis is represented by a long series. There are Phœnician tetradrachms having on the obverse a head of Apollo, facing, sometimes in a splendid style, which recalls the art of the immediate successors of Phidias, as seen, for instance, in the famous bronze female head in the British Museum. The reverse type is a flaming torch in an incuse square. There are also many Greek imperial bronze pieces of this city. The territory of Chalcidice is eminent for the excellence of some of its silver coins. These are Phœnician tetradrachms of the best period struck by the Chalcidian League (392-379 B.C., and later), Olynthus being probably the mint. The obverse bears the head of Apollo in profile crowned with laurel. It is in very high relief and treated with great simplicity, though not with the severity of somewhat earlier pieces. The delicacy of the features is balanced by the simple treatment of the hair and the broad wreath of laurel. On the reverse is a lyre. There is an early series of coins of Lete. Some are of a remote date and none later than about the time of Alexander I. The obverse type is a satyr with a nymph, and on the reverse is an incuse square divided fourfold, first diagonally and then in squares. Mende has money of Attic weight, the types being connected with Silenus, who on a tetradrachm of fine art is portrayed reclining, a wine-vase in his hand, on the back of an ass; the reverse bears a vine. Of Neapolis (Datenon) there are early coins with the Gorgon's head and the incuse square, which changes, as at Lete, and in the period of fine art gives way to a charming head of Nice crowned with olive. There is a very early Attic tetradrachm of Olynthus, with a quadriga, and an eagle within a double square, the only coin, save Philip's gold and silver and the money of Cyrene, which repeats the idea of the great Sicilian currencies, the record of Olympic victory. Orthagoria, better known as Aristotle's birthplace Stageira, has a few remarkable coins of good art and a peculiar style. The coins of Philippi in the three metals are mainly of the time of Philip II., who, having found a rich gold mine near Crenides, changed its name to Philippi. The gold coins are Attic staters, the silver pieces of the Phœnician or Macedonian weight, like Philip's own money. All bear the head of young

Heracles in a lion's skin, and a tripod. Imperial pieces were struck by the city as a colonia. There is a long series of Thessalonica, beginning with Greek bronze coins, the latest of which are asses with on the obverse the Roman head of Janus in strange combination with a Greek inscription. Then follow pieces of imperial time and others with imperial effigies. Uranopolis has a few coins with very curious astronomical types, probably issued by the eccentric Alexarchus, brother of Cassander. The issues of the Thraco-Macedonians are extremely interesting. They are all just anterior to, or it may be contemporary with, Alexander I. of Macedon. The leading coins are octadrachms of the Phœnician standard. They have usually but one type, the reverse bearing a quadripartite incuse square. Their sudden appearance and heavy weight are due to the working of the silver mines on the border of Macedonia and Thrace. The usual types are a warrior leading a horse or a yoke of oxen. The coins bear the names of the Bisaltæ, Getas king of the Edoni (whose only two coins, differing dialectically in their inscriptions, were found in the Tigris in 1818, and are now in the British Museum), the Orrescii, and other tribes. Besides these there are very curious Phœnician dodecadrachms of an unknown tribe, bearing the unusual type of an ox-car, in which is a figure seated, and on the reverse a triquetra.

The oldest coins of the Macedonian kings are of Alexander I., from 498 to 454 B.C., the contemporary of Xerxes. These are Phœnician octadrachms, having on the obverse a hero by the side of a horse, and coins of a lower denomination with the same or a similar type. The money of Alexander's successors illustrates the movement of art, but it is not until the reign of Philip II. that we have an abundant coinage. He first strikes gold pieces, chiefly Attic didrachms, from the produce of his mine near Philippi. They are of fair but somewhat careless style, and bear on the obverse the head of Ares. On the reverse is a victorious Olympic biga. Those coins were afterwards known as Φιλιππεῖοι and the gold money of Alexander as Ἀλεξανδρεῖοι—appellations which probably did not include larger or smaller pieces. Horace calls the gold coins of Philip "Philips" ("regale nomisma Philippos," *Epist.* ii. 1, 232). The silver coinage of Philip is mainly composed of tetradrachms of the Phœnician talent. Their type of obverse is a head of Zeus, and of reverse either a mounted hero wearing a causia or a victor in the horse-race with a palm,—these last coins being the best of Philip's, although the horse is clumsy.

The coinage of Alexander the Great, both in the number of the cities where it was issued and in its abundance, excels all other Greek regal money; but its art is, without being despicable, far below excellence. The types are not remarkable in themselves, and there is a great sameness characterizing the entire series. The system of both gold and silver is Attic. The gold coins are distaters or gold tetradrachms, staters or didrachms, hemistaters or drachms, with their half or a smaller denomination. The types of the distaters or staters, which last were the most common pieces, are for the obverse the head of Pallas and for the reverse Nice bearing a trophy-stand. The largest silver piece is the decadrachm, which is of extreme rarity. The types of the tetradrachms and most of the lower coins are on the obverse the head of Heracles in the lion's skin and on the reverse Zeus seated, bearing on his hand an eagle. The head has been supposed to be that of Alexander, but this is not the case, although there may be some assimilation to his portrait. The great currency was of tetradrachms. The coinage was struck in different cities, distinguished by proper symbols and monograms. The classification of the series is difficult, but is gradually advancing. The bronze money is not remarkable.

The coinage of Alexander is followed by that of Philip Arrhidæus, with the same types in gold and silver. That of Alexander IV. was alone issued by Ptolemy I. In these coins the types of Alexander were modified. Meanwhile Seleucus, Lysimachus, and Antigonus, king of Asia, struck Alexander's money with their own names, and the tetradrachms of Macedonia were generally of this kind until the time of Philip V. The same coinage, marked by a large flat form, was reissued later by the cities of western Asia, when the Romans, after the battle of Magnesia in 190 B.C., restored the liberties which Alexander had granted. The series of Alexandrine money is interrupted by various small coinages and the later issues of Lysimachus, king of Thrace, with the first Greek regal portrait, the head of Alexander with the ram's horn, as the son of Zeus Ammon, sometimes a work worthy of Lysippus and an excellent indication of his style. The reverse has a figure of Pallas holding a little Nice. The coins of Demetrius I. (Poliorcetes) comprise fine tetradrachms, some of the types of which have an historic reference. They bear either on the obverse his portrait with a bull's horn and on the reverse a figure of Poseidon, or on the one side a winged female figure (Nice or Fame) on the prow of a galley, blowing a trumpet, and on the other Poseidon striking with his trident. The latter types cannot be doubted to relate to the great naval victory which Demetrius gained over Ptolemy. The tetradrachms of Antigonus I. (Gonatas), which are of inferior style and work to those of Demetrius, have types which appear to refer in like manner to the great event of his time. The obverse type is a Macedonian buckler with the head of Pan in the midst, and the reverse type Pallas Promachus. The head of Pan is supposed to have been taken as a device in consequence of the panic which led to the discomfiture of the Gauls at Delphi. The money of Demetrius II. is unimportant, but Antigonus Doson is represented by tetradrachms with the head of Poseidon, and Apollo seated on a galley. The tetradrachms of Philip V. have on the obverse a head in the helmet of Perseus, representing Philip in the character of that hero, or else the hero himself, perhaps assimilated to the king. The reverse bears a club. Other tetradrachms and smaller coins have a simple portrait of Philip. The tetradrachms of Perseus are of fair style, considering the time at which they were struck. They bear on the one side the king's head and on the other an eagle on a thunderbolt.

The coin systems of northern Greece, Thessaly, Epirus, Corcyra, Acarnania, and Ætolia present certain difficulties which disappear if we consider them as originally Æginetan, modified in the west by Corinthian, and later by Roman, influence. The coinage of Thessaly presents very few specimens of a remote period, while pieces of the best time are numerous. These are in general remarkably like the finest coins of Sicily and Italy, although the style is simpler. The prevalence of the horse and horseman is significant. The money of the Thessalian Confederacy, being of late date (196-146 B.C.), is of little interest. The commonest types are the head of Zeus crowned with oak and the Thessalian Pallas Itonia in a fighting attitude. The coinage is resumed in imperial times. Of the town of Gomphi or Philippopolis there is a beautiful drachm, having on the obverse a female head, facing, which is probably that of a nymph as the city. The coins of Lamia are also to be noticed for their beauty. The drachms bear the head of Lamia, the mistress of Demetrius Poliorcetes, and young Heracles, who probably represents Demetrius. The series of Larissa begins with archaic pieces and some of the early period of good art, but sometimes of rather coarse execution. The small silver pieces have very interesting reverse types relating to the nymph of the fountain, and to be compared for mutual illustration with the didrachms of Terina and with some of those of Elis. These are followed by coins of fine work. The usual obverse type is the head of Larissa, the nymph of the fountain, facing, and on the reverse is generally a horse, either free or drinking. The head is treated in a very rich manner, like that of the fountain-nymph Arethusa, facing, on tetradrachms of Syracuse; indeed, the resemblance to the Sicilian type is most remarkable. If it be a copy, it is simpler and bolder than the original. The bronze money is also good. The coins of Pharsalus and Pheræ are also worthy of note. Of the tyrants of Pheræ Alexander is represented by coins.

The coinage of Illyria is usually of inferior or rude art; the pieces are Æginetic, ultimately changing to Attic. Of Apollonia there is a large series. The earliest have the Corcyræan types of the cow and the calf and the floral pattern; the latest, usually, the head of Apollo and three nymphs dancing round a fire, the outer ones holding torches. Dyrrachium, which never bears on its coins the more famous name of Epidamnus, is represented by an important series. First there are Æginetan didrachms with Corcyræan types. These are succeeded by tridrachms with Corinthian types, and, of course, on the Attic standard; and then the old types are resumed, but apparently without a return to the former weight. Dyrrachium, it must be remembered, was founded partly by Corcyræan and partly by Corinthian colonists.

The coins of Epirus are of higher interest and beauty than those of Illyria. Of the Epirots there are bronze coins of the regal period, and both silver and bronze of the republic (238-168 B.C.), with the heads of the Dodonæan Zeus and Dione, together or apart. The city of Ambracia is represented by beautiful silver pieces, with on the one side a veiled female head and on the other a kind of obelisk. The series of Greek imperial money of Nicopolis must also be mentioned. The coinage known to us of the kings of Epirus begins under Alexander I. His coins have been found in the three metals, but they are rare. It is probable that both gold and silver were struck in Italy while he was in that country. The coins of Pyrrhus in all metals are of high interest, and remarkable for their beauty, though the style is usually florid. There can be little doubt that they were for the most part struck in Italy and Sicily, at Tarentum and Syracuse. The tetradrachm has for the type of the obverse a head of the Dodonæan Zeus crowned with oak and for that of the reverse Dione seated. A fine didrachm bears on the obverse a head of Achilles helmeted, with for the reverse Thetis on a sea-horse carrying the shield of her son. Among the copper coins of Pyrrhus we must remark the beautiful ones with the portrait of his mother Phthia.

The coinage of the island of Corcyra begins with very early didrachms and drachms of the 6th century. The types are the cow suckling the calf and the floral pattern, as at Dyrrachium. These leading subjects are varied in later times by others illustrating the Corinthian origin of the nation, its maritime power, and the fame of its wine. Not the least curious are the bronze pieces with galleys bearing their names, as Strength, Freedom, Glory, Orderly

Government, Chace, Corcyra, Comus, Cypris, Victor of People, Victory, Youth, Pallas, Foremost, Preserver, Fame, Light-bearer. The abundant bronze series goes on under the emperors.

The coins of Acarnania are not remarkable for beauty or for variety in their types. The money of several cities in the 4th century B.C. is that of Corinthian colonies. We must mention that of the Acarnanian League (229-168 B.C.), which bears the head of the Achelous as a man-headed bull and the seated Apollo Actius. Of Leucas there are silver coins and an abundant series in bronze.

In Ætolia the gold and silver coins of the Ætolian League have some merit (279-168 B.C.). The gold pieces have on the obverse the head of Pallas or that of Heracles in the lion's skin and on the reverse Ætolia personified, seated on Gaulish and Macedonian shields,—a curious historical type. These subjects recur, with others indicating the hunter-life of the population, on the silver money; of especial interest is the head of Atalanta and the Calydonian boar, and the spear-head with which he was slain, in both silver and bronze. On some of the copper the spear-head and the jaw-bone of the boar are seen.

The coinage of Locris, Phocis, and Bœotia is entirely on the Æginetic standard. The coins of the Locri Epicnemidii are mainly didrachms, struck at Opus, with the head of Persephone and the figure of the Lesser Ajax in a fighting attitude, sometimes accompanied by his name. These coins were struck between 369 and 338 B.C., and are remarkable for the manner in which a Syracusan head is copied, and, as appears in other cases in Thessaly and elsewhere, not weakened but presented in a stronger and purer form. So much higher was the conception of art in Hellas than in the West.

The money of Phocis begins at a very early age, perhaps the 7th century B.C., and extends in silver down to the conquest by Philip (346 B.C.). The prevalent types are a bull's head and that of a goddess or nymph. Delphi, geographically included in Phocis, strikes very remarkable money, wholly distinct in types from the Phocian. The principal subjects are heads of rams and goats, the symbols of Apollo as a pastoral divinity, a dolphin (Apollo Delphinius), the omphalos and tripod, and a negro's head, which has not been satisfactorily explained. The Amphictyonic Council struck beautiful didrachms, probably on the occasion of Philip's presidency (346 B.C.), with the head of Demeter, and the Delphian Apollo seated on the omphalos. Under Hadrian and the Antonines there is an imperial coinage of Delphi, some pieces bearing the representation of the temple of Apollo, on one type the letter Ε appearing between the columns of the face, representing the mystic Delphic ΕΙ, on which Plutarch wrote a treatise.

The coinage of Bœotia is chiefly of a period anterior to the reign of Alexander, under whom the political importance of Thebes and the whole country came to an end. The main characteristic of the money is the almost exclusive use of the Bœotian shield as the obverse type, marking the federal character of the issues. These were struck by various cities, or by Thebes as ruling the League. The earliest pieces are drachms, presumably of Thebes, and certainly of Haliartus and Tanagra, issued between 600 and 550 B.C. These are followed by didrachms of the same and other cities until the time of the Persian War. The result of the unpatriotic policy of Thebes and most of the towns of Bœotia was the degradation of the leading city, and the coins reveal the curious fact that Tanagra then became the centre of the League-coinage. We now notice the abandonment of the old incuse reverse and the adoption of regular types, the wheel at Tanagra and the amphora at Thebes. These types increase and indicate several cities during the short period of Athenian influence (456-446 B.C.). The democratic institutions were next overthrown, and Thebes became again the head of Bœotia, and struck alone and in her own name, not in that of the League. To the earlier part of this period belong splendid didrachms with reverse types chiefly representing Heracles, subsequently varied by heads of Dionysus in a series only less fine. With the peace of Antalcidas (387 B.C.) Thebes lost her power, the League was dissolved, and the other Bœotian cities issued a coinage of some merit. In 379 B.C. Thebes became the chief state in Greece, and the patriotic policy of Pelopidas and Epaminondas is shown in the issue of the Bœotian coins at the great city without any name but that of a magistrate. Among those which occur is ΕΠΑΜ or ΕΠΑΜΙ, who can scarcely be any other than the illustrious general. The battle of Chæronea (338 B.C.), swiftly followed by the destruction of Thebes, closes the historic coinage, save only for the appearance of new League-money of Attic weight, with the head of Zeus and the figure of Poseidon, issued between 288 and 244 B.C. (On the whole subject see Head's *Coinage of Bœotia*.)

In Attica the great series of Athens is dominant, Eleusis alone in that country having issued an unimportant bronze coinage of good style while Athens was independent. The Athenian money begins with the issues which were struck under Solon's monetary law, practically adopting the Euboic standard instead of the Æginetic, by which the Attic weights were divided into the commercial and the monetary. The monetary standard became so famous through the widespread traffic of Athens as to give the name Attic to all subsequent measures which followed it except the Corinthian, and the term Euboic gradually fell into disuse. The earliest coins are tetradrachms of full weight (270 grains), with an extremely archaic head of Athene helmeted to the right, and within an incuse square an owl to the right with the letters ΑΘΕ. These may be early in the 6th century B.C. Soon afterwards a sprig of olive appears in the upper left corner of the square. The coins of the age of the Persian War have olive-leaves forming an upright wreath on the helmet of Athene. To this period belongs the decadrachm with the owl facing, its wings open. In the same age a crescent is added—symbol of the lunar character of the goddess—between the olive-sprig and the owl. These types continue during the period of fine art, with slight modification and the abandonment of the incuse square, but with no mark of the splendour of Athens as the centre of Greek sculpture. No doubt commercial reasons dictated this conservative policy, which makes the coinage of Athens a disappointment in numismatics. Her money was precious for its purity not only in the Greek world but among distant barbarians, so that imitations reach us from the Punjab and from southern Arabia, and any change would have injured their wide reception. There are many divisions of silver coinage with the types a little varied, and some different ones; and during the age of supremacy gold was issued in small quantities and bronze introduced. The Macedonian empire put an end to the autonomy of Athens, and when the money is again issued it is of a wholly new style and the types are modified. The great series of spread tetradrachms may be dated from the accession of Philip V. (220 B.C.), and lasted until the capture of the city by Sulla (86 B.C.). The obverse type is a head of Athene with a richly-adorned helmet, unquestionably borrowed from the famous statue by Phidias in ivory and gold, but a poor shadow of that splendid original, and an owl on an amphora within an olive-wreath. The earliest coins have the monograms of two magistrates, the later the names of two who are annual, and one changing about every month, but ultimately dropped. The occurrence in these of the names of Antiochus IV. (Epiphanes), before he came to the throne, of Mithradates VI. and his creature Aristion, helps to fix the dates. The abundance of this money shows the great commercial importance of Athens in these later times. Remarkable bronze coins of a later age bear two representations of the Acropolis and the great edifices. Both have on the obverse a head of Minerva. The reverse of one represents the Acropolis, with the grotto of Pan, the statue of Pallas Promachus, the Parthenon, and the Propylæa, with the steps leading up to the latter. The reverse of the other shows the theatre of Dionysus, above which are caverns in the rock, and higher still the Parthenon and the Propylæa. There are also Greek imperial pieces of Megara.

The money of the island of Ægina is of especial interest, since with it Greek coinage is said to have originated. The story is that, at a time when Ægina was a dependency of Argos, Phidon king of Argos struck the first Greek money there, probably in the seventh century B.C. It is said that previously silver was formed into spikes (ὀβελίσκοι), of which six made a handful (δραχμή), and that thus the name of the drachm and its sixth, the obolus, originated; but this account may be an invention of later times. There can be no doubt, however, that the earliest Æginetan coins are of extreme antiquity. The weight is of course on the Æginetic standard. The oldest pieces are very primitive didrachms, bearing on the obverse a turtle and on the reverse a rude incuse stamp. Afterwards the stamp becomes less rude, and later has a peculiar shape. There are some coins of the early part of the fine period of excellent work. The great currency was of didrachms. The bronze coins are not remarkable, but some appear to be of an earlier time than most Greek pieces in this metal.

The series of Achaia begins under the Achæan League, some time after 330 B.C., when we first find coins of the Achæans, with no distinction of cities,—a purely federal coinage. The silver coins, like the later ones, are either Attic tetrobols or Æginetic hemidrachms. Then follows the money of the ten cities of the Old League, beginning about 280 B.C.—Dyme, Patræ, Tritæa, Pharæ, Ægium, Bura, Cerynela, Leontium, Ægira, and Pellena. In 251 B.C. Sicyon, Corinth, and Megara added their strength to the little alliance; the towns of Arcadia and Argolis followed, then Sparta, Messene, and Elis. The type of the silver is the head of Zeus Homagyrius, the reverse with the monogram of the Achæans in a laurel-wreath. After the earliest money the reverse bears the symbols or monograms of the cities which struck. The oldest bronze repeats the silver types; the rest bears a standing Zeus and a seated Demeter, with the name of the city at full length.

Corinth is represented by a very large series of coins, the weight of which is always on the Corinthian standard, equivalent to Attic but differently divided,—the Corinthian tridrachm, the chief coin, corresponding to the Attic didrachm. The oldest pieces, of the 6th century B.C., bear on the obverse Pegasus with the letter Ϙ, koppa, the initial of the name of Corinth, and on the reverse an incuse pattern. In course of time the head of Athene in an incuse square occupies the reverse. The incuse square disappears, as generally elsewhere, in the early period of fine art. Of the age of the excellence and decline of art we find beautiful work. though generally wanting in the severity of the highest Greek art. Pegasus is ordinarily seen galloping, but sometimes standing or drinking, the koppa is usually retained, and the helmet of Athene, always Corinthian, is sometimes bound with an olive-wreath. The smaller coins have the same reverse, but on the obverse a charming series of types, principally female heads, mostly representing Aphrodite. There are some drachms with Bellerophon in a combatant attitude mounted on Pegasus on the one side and the Chimæra on the other. The autonomous bronze money is poor, but often of fair work, and interesting, especially when the type relates to the myth of Bellerophon. Under the Romans this city was made a colonia; and we have a large and interesting series of the bronze coins struck by it as such, including the remarkable type of the tomb of Lais. The colonies of Corinth form a long and important series, struck by Acarnanian towns with Corcyra, and in the west by Locri Epizephyrii in Italy and Syracuse. They range from the time of Timoleon, about 340 B.C., to the age of the earlier successors of Alexander, perhaps having ended in the time of Pyrrhus, probably shortly after 295 B.C. The colonies broke loose from Corinth and struck their own money, retaining the old types for commercial purposes, and Syracuse and Locri found it advisable to follow the same course, which in the case of Syracuse was not uninfluenced by gratitude to the mother-city and her noble citizen Timoleon. The coins are distinguished by the absence of the koppa and bear the names or monograms of the cities.

There are bronze coins of Patræ as an important Roman colonia, and silver and bronze money of Phlius, both of the period of good art. The coinage of Sicyon, on the Æginetic standard dominant in the rest of the Peloponnesus, is disappointing for a famous artistic centre. It begins shortly before the period of fine art; in that age the silver is abundant and well executed, but the leading types, the Chimæra and the flying dove within an olive-wreath, are wearying in their repetition, and good work could not make the Chimæra an agreeable subject. Small coins with types of Apollo are the only subjects which suggest the designs of the great school of Sicyon.

The money of Elis, or the Eleans, is inferior to none in the Greek world in its art, which reaches the highest level of dignified restraint, and in the variety of its types, which are suggested by a few subjects. The leading types are connected, as we might expect, with the worship of Zeus and Hera and Nice, the divinities of the great Panhellenic contest at Olympia. The prevalent representations are the eagle and the winged thunderbolt of Zeus, the head of Hera, and the figure of Nice. The series begins early in the 5th century B.C. with coins, some of which are didrachms (Æginetic), having as subjects an eagle carrying a serpent or a hare and on the reverse a thunderbolt or Nice bearing a wreath,—archaic types which in their vigour promise the excellence of later days. From 471 to 421 B.C., while Elis was allied with the Spartans, such types continue; the eagle and Nice (sometimes seated) are both treated with great force and beauty, and the subject of seated Zeus is remarkable for its dignity. The Argive alliance (421-400 B.C.) seems marked by the pre-eminence given to Hera, whose head may suggest the famous statue of Polyclitus at Argos. This alliance broken, the old types recur. Magnificent eagles, some admirably designed on a shield, and eagles' heads, the seated Nice, and fantastically varied thunderbolts mark this age. The types of an eagle struggling with a serpent and an eagle's head are marked with the letters ΔΑ. Professor Gardner has conjectured that they may be the work of the great sculptor Dædalus of Sicyon, who at this very time produced a trophy for the Eleans at Olympia. The political events of the age do not seem any longer to affect the coinage. Thus the return of the heads of Hera has no historical significance that we can trace. They are remarkable for their beauty, which is still severe, while around there are marks of the luxurious style of decline, and here the eagle-types have lost their vigour. The age of Philip is soon reached, and shows a marked decline in the coinage. It closes with imperial money, some types of which have a local interest, notably two of Hadrian bearing the head and figure of Zeus, copied from the famous statue by Phidias, of which the earlier currency appears to present no reflexion.[1]

Cephallenia gives us the early silver coins of Cranii, the money of Pale, of charming style, with the figure of Cephalus on the reverse, and that of Same, all cities of this island. Of the island of Zacynthus there are silver pieces, usually of rather coarse work, but sometimes of the style of the best Cephallenian money. The coins of Ithaca are of bronze. They are of interest on account of their common obverse type, which is a head of Ulysses.

Returning to the mainland, we first notice the money of Messene, or the Messenians. The earliest coin is a splendid Æginetic didrachm having on the obverse a head of Persephone, and excels in design the similar subjects on the money of Syracuse, from which it must have been copied, for it is of about the time of Epaminondas. Still more than the Locrian type this shows the purer style of Greece, which, copying Syracusan work, raised its character. On the reverse is a figure of Zeus Ithomatas. The other silver coins are of about the period of the Achæan League. The bronze money is plentiful, but not interesting. Lacedæmon, as we might have expected, has no early coins, the silver money being, like so much of that of the Greek cities, of the age of the Achæan League. Among the types of the autonomous bronze pieces may be noticed the head of the Spartan lawgiver Lycurgus, with his name. The series of Argos in Argolis begins with coins of an early period. The standard is Æginetic. The first pieces are the drachm with a wolf on the obverse, and on the reverse A, the initial letter of the name of the people, in an incuse square; the hemidrachm, with the forepart of a wolf; and the diobolon, with a wolf's head. Among coins of the period of good art we must especially notice those which have for the obverse type the head of Hera wearing a stephanos,—a design which is not equal to that of the coins of Elis, the style being either careless or not so simple. The reverse type of one of these coins, a drachm, represents Diomedes stealthily advancing with the palladium in his left hand and a short sword in his right. Of the town of Trœzen there are silver coins of the best period of art.

Of the money of Arcadia some pieces are doubtless among the most ancient struck by the Greeks; and the types of these and later coins are often connected with the remarkable myths of this primæval part of Hellas, showing particularly the remains of its old nature-worship. The first series to be noticed is that of the Arcadian League; it begins about 500 B.C. with hemidrachms having the type of Zeus Lycæus seated, the eagle represented as if flying from his hand, and a female head. Of a later time, from the age of Epaminondas, there are coins with the head of Zeus, and Pan seated on the Arcadian Olympus, a series of which the didrachms are very fine. The coins of Heræa begin deep in the 6th century B.C. The earliest have for obverse type the veiled head of Hera, and on the reverse the beginning of the name of the town, sometimes between wavy ornaments. The antiquity of Mantinea is in like manner attested by its money. The silver coins of a very early time have on the obverse a bear, representing Callisto the mother of Arcas, who was worshipped here, and on the reverse the letters **MA**, or three acorns, in an incuse square. Later coins, especially the bronze, have subjects connected with the worship of Poseidon at this inland town. The silver money of Megalopolis is important for art, as we know the city to have been founded in 370 B.C. The types are the same as those of the Arcadians of the same period, the heads of Zeus and of Pan. The silver coins of Pheneus must be noticed as being of fine work. The didrachms of the age of Epaminondas have a head of Persephone, and Hermes carrying the child Arcas. The obverse type is interesting as a copy, improved on the original, of the Syracusan subject, as in Locris and Messene. As in Locris, the merit is in the greater force and simplicity of the face, here most successful, the hair being treated more after the Syracusan manner than after that of the Messenians, who simplified the whole subject. The finest coin attributed to Stymphalus is a magnificent didrachm of the age of Epaminondas, with a head of the local Artemis laureate, and Heracles striking with his club, no doubt a subject connected with the Stymphalian birds. The smaller silver coins have on the one side a head of Heracles and on the other the head and neck of a Stymphalian bird, most resembling those of a vulture. There were representations of these birds in the temple of Artemis. The series of Tegea is not important, but two of the reverse types of its bronze coins are interesting as relating to the story that Athene gave a jar containing the hair of Medusa to her priestess Sterope, daughter of Cepheus, in order that she might terrify the Argives should they attack Tegea in the absence of Cepheus, when Heracles desired his aid in an expedition against Sparta.

The peculiar position of Crete and her long isolation from the political, artistic, and literary movements of Hellas have been already touched on. It is not until the age when the Macedonians and the Achæan League are striving for the leadership of Hellas that Crete appears in the field of history, but then only as the battle-ground of rival powers. The most remarkable influence of this age was when Athens, by the diplomacy of Cephisodorus, succeeded about 200 B.C. in drawing the Cretans into a great league against Philip V. of Macedon. That this project took actual shape is proved by the issue at all the chief mints of the island of tetradrachms with the well-known types of Athens, to be distinguished from the Atticizing types of other cities at this time. In the meanwhile the inborn love of adventure in her youth had been satisfied by hired service to the surrounding kingdoms, and hence grew a piratical instinct which ultimately cost the Cretans their freedom at the hand of Rome.

The oldest coins are probably of about 500 B.C., but few cities seem to have issued many until a hundred years later. Then there is a great outburst of coinage, sometimes beautiful, sometimes barbarously careless, which lasts until Alexander's commercial policy is seen in the appearance of his money with Cretan symbols in lieu of the old autonomous money. As Alexander's successors grew weak and no one of them could control Crete, the old rights were restored and the Cretan cities again coin their own types until the Roman conquest (67 or 66 B.C.). The chief issue is of silver; bronze is less abundant; and gold is unknown. The Cretan types have a markedly local character, yet they copy in some instances other coinages. The chief divinities on the pieces are Zeus, Hera, Poseidon, Heracles, and Britomartis, and the leading myths are those of Minos, the story of the Minotaur and the labyrinth being prominent, and also that of Europa. There is frequent reference to nature-worship as in Sicily, yet with a distinctive preference for trees, the forms of which, however, lend themselves readily to the free representation of Cretan art, which may in part explain their prominence. The weight is at first Æginetic, falling almost to Attic; and in the resumption of the coinage after Alexander's time it is Attic.

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[1] See Professor Gardner's *Elis*, on the whole subject.

Of the island in general there are Roman silver coins of the earlier emperors, some of which are of fine work for the period. The inscriptions are in Latin, or partly in Latin and partly in Greek. In the autoromous civic series there are didrachms of Aptera. The obverse bears a female head wearing a stephane and the reverse a warrior before a sacred tree. Of Chersonesus, the port of Lyctus, called on the coins Chersonasus, there are didrachms of coarse style, mainly copied from the splendid piece of Stymphalus in Arcadia. The head of Artemis is here appropriated to Artemis Britomartis, who had a temple at the place, and the reverse of Heracles striking with his club is varied by the substitution of the figure of Apollo seated. The silver money of Cnossus is of great interest. The oldest coins are archaic in style, and may be as early in date as the expedition of Xerxes. They bear the figure of the Minotaur as a bull-headed man, kneeling on one knee, and a mæander-pattern, in one case enclosing a star (the sun), in another a female head (Ariadne?). The antiquity of these coins disproves the supposition that the Cretan labyrinth at Cnossus was an invention of the later poets. Of the early time of good art there are didrachms of Cnossus with the head of Persephone and an unknown divinity, and the labyrinthine pattern enclosing the sun or the moon or a bull's head for the Minotaur, and at length becoming a regular maze. To this time belongs the wonderful coin in the Berlin Museum with Minos seated, his name in the field, and the head of Persephone within the mæander-pattern. In the later age of fine art a head of Hera wearing a stephanos occupies the obverse of didrachms and drachms, and the reverse has a maze through which the way may be clearly traced. The head is closely copied from the same type of Argos, and despite its beauty shows a distinct inferiority, unlike the copies of Syracuse by artists of the mainland. This series closes with Alexander's empire, and the native coinage disappears until the league of Cephisodorus revives it with the Athenian tetradrachm of Attic weight, bearing the name of the Cnossians. It is of inferior style, and is followed by base coins with heads of Minos and Apollo, and the Labyrinth, either square as before or in a new circular form, which is interesting as showing it was a mere matter of tradition. There are interesting coins of Cydonia, some of them of beautiful style and work. One is remarkably like a coin of Aptera, and bears an engraver's name, Neuantus,—a point showing the importance attached by the Cretans to the designs of their money. The head is that of a Mænad, and the reverse has a figure of the traditional founder Cydon, stringing his bow. The style is good, but the execution poor. A drachm presents a most beautiful repetition of the subject of Cydon. Gortys, or Gortyna, is represented by most remarkable coins, which generally allude to the myth of Europa. Didrachms of archaic style have on the obverse Europa carried by the bull and on the reverse the lion's scalp. These pieces are followed by a remarkably fine class of spread didrachms; the best are of about 400 B.C. They have on the obverse Europa seated in a pensive attitude on the trunk of a tree, doubtless the sacred plane at Gortyna, mentioned by Pliny, which was said never to shed its leaves, and on the reverse a bull suddenly turning his head as if stung by a fly. Nothing in Greek art exceeds the skill and beauty of these designs. The truth with which the tree is sketched, one engraver even indicating the letters cut by visitors in the trunk, and the graceful position of the forlorn Europa are as much to be admired as the fidelity with which the bull is drawn, even when foreshortened, sharply turning his head, with his tongue out and his tail raised. These designs, beautiful in themselves, are strikingly deficient in fitness, and afford equally strong illustrations of the excellencies and of the one great fault of the art of Cretan coins. Many pieces of the same class are of rude execution. There is a tetradrachm of the Athenian group having the symbol of a butting bull. Later silver coins have the head of Minos. The coins of Hierapytna are remarkable for bearing the representation of a date-palm. Of Itanus there are remarkable coins, the earlier, some of which are of good style, with the subject of a Tritonian sea-god (Glaucus?) and two sea-monsters, changed for a head of Athene and an eagle, the Triton frequently appearing in the field as a symbol. Lyctus, on the coins Lyttus, is represented by strangely rude pieces, with the types of a flying eagle and a boar's head which is curiously foreshortened. The coins of Phæstus form a most interesting series. Among the didrachms are some of admirable work, with on the obverse Heracles slaying the Hydra with his club and on the reverse a bull. Others have on the obverse Heracles seated on the ground, resting. Another noticeable obverse type is the beardless Zeus seated in a tree, with his Cretan name ϜΕΛΧΑΝΟΣ, where the Ϝ stands for the digamma. On his knee is a cock in the attitude of crowing, showing that he was a god of the dawn. The most remarkable coins of Phæstus are, however, those that bear representations of Talus, the man of brass, said to have been made by Hephæstus or Dædalus. One of these is a didrachm, on which he is portrayed as a winged youth, naked, bearing in each hand a stone, and in a combatant attitude. This figure is accompanied by his name. A similar design is seen on a bronze coin. The reader will recollect that Apollonius Rhodius (*Argonaut.*, iv. 1638 *sq.*) relates that Talus prevented the Argonauts from landing in Crete by hurling stones at them, until he was destroyed by the artifice of Medea.

The important town of Polyrrhenium, or Polyrrhenia (but one ρ on the coins), is represented by carefully-executed coins with a head of Zeus and a bull's head. A later piece has a remarkable obverse type, a whiskered head of Apollo, probably a Macedonian sovereign in that character. This is of Attic weight. Præsus has on its earlier coins the Gorgon's head and an archer, or an archer and an eagle; later, Zeus seated, and, after the Cretan fashion, foreshortened. The coins of Priansus comprise didrachms of an unusual style and type, a head of a goddess or nymph, the hair, bound by narrow bands crossed diagonally, filling the large field. Priansus also shows the remarkable type of Persephone seated beside a date-palm, placing her right hand on the head of a serpent, in reference to the myth of the birth of Zagreus. As usual, the figure is foreshortened. The reverse has a standing figure of Poseidon. Rhaucus has Poseidon beside his horse. The rare didrachm of Sybrittia, or Sybrita, may fitly close the series; the obverse has a charming subject, Dionysus seated on a running panther, and the reverse Hermes drawing on his right buskin,—a delightful figure. Another beautiful type is a seated Dionysus.

The coinage of Eubœa is all on the native standard, of which the Attic was a variety. It includes some of the very earliest Greek money. The older coins comprise tetradrachms, didrachms, and smaller pieces; the later are uniformly tetrobols. The pieces which bear the name of the Eubœans date from the fine period to the fall of Hellenic liberty, the silver lasting only to Alexander's time. They bear the head of a nymph and that of an ox. One variety is very beautiful. The great cities have a far more interesting series. Carystus begins in the time of the Persian War with the type of the cow and calf, as in Corcyra, and its special badge is the cock. Chalcis, the mother of Western colonies, has already in the 6th century a long series with the wheel-type and an incuse diagonally divided, and later, a nymph's head and an eagle devouring a serpent. Eretria begins as early as Chalcis, but the obverse type is the Gorgon's head. This is succeeded by the same type and a panther's head, and fine late archaic coins bear the cow and the cuttle-fish. Of Histiæa the usual type is the head of a Mænad and a female figure seated on the stern of a galley.

Among the other islands classed after Eubœa, Amorgos must not be passed by, as a bronze coin of Ægiale, one of its towns, presents the curious type of a cupping-glass. The silver money of Carthæa and Coressus in Ceos is extremely old, beginning in each case in the 6th century and ending early in the 4th. The weight is Æginetic, and there are didrachms and smaller coins. The usual types of Carthæa are an amphora and then a bunch of grapes; that of Coressus is a cuttle-fish and dolphin. Naxos is represented by early Æginetic didrachms and coins of the fine period, the latter being chiefly bronze pieces of remarkably delicate and good work. The types are Dionysiac. Of Paros there are early Æginetic didrachms with the type of a kneeling goat and beneath a dolphin. Of the third and second centuries B.C. there are Attic didrachms with a head, possibly of Artemis, at first of a charming style, and a goat on the reverse. There are very archaic Æginetic didrachms of Siphnos. Some of the bronze pieces are of the best period and very fine. Of Tenos there are silver coins of the age of the kings. The head of the bearded Ammon occurs on tetradrachms following the Attic standard, and on smaller pieces that of the younger Ammon, both heads laureate as well as horned; the reverse type is Poseidon.

The coinage of Asia begins with that of Asia Minor. It falls into certain great classes—first, the ancient gold and electrum, Lydian and Greek, in time succeeded by electrum or gold and silver, all struck in the west and mainly on the coast. Then the Persian dominion appears in the silver money of the satraps, circulating with the gold and silver of Persia, and the Greek money is limited to a few cities of the coast, none save the electrum of the great mint of Cyzicus uninterrupted by the barbarian. With the decay of the barbarian empire the renewed life of the Greek cities is witnessed by a beautiful coinage along the coast from the Propontis to Cilicia. On Alexander's conquest autonomy is granted to the much-enduring Hellenic communities, and is again interrupted, but only partially, by the rule of his successors, for there was no time at which Asia Minor was wholly parcelled out among the kings, Greek or native. The Romans, after the battle of Magnesia (190 B.C.), repeated Alexander's policy so far as the cities of the western coast were concerned, and there is a fresh outburst of coinage, which, in remembrance, follows the well-known types of Alexander. When the province of Asia was constituted and the neighbouring states fell one by one under Roman rule, the autonomy of the great cities was generally reduced to a shadow. Still the abundant issues of imperial coinage, if devoid of high merit, are the best in style of late Greek coins, and for mythology the richest in illustration.

The oldest money is the electrum of Lydia, which spread in very early times along the western coast. This coinage, dating from the 7th century B.C., has an equal claim with the Æginetic silver to be the oldest of all money. Probably the two currencies arose at the same period, and by interchange became the recognized currency of the primeval marts; otherwise we can scarcely explain the absence of Asiatic silver, though it is easy to explain that of European electrum or gold. The electrum of the coins is gold—the precious metal washed down by the Pactolus—with a native alloy of a fourth part of silver. Its durability recommended it to the Lydians, and it had the advantage of exchanging decimally with gold, then in the ratio 13·3 to silver. But this commercial advantage allowed the issue of electrum coins on silver standards, while it was natural to coin them on those of gold; hence a variety of weight-systems perplexing to the metrologist. The first coins were undoubtedly struck by a Lydian king, probably as early as about 700 B.C. They follow the Babylonic silver standard. The obverse is plain and merely marked with lines, the original rough surface of the die, while the reverse has three depressions, an oblong one flanked by two squares. Later the same people issued money on the Phœnician silver standard. This double currency, as Head suggests, was probably intended for circulation in the interior and in the coast towns to the west, the Babylonic weight being that of the land trade, the Phœnician that of the commerce by sea. Ultimately Crœsus abandoned electrum, and, reducing the Phœnician weight by one-fourth, the proportion of silver in the electrum, he produced a Babylonic gold stater, and again by similarly reducing the Babylonic weight he obtained a Euboic gold stater. His silver was Babylonic only, the silver stater exchanging as the tenth of the Euboic gold stater. These results are explained by the metrological data given earlier in this article. The Greek marts of the western coast were not long in imitating the example of Lydia; hence a series of early electrum staters, on the Phœnician weight, of Miletus, Ephesus, Cyme, Chios, Clazomenæ, Lampsacus, Abydos, and Samos, with smaller pieces which add other mints to the list. The Euboic weight naturally found its way into the currencies, but was as yet limited to Samos. Phocæa, Teos, and Cyzicus, with other towns, followed from a very early period the Phocaic standard, which for practical purposes may be called the double of the Euboic. Consequently their stater was twice as heavy as the Euboic gold stater. They alone before Crœsus issued gold money, which was superseded at Phocæa and Cyzicus by electrum. This is the main outline of the native coinage of Asia Minor before the Persian conquest. Its later history will appear under the several great towns, the money of Persia being treated in a subsequent place.

The first countries of Asia Minor are Bosporus and Colchis, the coins of the cities of which are few and unimportant. The autonomous coinages of the cities of Pontus are more numerous, but none of them are archaic or deserve to be characterized as fine. There are also imperial pieces. The bronze coins are sometimes large and often thick. The only place meriting a special notice is Amisus, which almost alone of the cities of Pontus seems to have issued autonomous silver money. This is continued under the emperors in the form of Roman denarii and larger pieces. The common subjects of the bronze money of this place relate to the myth of Perseus and Medusa, a favourite one in this country.

The regal coins are of the old kingdoms of Pontus and of the Cimmerian Bosporus, of the two united as the state of Bosporus and Pontus under Mithradates VI. (the Great), and as reconstituted by the Romans when Polemon I. and II. still held the kingdom of Mithradates, which was afterwards divided into the province of Pontus and the kingdom of Bosporus. The early coinage of the kingdom of Bosporus is of little interest. Of that of Pontus there are tetradrachms, two of which, of Mithradates IV. and Pharnaces I., are remarkable for the unflinching realism with which their barbarian type of features is preserved. Mithradates VI., king of Bosporus and Pontus, is represented by gold staters and tetradrachms. The portrait on the best of these is fine despite its dramatic quality, characteristic of the later schools of Asia Minor. The kings of Bosporus struck a long series of coins for the first three centuries after the Christian era. Their gold money is gradually depreciated and becomes electrum, and ultimately billon and bronze. They bear the heads of the king and the emperor and are dated by the Pontic era.

In Paphlagonia we must specially notice the coins of the cities Amastris and Sinope. The silver pieces of the former place bear a youthful head in a laureate Phrygian cap, probably representing Men or Lunus,—Amastris, the foundress, being seated on the reverse. On the late bronze money the bust of Homer occurs. There are also bronze coins of the imperial class. The silver pieces of Sinope are plentiful. The types are the head of the nymph Sinope and, as at Istrus, an eagle preying on a dolphin. Bithynia is represented by a more important series. Of the province generally there are Roman silver medallions of the weight of cistophori (to be presently described), with Latin inscriptions, and imperial bronze pieces with Greek inscriptions. There is a long series of imperial bronze of Apamea as a colonia. The ordinary silver coins of Chalcedon strikingly resemble on both sides those of Byzantium, a circumstance confirmatory of the statement that the two cities were colonized at nearly the same time from Megara. Of Cius, also called Prusias ad Mare, there are gold staters and smaller imperial silver pieces. Hadriani and Hadrianuthera issued imperial bronze money. Of Heraclea there are silver coins of good style; these are of the Persic standard. The obverse type is a head of Heracles, either bearded or beardless, in the lion's skin; the most interesting reverse type is a female head wearing a tiara on which are three turrets, probably that of the town personified. Of the tyrants of Heraclea there are silver coins of Clearchus, of Timotheus and Dionysius ruling together, and of Dionysius ruling alone. Of the imperial class there is a large series of Nicæa, and there are many coins of Nicomedia. The series of Bithynia closes with the money of its kings, consisting of Attic tetradrachms and bronze pieces. The tetradrachms bearing the name of Prusias are of Prusias I. and II. The bronze coins with the same name, some of which are fine, cannot be otherwise classed than to Prusias I. or II., since we do not know by which of the two they were issued. Of Nicomedes II. and III. there are only tetradrachms.

The fine Greek coinage of Asia may be considered to begin with Mysia. Cyzicus is in numismatics a most important city. The famous electrum Cyzicene staters were struck here for nearly a century, from 478 to 387 B.C., as Head conclusively argues (*Num. Chron.*, 1876, p. 277). During that whole period they were not only the leading gold coinage in Asia Minor but the chief currency in that metal for the cities on both shores of the Ægean; for it must be remembered that their alloy of silver was not allowed any value. The actual weight is of the Phocaic standard, just over 248 grains, so as to be equivalent to a Babylonic gold stater. The division was the hecta or sixth. The abundance of the staters and hectæ and the variety of their types, which usually are common to both denominations, led some numismatists to suppose that Cyzicus was a central mint striking for neighbouring cities their own coinage, but our present knowledge of the types of these cities shows that this was not the case. But it is certain that the staters of Cyzicus served as gold for other great marts which struck little or no money in that metal, and contented themselves with issuing the hecta; hence an instinct that they were striking for the use of others may have led the Cyzicene moneyers to use great freedom in the choice of subjects. Many they invented and some they borrowed, retaining for themselves the distinctive badge of the tunny-fish beneath the type. This type occupied the obverse of the coin, while the reverse was invariably the quadripartite incuse square in four planes of the so-called mill-sail pattern. The coins are very thick and the edges are rude. The art is frequently of great beauty, though sometimes careless. After the earlier examples it shows the dominant influence of painting, being characterized by flowing lines and an intensity of expression in some of the finest examples, and always recalling painting or relief rather than sculpture in the round. The subjects are heads, figures, groups, and animals. The silver coinage of Cyzicus is distinctly local. It comprises beautiful tetradrachms of the Rhodian standard. The obverse bears a head of Persephone with a veil on the back, wound round her head, and a wreath of ears of corn. This is an example of the best Greek art, equally simple, delicate, and graceful, and in the expressive style of the Ionian school. Above the head is the inscription **ΣΩΤΕΙΡΑ**, which may be compared with **ΚΟΡΗ ΣΩΤΕΙΡΑ ΚΥΖΙΚΗΝΩΝ**, on a late copper coin, accompanying a head which is probably that of the younger Faustina in the character of Persephone. The reverse type of the finest tetradrachms is a lion's head in profile above a fish. Both late autonomous and imperial coins in bronze are well executed and full of interest, the two classes running parallel under the earlier emperors.

Lampsacus is represented by a long series of coins. There are archaic and fine silver coins with a janiform female head, and on the reverse that of Athene in a Corinthian helmet, besides a few of other types. Contemporary with the later silver are electrum staters of Rhodian weight with a half-Pegasus and peculiar quadripartite incuse square. These are succeeded by splendid gold staters with various types of obverse and the half-Pegasus on the reverse. The most remarkable type is a bearded head with streaming hair in a conical cap, bound with a wreath, singularly pictorial in treatment as well as in expression, and roughly executed as if by a great artist unused to medal work. In contrast to this is a most carefully executed head of a Mænad with goat's ear, still markedly in a painter's style. This head is in repose; that of another Mænad with human ear is marked by its expression of frenzy. Of Parium there are very early silver coins, interrupted and resumed in the period of good art. The leading type is the Gorgon's head.

The money of the great city of Pergamus or Pergamum is chiefly of a late time. There are, indeed, small gold and silver pieces of the good period, the former being very rare; the leading type is an archaic figure of Pallas. The silver coinage is next supplied by the money of the kings of Pergamum, followed by cistophori, which began under the kingdom. The bronze pieces of the city are numerous, both autonomous and imperial, the two classes overlapping, and there are medallions of the emperors. The local worship of Æsculapius is especially prominent under the Roman rule. The chief coins of the kings are Attic tetradrachms, with on the obverse a laureate head, supposed to be that of Philetærus, the founder of the state, and on the reverse a seated Athene, the common type of Lysimachus, from whom Philetærus revolted. This type is but twice varied by the heads of later kings. The inscription is always ΦΙΛΕΤΑΙΡΟΥ, a monogram sometimes indicating the name of the king by whom the coin was issued. The absence of the regal style is noticeable, and, though in the usual type the diadem is generally shown as wound round the laurel-wreath, it does not always appear. There are also unimportant bronze coins of the kings. The cistophorus was so called from its obverse type, the cista mystica, a basket from which a serpent issues, the whole enclosed in an ivy-wreath. The reverse type represents two serpents, and between them usually a bow-case. The half and the quarter of the cistophorus have on one side a bunch of grapes on a leaf or leaves of the vine, and the club with the lion's skin of Heracles within an ivy-wreath. They were tetradrachms equal in weight to three Attic drachms or three denarii, and the half and the quarter would be exchangeable with Roman coins, three quinarii and a quinarius and sestertius respectively. These coins became abundant when the kingdom of Pergamum was transformed into the province of Asia, and are struck at its chief cities, Pergamum, Parium, Adramyttium, Thyatira, Sardis, Smyrna, Ephesus, Tralles, Nysa, Laodicea, and Apamea. They have at first the names of Greek magistrates, afterwards coupled with those of Roman proconsuls or proprætors. The silver medallions of Asia, the successors of the cistophori, range from Mark Antony to Hadrian and Sabina. They bear no names of cities, but some may be attributed by their references to local forms of worship. The obverse bears an imperial head, the reverse a type either Greek or Roman. The art is the best of this age, more delicate in design and execution than that of any other pieces, the Roman medallions excepted.

The coinage of the Troad is interesting from its traditional allusions to the Trojan War. Of Abydos there is a fine gold stater, with the unusual subject of Nice sacrificing a ram, and the eagle, which is the most constant type of the silver money,—a series chiefly noticeable for the coarse style and bad fabric of the late Attic tetradrachms. One of the few imperial coins commemorates the legend of Hero and Leander. The late tetradrachms of Alexandria Troas bear the head of Apollo Smintheus, and on the reverse his figure armed with a bow; the inscription is ΑΠΟΛΛΩΝΟΣ ΖΜΙΘΕΩΣ ΑΛΕΞΑΝΔΡΕΩΝ. There is a long series of the town as a colonia, of extremely poor work. Dardanus has remarkable silver coins, both early and fine. Ilium Novum strikes late Attic tetradrachms with a head of Athene, and on the reverse the same goddess carrying spear and distaff, with the inscription ΑΘΗΝΑΣ ΙΛΙΑΔΟΣ. On the autonomous and imperial bronze we notice incidents of the tale of Troy, as Hector in his car, or slaying Patroclus, or fighting; the other side, for this coin is autonomous, shows the wolf and twins, and again the flight of Æneas. Of Scepsis, which is said to have been the capital of a Dardanian kingdom for a long period between the fall of Troy and the age of Alexander, there are early silver coins, and some of its bronze money is of good style. The island of Tenedos is represented by very early coins, and others of the fine and late periods. The usual obverse type of all the silver pieces is a Janus-like combination of two heads, probably those of a Zeus and a Hera; and the reverse type of all but the oldest is a two-headed axe.

In Æolis the most noteworthy coins are the late tetradrachms of Cyme and Myrina, both of the time of decline, yet with a certain strength which relieves them from the general weakness of the work of that age. Cyme has the head of the Amazon Cyme, and a horse within a laurel-wreath; Myrina, a head of Apollo and his figure with lustral branch and patera. The rest of the coins of these and other towns are bronze, autonomous and imperial.

Lesbos is remarkable for having coined in base as well as pure silver, its early billon coins being peculiar to the island, and not easily classed to the cities like the silver. They are of various weights, as if the alloy had not been reckoned at first, but afterwards admitted, unlike the electrum of the coast, in which the silver was always excluded from the value. Methymna has very interesting archaic silver coins, with the boar and the head of Athene, her helmet adorned with a Pegasus rising above her forehead. There are later coins of about 400 B.C. and about Alexander's time. The types are the head of Athene and the lyre. The weight is Attic. Of Mytilene there are few coins until late in the Persian dominion. The types are the head of Apollo and the lyre. The style is fine for the period, with the strongly expressive quality that marks the contemporary western Asiatic currencies, and the execution is careful. There is a long and important series of the imperial time, including very interesting commemorative coins, some probably of persons of legend as Nausicaa, or of remote history as Sappho, others of benefactors of the city as Theophanes the friend of Pompey, from whom he obtained for this his native place the privileges of a free city. The usual style for these persons is hero or heroine, but Theophanes is called a god, and Archedamis, probably his wife, a goddess.

The money of Ionia is abundant and beautiful. Clazomenæ is the first city of interest. Here we observe a very early tetradrachm of Attic weight with the types of a lion gnawing his prey, and the forepart of a winged sow. Drachms and smaller coins follow with the forepart of the sow and an incuse. Then there is the break frequently noticeable in Asia Minor, and the coinage begins anew with splendid coins of the age before Alexander, having for types the head of Apollo, three-quarter face, and a swan. The chief pieces, the gold drachm and a half or octobol, and the silver stater or tetradrachm, present two types of the head of Apollo, very grand on the gold and the silver, with the signature of Theodotus, the only known Asiatic engraver, and richly beautiful on the other silver piece. These coins are marked by the intense expression of the school of western Asia Minor. Colophon has a very early Attic didrachm, followed by transitional Persic coins with the head of Apollo and the lyre, next the common break, during which the famous pieces with a regal portrait, to be noticed under Persia, were probably issued, and then, about Alexander's time, an over-refined repetition of the earlier type.

The money of Ephesus is historically interesting, but very disappointing in its art, which is limited by the small range of subjects and their lack of beauty. The leading type is the bee; later the stag and the head of Artemis appear. Thus the subjects relate to the worship of the famous shrine. The oldest coins are electrum and silver, both on the Phœnician standard. The type is a bee and the reverse is incuse. The silver coinage continues with the same types, unbroken by the Persian dominion, until in 394 B.C. a remarkable new coin appears. When Conon and Pharnabazus defeated the Lacedæmonian fleet and liberated the Greek cities of Asia from Spartan tyranny a federal coinage was issued by Rhodes, Cnidus, Samos, and Ephesus, with their proper types on the reverse, but on the obverse the infant Heracles strangling two serpents; these are Rhodian tridrachms. About this time the Rhodian standard was introduced, and a series of tetradrachms began with the bee, having for reverse the forepart of a stag looking back, and behind him a date-palm. This type continues till 301 B.C. on the Rhodian standard, which is then abandoned, and the Attic supersedes it for a short time. Bronze now begins. The head of Artemis as a Greek goddess next occupies the obverse, and the mint of Ephesus also issues tetradrachms of Lysimachus. He subsequently gave the city the name of Arsinoe, his wife, and a few coins record this short-lived change. The next coins repeat the head of Artemis, and the forepart of the stag and the palm-tree again occupy the reverse. The head is specially beautiful, and the whole coin of most careful work. The Ptolemaic rule is commemorated by the splendid octadrachm of Queen Berenice II. struck here. At this time the Attic standard was abandoned, and the Rhodian, then very popular in the commerce of the eastern Mediterranean, was adopted. The city afterwards fell into the hands of Antiochus III. About this time Alexandrine tetradrachms were here minted; it would seem most reasonable to date them from the peace of 189 B.C., when the Romans endeavoured to conciliate the cities of the coast, but there are reasons for supposing that they began earlier with a monetary alliance between Ephesus and the great Phœnician mart Aradus. The Attic weight was thus restored, and there is a long issue of drachms on that standard, with the types of the bee, and the stag standing on the nearer side of the palm-tree. To the same age belong the Ephesian tetradrachms of the kings of Pergamum, to whose territory the Romans had assigned Ephesus, and undated cistophori. When in 133 B.C. the Roman people inherited the kingdom of Pergamum, an issue of dated cistophori began at Ephesus, which was the chief city of the Roman province of Asia. This is not interrupted by the revolt, when Ephesus took the side of Mithradates (87-84 B.C.), which, however, is marked by a series of gold Attic didrachms and a solitary coin of strange weight, which may be a half-aureus issued by Sulla (84 B.C.), as Mommsen ingeniously supposes. The Roman rule is next marked by the issue of proconsular cistophori. After the disturbance caused by the civil wars these cease, and there are only bronze pieces, which we may suppose to be of the latest days of the republic. The imperial money follows, of far higher interest than the autonomous. There are many representations of the temples of the city, including that of the famous shrine of Artemis, which shows the bands of sculpture on the columns, as well as many other remarkable subjects, particularly the Zeus of rain seated on Mount Prion, a shower falling from his left hand, while below are seen the temple of Artemis and the river-god Caÿster; on another coin the strange Asiatic figure of the goddess, frequent in this series, stands between the personified rivers Caÿster and Cenchrius (see Head's *Ephesus*).

Erythræ has fine coins, mainly transitional, with a horseman about to mount his steed, and a flower. These are Persic, and after a long pause there is a series of Rhodian weight of about Alexander's age, and later, having Attic types connected with Heracles. The series of autonomous bronze is large. The money of the Ionian Magnesia begins with the issue of Themistocles, when he was dynast under Persian protection. In the decline of the Oriental power the city strikes her own money, with the types of an armed horseman and a humped bull butting, surrounded by the labyrinth pattern which symbolizes the river Mæander. The weight is Persic. After a long pause we observe the currency recommencing with spread tetradrachms of the decline of art, more delicately executed than those of Cyme and Myrina, with a bust of Artemis and a figure of Apollo standing on a mæander and leaning against a lofty tripod, the whole in a laurel-wreath. The great city of Miletus is disappointing in its money. The period of its highest prosperity is too early for an abundant coinage, yet in the oldest electrum issues we see the lion of Miletus. It is not, however, until the confederacy with Athens after the battle of Mycale that there is a common silver coinage, with the lion's head and a star, of Attic weight. Later money with the same types seems to show the influence of the Carian princes. It closes with beautiful coins bearing the head of Apollo facing and the lion looking back at a star, with the inscription ΕΓ ΔΙΔΥΜΩΝ ΙΕΡΗ, showing, whatever be the word understood, that this was the "sacred" money of the famous temple at Didyma. Next come fine coins of about Alexander's time, differing from the last in having the head in profile. The weight is equally Phœnician. The types continue through a series of various standards with very rare Attic gold staters. Phocæa is represented by two very interesting currencies: an electrum series of hectæ like that of Cyzicus, but of inferior purity, characterized by a seal, the badge of the town, beneath the type; and also a widespread early silver coinage, apparently common to the Western colonies of the city. The autonomous money is wholly anterior to the Persian conquest. Smyrna first strikes late Attic tetradrachms, with the turreted head of Cybele or the city or the Amazon Smyrna, and an oak-wreath sometimes enclosing a lion. A rare silver coin presents on the reverse the seated figure of Homer, also occurring in the autonomous bronze, of which there is very much, partly of imperial time as well as a long series of imperial bronze. Among the bronze coins we notice those with the head of Mithradates. The earlier imperial coins are of delicate work. Those of the young Vespasian are historically interesting.

Of Teos there are early Æginetic didrachms, bearing on the one side a seated griffin with curled wings and on the other a quadripartite incuse square. These ceased at the moment when the population left the town, destroyed by the Persians, and fled to Abdera, where we recognize their type on the coinage of the time. There are much later coins of less importance.

Chios and Samos, islands of Ionia, are represented by interesting currencies. Chios struck electrum and abundant silver. The type was a seated sphinx with curled wing, and before it stands an amphora, above which is a bunch of grapes; the reverse has a quadripartite incuse. The coins begin before the Persian conquest (490 B.C.), and are first archaic and then of fine style. There is apparently a gap in the later Persian period. Afterwards there is a cessation of money until Sulla's time, when silver is again struck and bronze seems to begin.

The coinage of Samos is artistically disappointing, but as a whole has many claims to interest. The earliest money must have included electrum, but we are unable to discriminate between the rival claims of Lesbos and Samos; some pieces, however, cannot reasonably be doubted to belong to Samos. The silver begins before 494 B.C., when history comes to our aid to make a marked division. The types are the well-known lion's scalp and bull's head, of Oriental origin, both probably connected with the worship of Hera. They are continued in the next period, and the Athenian conquest (439 B.C.) is only marked by the introduction of the olive-spray as a constant symbol on the reverse and the more important change from degraded Phœnician to Attic weight. Notwithstanding the regularity of their coin type, the Samians, having joined the anti-Laconian alliance after Conon's victory in 394 B.C., struck the coin with Heracles strangling the serpents already noticed under Ephesus; the Rhodian weight is thus introduced. We next notice an Alexandrine tetradrachm of the class of those issued after the battle of Magnesia. There is nothing further of interest until the long series of imperial money, which, though wanting in beauty of style, is not without interesting types. Of the mythological subjects the most remarkable is the Asiatic figure of the Samian Hera, which clearly associates her with the group of divinities to which the Ephesian Artemis belongs. Very noticeable also are the representations of Pythagoras, seated or standing, touching a globe with a wand (see Professor Gardner's *Samos*).

The money of Caria does not present any one great series. Autonomous silver coins are not numerous except at Cnidus, and rarely of good style. Antiochia has late Attic silver pieces; as this city was founded by Antiochus I., its coinage is important as fixing the date of similar money of Miletus. There are imperial coins of this town, and of Aphrodisias, worthy of notice. Cnidus is represented at first by archaic coins going down to about 480 B.C. Their weight is Æginetic, and the types are a lion's head and the head of Aphrodite. There are, after a break, coins of Rhodian weight, about 400 B.C., others preceding Alexander, and others, again, after his age. An imperial coin represents the famous statue of Aphrodite by Praxiteles. Of Halicarnassus there are small silver pieces of the age of good art, and others of subsequent times, including that of the Carian kings, and the silver money continues after Alexander. Among the imperial types the head of Herodotus is noteworthy. There is late silver money of Iasus with the head of Apollo, and a youth swimming beside a dolphin around which his arm is thrown. It is interesting to compare this type with the similar subjects of Tarentum. Idyma has silver pieces of fine style on which the head of Apollo is absolutely facing, as sometimes at Catana in Sicily; the reverse type is a fig-leaf. Myndus on its late silver perhaps shows in the head-dress of Isis a trace of the Ptolemaic occupation. Tabæ has also late silver; and of Termera we have the rare coin of its tyrant Tymnes, dating about the middle of the 5th century and struck on the Persic system.

The Carian kings prove their wealth by their series of coins, which bear the names of Mausolus, Hidrieus, and Pixodarus, Artemisia, the widow of Mausolus, being absent. The weight is Rhodian; the types are the three-quarter head of Apollo, and Zeus Labrandeus standing, holding the labrys or two-headed axe. Mausolus strikes tetradrachms, Pixodarus gold of Attic weight. His silver is the best in the series, and clearly shows the Ionian style in its quality of expression.

Calymna heads the islands of Caria. Its money begins with curious archaic Persian double drachms bearing a barbarous helmeted male head and on the reverse a lyre incuse. Later there are coins of about 400 B.C. The series of Cos begins with small archaic pieces, the type a crab and the reverse incuse. Next come fine coins of transitional style and Attic weight, with the types of a discobolus before a tripod, and a crab. The wrestlers of Aspendus may be compared with the remarkable obverse type. The common break then interrupts the issue, and a new coinage occurs before the time of Alexander. The weight is Rhodian, the types the head of Heracles and the crab. After Alexander there is another currency which ceases about 200 B.C. It is resumed later with the new types of the head of Æsculapius and his serpent. This continues in Roman times. The bronze of that age comprises a coin with the head of Hippocrates and on the reverse the staff of Æsculapius. Xenophon's head likewise occurs, and the portrait of Nicias tyrant in Cos (*c.* 50 B.C.) on his bronze. Imperial money ends the series. Of the island of Megiste there are charming little silver pieces of about 400 B.C. with Rhodian types, the head of Helios in profile and the rose.

The island of Rhodes, great in commerce and art, has a rich series of coins. The want of variety in the types—at the city of Rhodes almost limited to the head of Helios and the rose—is disappointing, but happily the principal subject could not fail to illustrate the movements of art, one of which had here its centre, and the continuity of the money affords valuable metrological evidence. The city of Rhodes was founded *c.* 408 B.C. on the abandonment by their inhabitants of the three chief towns of the island, Camirus, Ialysus, and Lindus. The money of Camirus seems to begin before 480 B.C. The type is the fig-leaf, the weight Æginetic, later degraded or changed to Persic. The coins of Ialysus, of the 5th century, follow the Rhodian standard. Their types are the forepart of a winged boar and an eagle's head of a vulturine type. The money of Lindus, apparently before 480 B.C., is of Phœnician weight, with the type of a lion's head. The people of the new city of Rhodes adopted another standard, the Attic, and very shortly abandoned it, except for gold money, using instead that peculiar weight which has been called Rhodian but may better be considered to be heavy Phœnician; this they retained until the last years of their independent coinage, when they resumed the Attic. The types are the three-quarter face of Helios and the rose. The first series was issued from the building of Rhodes to 304 B.C., the chief coins being the gold stater and the silver tetradrachm. There is a grandeur and noble outlook in the countenance of Helios which well befits his character, but the pictorial style is evident in the form of the hair and the expression, which, with all its reserve, has a dramatic quality. From 304 to 186 B.C. there is a change of type, and the head of Helios is radiate. The profile head which now also occurs, and the constant pictorial handling of the hair, not, as before, in its outlines only, but also in its masses, show the qualities of Lysippus. It is perplexing to note that the standard of weight is below that of those coins which Ptolemy I. struck for Alexander IV. on the Rhodian weight; but this difficulty disappears if we regard the standard as Phœnician, and both the Rhodians and Ptolemy as borrowers. The Alexandrine tetradrachms, which were issued after the battle of Magnesia, find a place in the Rhodian mintage.

Small coins follow this currency. In 166 B.C. favourable political circumstances cause a new issue of money. The Attic gold staters of this age have a strikingly dramatic style, pointing to the great local school; the silver, with the head of Helios in profile,—in the gold it is three-quarter face,—is still marked by careful execution. In the latest coins, from 88 to 43 B.C., the Attic standard, now universal, whether the chief coin was called drachm or denarius, again appears. During the age after Alexander there is an abundant bronze coinage, with some pieces of unusual size. The series closes with a few imperial coins ranging from Nerva to Marcus Aurelius.

The early coinage of Lycia introduces us at once into a region of Asiatic mythology, art, and language, raising many questions as yet without an answer. The standard of the oldest coins is Persic, and it falls perhaps under Athenian influence, until it becomes equivalent with the Attic. The Lycian character belongs to the primitive alphabets of Asia Minor, which combine with archaic Greek forms others which are unknown to the Greek alphabet, and it expresses a native language as yet but imperfectly understood. The art is stiff and delights in animal forms, sometimes of monstrous types, which recall the designs of Phœnicia and Assyria. The most remarkable symbol is the so-called triquetra, an object resembling a ring, to which three or four hooks are attached. It is supposed to be a solar symbol like the swastika. The oldest money, probably dating from about 480 B.C., has a boar or his fore-part and an incuse. This is succeeded by a series in which the hooked ring is the usual reverse type. It bears Lycian inscriptions, which may usually denote tribes; one certainly indicates the town of Tlos. This coinage probably reaches as late as Alexander's time. It is followed by silver and bronze money of the Lycian League before Augustus and under his reign, but ceasing in that of Claudius,—the usual types of the chief silver piece, a hemidrachm, being the head of Apollo and the lyre. Besides this general currency there are some special ones of towns not in the League. The imperial money rarely goes beyond the reign of Augustus, and is resumed during that of Gordian III. There is a remarkable coin of Myra of this emperor, showing the goddess of the city, of a type like the Ephesian Artemis, in a tree; two woodcutters, each armed with a double axe, hew at the trunk, from which two serpents rise as if to protect it and aid the goddess. Phaselis is an exceptional town, for it has early Greek coins, the leading type being a galley.

The coinage of Pamphylia offers some examples of good art distinctly marked by the Asiatic formality. Aspendus shows a remarkable series of Persic didrachms, extending from about 480 B.C. to Alexander's time. The oldest coins have the types of a warrior and the triskelion or three legs, more familiarly associated with Sicily; it is probably a solar symbol. One has an extraordinary reverse type, in which the triskelion is engraved upon an advancing lion, also held to have a solar meaning. These coins are followed by a long series with the types of two wrestlers engaged and a slinger. The main legend is almost always in the Pamphylian character and language. There are also very curious imperial types. The money of Perga is very interesting. It begins in archaic style, and is resumed after the age of Alexander with Greek types of the Artemis of Perga. Her figure in a remarkable Asiatic form occurs in the long imperial series. Bronze coins earlier in date than the silver money with the Greek types have the Pamphylian title of the goddess, read by W. M. Ramsay (*Hellenic Journal*), FANAΣΣΑΣ ΠΡΕΙΙΑΣ, "of the queen of Perga." Side has at first Persic didrachms of about 480 B.C., their types the pomegranate and dolphin and mystical eye, or pomegranate and dolphin and head of Athene; then there are satrapal money of about 400 B.C. and late Attic tetradrachms, their types being the head of Athene and Nice, of about the first century B.C., for they are imitated by Amyntas, king of Galatia.

The money of Pisidia is chiefly imperial. There is a long series of this class of the colonia Antiochia. The autonomous coins of Selge have the wrestlers and the slinger of Aspendus in inferior and even barbarous copies. Of Isauria and Lycaonia a few cities strike coins of imperial class or time.

Cilicia, a coastland, is numismatically of high interest. Celenderis, a colony of Samos, has archaic coins of Æginetic weight, their type a goat, the reverse being incuse. These are followed by a splendid coinage of transitional and fine art, with a horseman seated sideways on the obverse and on the reverse a goat kneeling on one knee. The latest, about 400 B.C., are free from stiffness, and the horseman may be favourably compared with the similar types of Tarentum. The weight is the Persic didrachm. Mallus has a most interesting series of silver coins, some with curious Asiatic types. Of Nagidus there are Persic didrachms of good style, one interesting type being Aphrodite seated, before whom Eros flies crowning her, with, on the other side, a standing Dionysus. Soli has silver coins of the same weight, the types being the head of Athene, one variety imitated from remote Velia, and a bunch of grapes; they are anterior to Alexander. The coinage of Tarsus begins with rough and thick tetradrachms of Attic weight, evidently issued soon after Alexander's reign, and for no long time subsequently. The types are the Baal of Tarsus and a lion. The autonomous bronze of the Seleucid age shows the remarkable subject of the pyre of Sandan, the local form of Heracles; and there is a long and curious imperial series.

The coinage of the great island of Cyprus is, as we might expect from its monuments, almost exclusively non-Hellenic in character. The weight-system, except of gold, which is Attic, is Persic, save only in the later coins of the kings of Salamis, who strike on the reduced Rhodian standard. The art is usually very stiff down to about 400 B.C., with types of Egypto-Phœnician or Phœnician or of Greek origin. The inscriptions are in the Cyprian character, belonging to the interesting group of alphabets of Asia Minor, of which the Lycian and Pamphylian are instances. The character has been read, and the attributions of the coins are thus taking shape. The prevalent types are animals or their heads, the chief subjects being the bull, eagle, sheep, lion, the lion seizing the stag, the deer, and the mythical sphinx. The divinities we can recognize are Aphrodite, Heracles, Athene, Hermes, and Zeus Ammon. But the most curious mythological types are a goddess carried by a bull or by a ram, in both cases probably Astarte, the Phœnician Aphrodite. The most remarkable symbol is the well-known Egyptian sign of life. The coins appear to have been struck by kings until before the age of Alexander, when civic money appears. There are two well-defined currencies, that of the kings of Salamis, who claimed a Greek origin, and that of the Phœnician dynasty of Citium. The coins of the Salaminian line are in silver and gold. The earlier have Cyprian, the later Greek inscriptions, the types generally being native, though after a time under Hellenic influence. They are of Evagoras I., Nicocles, Evagoras II., Pnytagoras, and Nicocreon, and the coinage is closed by Menelaus, brother of Ptolemy I., who, of course, does not take the regal title. The kings of Citium from 448 to 332 B.C., Baalmelek, Azbaal, Melekiaton, and Pumiaton, strike silver and in one case gold, their general types being Heracles, and the lion seizing the stag. Bronze begins soon after 400 B.C., and of the same age there are autonomous pieces, one of Paphos in silver, and several of Salamis in bronze. There is Greek imperial money from Augustus to Caracalla. The most remarkable type is the temple at Paphos, represented as a structure of two stories with wings. Within the central portion is the sacred stone, in front a semicircular court.

The earliest coinage of Lydia is no doubt that of the kings, already described. The next currency must have been of Persian darics (gold) and drachms (silver), followed by that of Alexander, the Seleucids, and the Attalids of Pergamum, and then by the cistophori of the province of Asia. There is an abundant bronze coinage of the cities, autonomous from the formation of the province, and of imperial time, but mostly of the imperial class. The largest currencies are of Magnesia, Philadelphia, Sardis, Thyatira, and Tralles. The art is not remarkable, though good for the period, and the types are mostly Greek.

The coinage of Phrygia has the same general characteristics as that of Lydia. Among noteworthy types must be noticed Men or Lunus, the Phrygian moon-god, and the legendary Minos. There are curious types of Apamea, surnamed Kibotos or the Ark, and more anciently Celænæ. One of Severus represents the legend of the invention of the double pipe, a type already described. Of the same and later emperors are coins bearing the famous type of the ark of Noah and the name ΝΩΕ. The town of Cibyra is remarkable for a silver coinage, of which the large pieces have the weight of cistophori. They are of the first century B.C., and were probably struck by one or more tyrants of the four confederate cities of which Cibyra was the head, a state which came to an end 84 B.C.

Galatia has little to offer of interest. Trajan issued bronze imperial coins for the province, and there is imperial money of Ancyra and Pessinus, besides other series of less importance. The only remarkable regal issue is that of Amyntas, Strabo's contemporary, who struck tetradrachms, imitating the late money of Side.

With the coinage of Cappadocia we bid farewell to Greek art and enter on the domain of Oriental conventionalism, succeeded by inferior Roman design coarsely executed. There is one large imperial series, that of Cæsarea, which numismatists have unduly increased by the introduction of many uncertain coins, all of which cannot even be proved to be Asiatic. The issues range from Tiberius to Gordian III., and are in silver and bronze. The most common type is the sacred Mount Argæus, on which a statue is sometimes seen,—a remarkable type curiously varied. There are scanty issues of a few other towns. There is an interesting series of coins of the kings of Cappadocia, who struck Attic drachms, and far more rarely tetradrachms. The usual names are Ariarathes and Ariobarzanes, the first being that of the old line who claimed descent from one of the Persian chiefs who slew the Magian. The earliest coins are of Ariarathes IV. (220-163 B.C.). The rare tetradrachms of Orophernes, a successful claimant in the next reign, bear a fine portrait. There are also tetradrachms of Ariarathes V. and of another king of the same name, a son of Mithradates of Pontus, put by him on the Cappadocian throne. The coins of Archelaus, the last king set up by Antony, have a good head on the obverse. Of Armenia there are a few silver and bronze coins of late sovereigns.

The great series of Syrian money begins with bronze coins of Trajan, struck, according to his custom, for the province. From these we pass to the money of the Seleucid kings of Syria, only rivalled for length and abundance by that of the Ptolemies, which it excels in its series of portraits, though it is far inferior in its gold money and wants the large and well-executed bronze pieces which make the Egyptian currency complete. The gold of the Seleucids is scarce, and their main coinage is a splendid series of tetradrachms bearing the portraits of the successive sovereigns. The reverse types are varied for the class of regal money. The execution of the portraits is good, and forms the best continuous history of portraiture for the third and second centuries before our era. The reverses are far less careful. The weight is Attic, but the cities of Phœnicia were ultimately allowed to strike on their own standard. Seleucus I. began by striking gold staters and tetradrachms with the types of Alexander the Great. The same king, like his contemporaries, then took his own types: for gold staters, his head with a bull's horn, and on the reverse a horse's head with bull's horns; for tetradrachms, Alexander's head in a helmet of hide with bull's horn and lion's skin, and Nice crowning a trophy, or the head of Zeus, and Athene fighting in a car drawn by four or two elephants with bull's horns. The Zeus and elephant-car type is remarkable for presenting in some cases the names of Seleucus I. and his son Antiochus I. as colleagues. Antiochus I., like his father, first struck tetradrachms with Alexandrine types, and then with his own head, Heracles seated and Apollo on the omphalos occupying the reverse. The portrait of Antiochus has a characteristic realism, though marked by the deep recession of the eye which is a characteristic of the school of Lysippus. The tetradrachms assigned to Antiochus II., Seleucus II., Antiochus Hierax (a doubtful attribution), Seleucus III., and young Antiochus his son are not specially noteworthy. Antiochus III. is represented by a fine and interesting series. He alone of the Seleucids seems to have struck the great octadrachm in gold in rivalry of the Ptolemies. His portrait is vigorous, and the elephant which varies the seated Apollo on the reverse of his silver tetradrachms relieves the heraldic dryness of that type. There are rare copper coins of the rebel satraps Molon and Achæus. The regal series is continued under Seleucus IV., and again becomes interesting with the money of Antiochus IV. (Epiphanes). His portrait is extremely characteristic, marked by the mad obstinacy which is the key to the tyrant's history. The most remarkable coin is a tetradrachm with the head of Antiochus in the character of Zeus, an instance of audacity unexampled in coinage. In his time mints became numerous in the bronze coinage, and there is a remarkable series in that metal with Ptolemaic types, marking his short-lived usurpation in Egypt. Passing by his son Antiochus V., we note a great change in the coinage of Demetrius I. The silver tetradrachms now bear both mints and dates, a custom that generally prevails henceforward. In one type the heads of Demetrius and Queen Laodice occur side by side. One of these coins in the British Museum is struck on a tetradrachm of Timarchus, the revolted satrap of Babylon, who takes the style "Great King." With Alexander I. (Balas) Tyre and Sidon begin to strike royal tetradrachms on their own Phœnician weight. The money of Demetrius II. follows, then that of the young Antiochus VI., with the most carefully executed portrait in the whole series, which, despite its weakness, has a certain charm of sweetness that marks it as a new type in art. The same artist's hand seems apparent in the fine portrait of the cruel usurper Tryphon, whose features have a beauty of expression that must surely be ideal, and also in the picturesque spiked Macedonian helmet with a goat's horn and cheek-piece which occupies the reverse, on which is written after "King Tryphon" the strange title "autocrator." Antiochus VII. continues the series with, amongst other coins, the solitary bronze piece of Jerusalem, bearing the lily and the Seleucid anchor. On his money of Tarsus we note the first appearance of the pyre of the local Oriental divinity. The restored Demetrius II. now reappears, the Phœnician money with his beardless head, the rest usually with the beard he had grown in his Parthian captivity. Alexander II. (Zebina) follows, and then Cleopatra, widow of Demetrius II., Alexander I., and Antiochus VII., next appears as colleague of her son Antiochus VIII. Her coarse features are in keeping with the vileness of her character. Antiochus VIII. alone amid the subsequent Seleucids has an interesting coinage, and the empire closes with the coarse money of the Armenian Tigranes, his portrait with the lofty native tiara, and for reverse Antioch seated, the Orontes swimming at her feet.

There is a copper coinage of the cities of Commagene, Samosata, and Zeugma, and less important mints. The money of Samosata is of the time of the kings of Commagene and also imperial, this showing the type of the city derived from the famous statue of Antioch. The series of Zeugma is imperial, and has the subject of a temple on a mountain. The money of the kings of Commagene is in bronze, of late date, and not of much interest.

Cyrrhestica has bronze coins of a few cities, nearly all imperial, the chief mints being Cyrrhus and Hierapolis. The last bear the inscription ΘΕΑΣ ΣΥΡΙΑΣ ΙΕΡΟΠΟΛΙΤΩΝ, and have figures of the goddess seated on a throne flanked by lions or riding on a lion, thus directly connecting her with Cybele.

Of Chalcidene there are bronze coins of Chalcis and of the tetrarchs, and Palmyrene shows only the small bronze pieces of Palmyra, the money of Zenobia and the family of Odenathus being found in the series of Alexandria.

Seleucis and Pieria, the brother states (on the coins ΑΔΕΛΦΩΝ ΔΗΜΩΝ), have bronze coins, dated (149-147 B.C.) and undated. But the bulk of the money of this territory is of the great city of Antioch on the Orontes. This long series, second only to that of Alexandria in quantity, is of far less interest from the want of variety in the types, but it is curious chronologically. The coinage is both autonomous bronze before and of Roman times, and imperial base metal and bronze. The base metal money is at first of debased silver, then of potin, and at last of bronze washed with silver. The imperial bronze coins have at the same time both Greek and Latin inscriptions, the last with S.C. Trajan combines the Greek inscription with the Latin S.C., and when the city had been made a colonia by Caracalla this is indicated in Greek inscriptions from Elagabalus downwards. No less than four eras are used. The era of the Seleucids, the dates being from 97 to 37 B.C., occurs on the autonomous money; so also the Pharsalian era, from 38 to 22 B.C., and on imperial coins as late as Titus; the Actian era on autonomous coins, from 6 B.C. to 13 A.D., continuing under the early emperors; and the Cæsarian era on the autonomous class, from 55 to 158 A.D. The mass of imperial coins and all after Titus are dated by the tribunitian years of the emperors. The leading types are the figure of Antioch seated, the river Orontes swimming at her feet, from the famous statue by Eutychides, and the eagle on a thunderbolt, a palm in front. Under Hadrian the eagle is represented carrying an ox's leg, a reference to the story of the foundation of the city when an eagle carried off part of the sacrifice and deposited it on the site which was consequently chosen. There are few other types. The art is rude, though certain base metal coins show a largeness and decision in the heads, while wanting Hellenic refinement. The imperial series is very full and has an historical value as showing what emperors ruled Syria. It includes money of Sulpicius Antoninus, the Uranius Antoninus of Roman gold also struck in Syria. The series ends with Valerian, though it begins anew in the Roman provincial money of the reform of Diocletian, to be noticed later.

Of Apamea there are bronze coins of the age of the Seleucids, the elephant type which occurs being appropriate. At Emesa in the bronze imperial money Sulpicius Antoninus reappears, one of his coins having for reverse the characteristically Syrian type of a sacred conical stone in a temple. The money of Gabala is autonomous and imperial, with, in this class, curious mythological types. Laodicea has an important series. It begins with Phœnician tetradrachms and bronze money of the later Seleucids. The tetradrachms have a turreted and veiled female bust of the city, a favourite Syrian and Phœnician type. These autonomous coins are followed by an imperial coinage like that of Antioch; from Caracalla downwards Laodicea is a colonia; the inscriptions become Latin, then, very strangely, Greek on the obverse of the coins and Latin on the reverse. Seleucia has a similar autonomous and imperial currency, but does not become a colonia. There is a curious type of an apparently open shrine of Zeus Casius containing a sacred stone.

In Cœle-Syria there is bronze of Damascus, late autonomous and imperial; the city becomes a colonia. The imperial money of Heliopolis, a colonia, shows a great temple in perspective, another temple containing an ear of corn as the central object of worship, and a view of the Acropolis with the great temple upon it, and steps leading up the rock.

The coinage of Phœnicia is a large and highly interesting series. The autonomous money is here important, and indicates the ancient wealth of the great marts of the coast. The earliest coins were struck during and shortly after the Persian rule, and the most important classes have not been certainly fixed. It is therefore needful to speak of them before describing the attributed money of the cities. These coins are of Phœnician weight, except one class, which follows the Persic standard. The great currency is of silver octadrachms. The types, limited in number, are Oriental in character; the leading one is the war-galley; the king of Persia also occurs, and the fish-god Dagon. The art is hard, but has a force that reminds us of archaic Greek; it is, however, Oriental. The inscriptions are in the Phœnician character. Three great classes are distinguished. Octadrachms range from about 400 B.C. to Alexander's time. The types are a war-galley in full sail and the king in a car; then for the obverse the war-galley beneath the walls of a fort, and below two lions. Didrachms with a similar obverse have for reverse the king slaying a lion. Octadrachms follow with the war-galley and the king in his car apparently followed by a vassal. These coins have been assigned to Sidon. A series of tetradrachms is of less importance. The obverse has a dolphin or the king as an archer on a sea-horse, the reverse an owl with the Egyptian symbols of sovereignty, the crook with the flail across it. These are after 400 B.C. and have been given to Tyre, but the Egyptian influence would perhaps suggest some town nearer the southern border of Palestine. A third class of money of the same age is of Persic weight. The earliest pieces have a head supposed to be of Melkarth and a war-galley, the later examples bearing dates. The dated series continues, but the obverse type changes to Dagon. These are assigned to Aradus. The series bearing the names or symbols of cities would not be difficult to class were it not for their constant interruption by Ptolemaic and Seleucid coins and by the issue of Alexandrine tetradrachms. Berytus has bronze, both autonomous and of the city as a colonia. The types of interest are the founding of the colonia, Poseidon, not always of a purely Greek type, Poseidon and the nymph Berytus, the temple of the same divinity, and the eight Phœnician gods or Cabiri. To Byblus we may class with certainty a Phœnician currency, that of the native kings from about 400 B.C. to Alexander's age. The imperial coinage presents a very curious perspective representation of a temple in Græco-Phœnician style, with a conical edifice in the court. Cæsarea ad Libanum shows in its imperial money a strange type of Elagabalus, a half-figure of the Syrian goddess in a shrine. She wears a cap like a papyrus head and is enwrapped in shapeless drapery. The shrine is of Egyptian style, and a sceptre with a bird upon it is beside the goddess. Marathus has a very fine Phœnician tetradrachm of 226 B.C., with the head of the city turreted and a youth holding an aplustre and seated on bucklers. This is a work of Greek design and style, as is also a small coin of the year following with the head of Queen Berenice II., then reigning. The copper is dated from 198 to 153 B.C.

The undoubted money of Sidon begins with Alexandrine gold and silver, dated shortly after the king's reign. This was followed by other Alexandrine money, interrupted by that of Ptolemy II., Arsinoe II., and Ptolemy III. Ptolemy IV. also struck here and Antiochus IV. in bronze; and later Seleucids issued tetradrachms from 151 to 114 B.C. The era of the autonomy of Sidon was 111 B.C. There are tetradrachms dated by this reckoning with the head of the city and an eagle on a rudder, across him a palm. In the bronze we observe the type of Europa carried by the bull. Some pieces of this class have Phœnician as well as Greek inscriptions. The imperial money shows a curious shrine on wheels. In the time of Elagabalus Sidon is characterized as a colonia. The type of a temple of Astarte as a local Aphrodite is worth notice. The series closes with Julia Mæsa. Tripolis has an interesting but limited autonomous and imperial series. The worship of the Dioscuri is here associated with Asiatic religion. Architecturally these coins are highly curious.

The early money that can be classed with certainty to Tyre exhibits similar historical vicissitudes to that of Sidon. Before she gained her independence the Seleucids struck here from 149 to 125 B.C., and in that very year the autonomous era begins. The tetradrachms dated by this era bear the head of the Tyrian Heracles in a Greek form, and the eagle on a rudder, across him the palm. The latest coin of this series known to us is a didrachm of 66 A.D. There is also autonomous bronze. The imperial class begins with Severus, and under him the constitution of the colonia is shown; but the most interesting type is a serpent coiled round an egg, between a date-palm (the phœnix or tree of Phœnicia) and a murex, the shell which produced the Tyrian purple. The series ends with Gallienus. Aradus has Alexandrine coins, and acquired its independence in 258 B.C. From this date it struck, first its chief coins with Alexandrine types, then drachms with the types of Ephesus, the bee, and the stag on this side of the date-palm, and lastly tetradrachms with the bust of the city and Nice holding an aplustre and a palm within a wreath. These are of heavy Phœnician weight. The imperial coinage ranges from Tiberius to Gordian III.

In Galilee there are a few autonomous and imperial coins of Ptolemais, which was a great mint under the earlier Ptolemies; and other towns are represented. In Peræa there is an imperial series of Gadara. Samaria has money of Cæsarea, both autonomous and imperial, the last for the most part colonial, and also imperial of Neapolis, among the types of which occurs the interesting subject of Mount Gerizim surmounted by the Samaritan temple. The coinage of Judæa is an interesting series. The money of Jerusalem is of high interest, and more extensive than appears at first sight. Here was struck the coin of Antiochus VII., with the native lily as a type, the series of the Maccabæan princes, that of the Roman procurators, and the bronze coins countermarked by the tenth legion, quartered by Titus in the ruins of the city. One of these bears the remarkable symbol of a pig. After the reduction of Judæa in the reign of Hadrian, Jerusalem was rebuilt as a colonia with the name Ælia Capitolina. The earliest coin commemorates the foundation. The coinage lasts as late as Hostilian. Ascalon strikes autonomous silver and bronze, including remarkable tetradrachms with the portraits of Ptolemy Auletes, of his elder son Ptolemy XIV., and of his daughter Cleopatra. There is also money of Gaza of some importance, and of Joppa, both previously mints of the earlier Ptolemies.

The independent Jewish coinage begins with the famous shekels. They have been assigned to various periods, but the preponderance of evidence would class them to Simon Maccabeus, to whom the right of coining was granted by Antiochus VII. The series is of shekels and half-shekels, of the weight of Phœnician tetradrachms and didrachms. The obverse of the shekel bears the inscription "the shekel of Israel," and for type the pot of manna, or it may be a sacred vessel of the temple, above which is the initial of the word year, and the letter indicating the year of issue. The reverse reads "Jerusalem the Holy," and the type is a flowering branch, either Aaron's rod that budded or a native lily. The half-shekel differs in having the inscription "half-shekel" on the obverse. The types are markedly peculiar; the obverse inscription is equally so, for the regular formula of the neighbouring cities would give nothing but the name of the city; but the reverse inscription is like that of Tyre and Sidon, for instance, "of Tyre sacred and inviolable," of Sidon the same. This agreement is confirmatory of the assignment to Simon Maccabeus. This coinage bears the dates of years 1, 2, 3, 4 (rare), and 5 (one specimen only). There is great difficulty as to the date. It may be reckoned from the beginning of Simon's actual rule (142 B.C.), or from that of his official rule, which is stated to have been used by the Jews as an era (141 B.C.), or from the decree of Antiochus VII. granting him the right of coinage (c. 140-139 B.C.). On the whole, the evidence in favour of the official date is best. Any one of the three modes of dating would allow five annual issues. There is another explanation which must not be hastily dismissed. It may be that the computation is by sabbatical years, and the fact that there are two types of year 1 lends some colour to this supposition, though if it be admitted there would be a gap of six years between the first and second issues, as both types of year 1 have an inscription modified on the coins of years 2 to 5. There are bronze "half-shekels" and "quarter-shekels" of the year 4. These may be later. The certain coins of the successors of Simon are small bronze pieces of John Hyrcanus, of Judas Aristobulus, of Alexander Jannæus, who strikes bilingual Hebrew and Greek and also Hebrew coins, showing his native name to have been Jonathan, and of Antigonus, who has the Hebrew name Mattathiah. The Maccabæan coinage is followed by that of the Herodian family, equally of bronze, the two most important issues being those of Herod the Great and Herod Agrippa II. The money of the procurators of Judæa, in part parallel with the Herodian, is of small bronze coins, struck between 6-7 A.D. and 58-59 A.D., the latest period of their administration being as yet unrepresented. These are followed by two important classes, the money of the first revolt (66-70 A.D.) and that of the second (suppressed 135 A.D.). Both risings caused the issue of native silver coinage, some of which may be assigned with certainty to each, while the assignment of others is doubtful. Of the first revolt are silver and bronze pieces with the name of Eleazar the priest, silver of Simon, and large and smaller bronze pieces with the name of Simon the prince of Israel. Of the second revolt are restruck denarii with the name of Simon, which appears to have been that of the leader surnamed Bar-cochab or Bar-coziba. Of the first or second revolt are shekels with the name of Simon, the obverse type a gate of the temple, and on the reverse a bundle of branches and a citron, symbols of the feast of tabernacles. Though these differ, it is rash to assign one variety to the earlier and another to the later revolt. Besides this native currency there are coins struck in Palestine by Vespasian, Titus, and Domitian. (See Madden's *Jewish Coinage*, new ed.)

Of Roman Arabia there are bronze imperial coins of Bostra and less important mints. In Mesopotamia the colonia of Carrhæ deserves notice, and the city of Edessa, which issues imperial money as a colonia, and has a series of coins of its kings, striking with Roman emperors in silver and bronze. Curiously, this and the colonial issue are long contemporary. The colonial coinages of Nisibis and of Rhesæna, which became a colonia, close the group. Assyria is remarkable for the imperial money of the ancient city of Nineveh, which appears as a colonia with the name Niniva Claudiopolis. The money of Babylon struck by the usurpers Molon and Timarchus has been noticed under the Seleucids.

The coins of Africa are far less numerous than those of the other two continents, as Greek, Phœnician, and Roman civilization never penetrated beyond Egypt and the northern coast to the west. The series of Egypt is first in geographical order. As yet no coins have been here assigned of a date anterior to Alexander. The old Egyptians kept their gold, electrum, and silver in rings, and weighed them to ascertain the value. During the Persian rule the Persian money must have been current, and the satrap Aryandes is said to have issued a coinage of silver under Darius I. In the papyri of this age the argenteus of the temple of Ptah is mentioned, and this has been thought to be a coin of Persian type generally assigned to Phœnicia. (Revillout, in *Revue Égyptologique*.) With Alexander a regular Greek coinage must have begun, and some of his coins may be of Egyptian mints. With Ptolemy I. the great Ptolemaic currency begins which lasted for three centuries. The characteristics of this coinage are its splendid series of gold pieces and the size of the bronze money. The execution of the earlier heads is good; afterwards they become coarse and careless. At first the fine pieces were issued by the Phœnician. Cyprian, and other foreign mints, the Egyptian work being usually inferior. While the Seleucids were still striking good coins, the Ptolemies allowed their money to fall into barbarism in Egypt and even in Cyprus. The obverse type is a royal head, that of Ptolemy I. being the ordinary silver type, while that of Arsinoe II. was long but not uninterruptedly continued on the gold. The head of Zeus Ammon is most usual on the bronze coinage. A type once adopted was usually retained. Thus Ptolemy I., Arsinoe II., Ptolemy IV., Cleopatra I., have a kind of commemoration in the coinage on the analogy of the priesthoods established in honour of each royal pair. The almost universal type of reverse of all metals is the Ptolemaic badge, the eagle on the thunderbolt, which, in spite of variety, is always heraldic. For art and iconography this series is far inferior to that of the Seleucids. The weight after the earlier part of the reign of Ptolemy I. is Phœnician for gold and silver and either Attic or Egyptian for the bronze. The chief coins are octadrachms in gold and tetradrachms in silver, besides the abundant bronze money. Ptolemy I. appears to have issued his money while regent for Philip Arrhidæus; it only differs in the royal name from that of Alexander; but as yet it has not been possible to separate Ptolemy's coinage from that of the other generals. He then struck money for Alexander IV. on the Attic standard with the head of Alexander the Great, with the horn of Ammon in the elephant's skin and Alexander's reverse. He soon adopted a new reverse, that of Pallas Promachus, and next lowered the coins to the Rhodian standard. This money he continued to strike after the young king's death until he himself took the royal title, when he issued his own money, his portrait on the one side and the eagle and thunderbolt with his name as king on the other, and adopted the Phœnician standard. This type in silver, with the inscription "Ptolemy the king," is thenceforward the regular currency. He also issued pentadrachms in gold, and he or his successor octadrachms in silver. Ptolemy II. (Philadelphus), the richest of the family, continued his father's coinage, and, having acquired the cities of Phœnicia, struck money there with his father's title Soter, while the Egyptian coinage merely bore the title of king: the one was a commemorative coinage, the other, though bearing the portrait of Ptolemy I., was issued in the name of the reigning sovereign. Philadelphus probably began the issue of the gold octadrachms with the busts of Ptolemy I. and Berenice I., Ptolemy II. and Arsinoe II., and certainly struck beautiful octadrachms in gold and decadrachms in silver of Arsinoe II., the gold being long afterwards continued. The Phœnician octadrachms and tetradrachms are dated by the king's reign. Philadelphus also began the great bronze issues of the system which includes the largest coin, sometimes exceeding 1400 grains in weight. Ptolemy III. (Euergetes I.) continued his father's coinages, after a while abandoning the dates in Phœnicia. He also struck fine gold octadrachms with his own portrait. His queen Berenice II., striking in her own right as heiress of the Cyrenaica and also as consort, but with the royal title only given to heiresses in the Ptolemaic line, issued a beautiful currency with her portrait, both octadrachms and decadrachms like those of Arsinoe, and a coinage for the Cyrenaica of peculiar divisions. Under Ptolemy IV. (Philopator) the coinage in its scantiness bears witness to the decline of the state, but the gold octadrachms are continued with his portrait and that of Arsinoe III. Ptolemy V. (Epiphanes) still strikes octadrachms with his portrait, and begins the continuous series of the tetradrachms of the three great cities of Cyprus, which, bearing regnal years, afford invaluable aid in the classing of his and the later coinages. Among the money of the regency of Cleopatra I. must be noticed a copper coin with her portrait. Contemporaneously with it begins the series of Ptolemy VI. (Philometor), broken by the invasion of Antiochus IV. (Epiphanes). This and the money of Philometor's brother and successor Ptolemy Physcon are only remarkable for the many dates they bear, and so with the coinage of succeeding kings, all showing a gradual degradation of art and ultimately a great debasement in metal. In the latest series, the money of the famous Cleopatra VII., it is interesting to note the Egyptian variety of her head, also occurring on Greek imperial money and on that of Ascalon. In Egypt we have the best executed and one of the youngest portraits, and it shows that her face was marked by strong characteristics of acuteness and mobility rather than of beauty.

Under the Roman rule the imperial money of Alexandria, the coinage of the province of Egypt, is the most remarkable in its class for its extent and the interest and variety of its types; and it deserves a more careful study than it has received. It begins under Augustus and ends with the usurper or patriot Achilleus, called on his money Domitius Domitianus, overthrown by Diocletian, thus lasting longer than Greek imperial money elsewhere. In the earlier period there are potin coins continuing the base tetradrachms struck by Auletes, and bronze money of several sizes. The types are very various, and may be broadly divided into Greek, Græco-Roman, and Græco-Egyptian. The Græco-Roman types have the closest analogy to those of Rome herself; the Græco-Egyptian are of high interest as a special class illustrative of the latest phase of Egyptian mythology. These native types do not immediately appear, but from the time of Domitian they are of great frequency. The money of Trajan, Hadrian, and Antoninus Pius is abundant and interesting. A coin of Antoninus, dated in his sixth year, records the beginning of a new Sothiac cycle of 1460 years, which happened in the emperor's second year (139 A.D.). The reverse type is a crested crane, the Egyptian bennu or phœnix, with a kind of radiate nimbus round its head, and the inscription ΑΙΩΝ. Under Claudius II. (Gothicus) and thenceforward there is but a single kind of coin of bronze washed with silver. In this series we note the money of Zenobia, and of the sons of Odenathus, Vabalathus and Athenodorus.

Coins of the nomes of Egypt were struck only by Trajan Hadrian, and Antoninus Pius. Their metal is bronze, and they are of different sizes. They were struck at the metropolis of each nome, and their types relate to the local worship, and so illustrate the Egyptian religion under a form modified by Greek influence. The inscriptions are the names of the nomes. There is an exceptional coin of the town of Pelusium.

Passing by the unimportant coinage of the Libyans, we reach the interesting series of the Cyrenaica, the one truly Greek currency of Africa. It begins under the line of Battus (640-450 B.C.), and reaches to the Roman rule as far as the reign of Augustus. There are coins without the name of any city, which we may consider to be of the Cyrenaica generally, and others of Cyrene, Barca, Enesperides, and smaller towns. The weight of the gold always, and of the silver until some date not long after 450 B.C., is Attic; afterwards it is Phœnician, of the Samian variety. The ruling types are the silphium plant and its fruit, and the head of Zeus Ammon, first bearded then beardless. The art is vigorous, and in the transitional and fine period has the best Greek qualities. It is clearly an outlying branch of the school of central Greece. The oldest coins are of the class which is without the name of any city. So archaic are they that they may vie in antiquity with the first issues of Lydia and of Ægina, and date in the 7th century B.C. The money of Cyrene begins later, it may be a little before the fall of the kings in 450 B.C. It comprises a fine gold series of Attic staters with the types of the Olympian Zeus, more rarely Zeus Ammon, and a victorious quadriga. Barca has a smaller coinage than Cyrene. It comprises a wonderful tetradrachm (Phœnician), with the head of Ammon bearded, boldly represented, absolutely full face, and three silphiums joined, between their heads an owl, a chameleon, and a jerboa. The money of Euesperides is less important. The Ptolemaic currency of the Cyrenaica has been already noticed.

Syrtica and Byzacena offer little of interest. Their coins are late bronze, first with Punic inscriptions, then in imperial times with Latin and Punic or Latin. Latin and Greek are used in the same coins at Leptis Minor in Byzacena.

In Zeugitana the great currency of Carthage is the last representative of Greek money, for, despite its Orientalism, its origin is Hellenic, and of this origin it is at first not unworthy. Its range in time is from about 400 B.C. to the fall of Carthage in 146 B.C. The earliest coins are Attic tetradrachms of the class usually called Siculo-Punic. It has been usual to consider these coins as having been wholly struck by the Carthaginians in Sicily, like the undoubted Sicilian money of their settlements there and those absolute imitations of Syracusan money which may be as reasonably classed to the island. But those who insist on the attribution of the whole so-called Siculo-Punic class to Sicily leave Carthage without any but a provincial coinage for at least half a century. It is far more reasonable to infer that the earliest coinage of Carthage was struck for the whole dominion, that with purely Sicilian types being limited to Sicily. The next issues are of gold and electrum and silver, degenerating into potin. The weights are extremely difficult. In the silver money the Phœnician standard is almost universal, and we note the drachm, didrachm, tetradrachm, hexadrachm, octadrachm, decadrachm, and dodecadrachm. Coins are also found which appear to follow the Persic standard, unless they are octobols and their doubles. While the silver is thus explicable, the gold and electrum money is very puzzling, and its very varying weights can only be explained by the theory that silver was the standard, and gold was constantly fluctuating in its relation. The earlier types are the horse or half-horse crowned by Nice and the date-palm, the head of Persephone and the horse and palm-tree, a female head in a cap, in splendid style, and a lion and a palm, and a head of young Heracles and a horse's head with a palm. It will be noted that the horse and the palm-tree are most constant. On the later coins the obverse is uniformly occupied by the head of Persephone and the reverse by the horse, sometimes with the palm, the horse's head and Pegasus being rare varieties. The bronze money imitates the later silver. The few inscriptions are extremely difficult. One that seems certain is קרת חדשת, the "new city," Carthage. The art of the earlier coins is sometimes purely Greek of Sicilian style. There is even in the best class a curious tendency to exaggeration, which gradually develops itself and finally becomes very barbarous. Roman Carthage has a bronze coinage which is insignificant. There are a few other towns which issued money with Roman legends, Utica, however, having first Punic and then

Latin inscriptions. The denarii of Clodius Macer, who revolted in 68 A.D., are curiously illustrative of his policy, which was to restore the Roman republic.

The cities of Numidia have Punic inscriptions, and there are interesting coins of Juba I., his denarii presenting his portrait of a characteristic Libyan type. Of Mauretania there are civic coins, chiefly using Punic characters, and an interesting regal series, mainly denarii, of Bogud II., Juba II. with his consort Cleopatra, daughter of Mark Antony and the famous Egyptian queen, and of Ptolemy their son, the last of the great family of the kings of Egypt.

II.—ROMAN COINS.

The Roman coinage is of two great classes,—the republican, commonly called the family coinage, and the imperial; the first lasted from the origin of money at Rome to the reform of Augustus in 16 B.C., and the second from this date to the fall of the Western empire in 476 A.D. The origin of the republican coinage is one of the hardest problems in archæology. The evidence of the money is at variance with that of the ancient writers, and in setting these aside we are at variance with the best authorities of our time; but the general principles of criticism must be maintained here as in other matters of early Roman story.

The oldest money of Rome was of bronze, and it is stated that it was first cast as *æs rude*. This statement is confirmed by the discovery of shapeless masses of bronze, evidently broken off from large quadrilateral masses, and then rendered of a roughly uniform weight. To the æs rude succeeded the *æs signatum*, the stamped bronze. This step is attributed to Servius Tullius by ancient authority; it is said that he adopted the types of a sheep, ox, or pig; and large masses of bronze have been found which present animal types, including the pig. These are held to represent the coinage traditionally attributed to the regal age, though it is admitted that they are for the most part contemporary with the first circular money, the libral, the origin of which Mommsen dates about 450 B.C. All the masses, however, which bear a distinct type are clearly later than 300 B.C., as is proved by their style; and in the case of the elephant type we are forced, by the first appearance of the animal in Italy under Pyrrhus, to adopt a still later date. Moreover, the date of 450 B.C. is too early for the origin of circular money; consequently the idea of any trace of the supposed regal coinage must be abandoned, though the late ingot may be descended from a currency intermediate between the æs rude and the libral circular money. The first regular Roman coinage consists of a series of cast pieces, the as of a pound weight, libral, and its chief divisions, the semis (half), triens (third), quadrans (fourth), sextans (sixth), and uncia (twelfth). The as was not cast of full weight; the older specimens usually weigh from 11 to 9 unciæ, on an average 10. The origin of this system is assigned by Mommsen to the decemvirs, on the ground of their legal institution, and particularly from the condition in the Lex Julia Papiria (430 B.C.) that fines should not be paid in cattle but in money. Admitting the law to be correctly stated in its original form, it proves no more than that money was current in Rome. The libral coinage cannot, either in style or in types, possibly be much anterior to 350 B.C. It is easy to mistake barbarism for archaism, but a practised eye will see that the types of these coins do not present a trace of archaism, and are imitations of the types which originated in the latter part of the 5th century, and were in fashion in the fourth. The heads of Jupiter and the beardless Hercules are of this class. We must therefore suppose that the fines were paid in metal by weight or in Greek money, which if it was bronze no doubt was also weighed.

At first there was no corresponding gold or silver, but the pound of bronze was held to be equal to a scruple of silver. Campanian gold and silver money with the name of the Romans or Rome was next struck to supply the want. The silver is of Greek weight, with types usually connected with Roman legend. From one of the earlier reverses being distinctly borrowed from the money of the Syracusan tyrant Agathocles, who began to reign in 317 B.C., we cannot date the first issue before about 300 B.C. The scanty gold in two or three groups is evidently of later dates; it presents great metrological difficulties. The libral as fell in course of time from a weight of 10 to one of 8 unciæ, and was at length reduced to a weight of 4, or that of a triens, and thus became triental. This is shown by the colonial coins of Italy to have occurred about 269 B.C., probably in that very year, when the silver coinage of Rome began. The dupondius (2 asses), tressis (3), and decussis (10) were now issued at Rome, also the semuncia ($\frac{1}{2}$ oz.) and the quadruncia ($\frac{1}{4}$ oz.). Casting was ultimately abandoned and all coins struck, and by about 254 B.C., or soon after, the triental system became sextantal; the multiples of the as and divisions of the uncia now cease. The silver coinage was first issued in 269 B.C.; it consisted of the denarius of 4 scruples or 72 grains (72 denarii being struck to the pound), the quinarius of 2 scruples, and the sestertius of 1. As the old as libralis was equal to 2½ triental asses, the new sestertius was equal to the as libralis; as the coin was still in circulation this was inevitable, and the words sestertius and æs grave are used synonymously. The relative value of silver to bronze being thus maintained, the silver sestertius was exchanged for the old as of 10 unciæ, which was a real coin, whereas the new as of 4 unciæ (triental) was a mere token. The value in the bronze, X, was inscribed on the denarii instead of IV. The bronze money soon became a token currency. The victoriatus was issued in 228 B.C., not much after the denarius; it was of 3 scruples, or three-fourths of the heavier coin, and was intended to serve in the provinces for the Illyrian drachms of light Attic weight; it could pass at Rome. The first purely Roman gold money is that of Sulla, probably struck in Greece. Julius Cæsar struck similar coins in 49 B.C. To Octavian is due the settlement of the gold coinage. In 217 B.C. the standard was reduced; the denarius was struck at 80 to the pound, and the as became uncial. The denarius remained stationary for nearly three centuries, and its purity was maintained. The fate of the divisions of the denarius is too complicated to be here noticed, but it may be remarked that in 104 B.C. the quinarius appeared with the type of the victoriatus, which had disappeared, but with its own mark Q. When the as fell from sextantal to uncial, the value changed from one-tenth to one-sixteenth of the denarius, but as troops were still paid at 10 asses to the denarius, the X almost always appears as the mark of value on the silver piece. By this reduction the relation of silver to bronze fell to less than half the original value still current in accounts, and became 1 to 112. Thus the bronze money represented more than double its metal value. In 89 B.C. the semuncial as was introduced, and from 80 B.C. bronze coinage ceased until Augustus issued his new currency in that metal.

The Roman coinage was struck both in the city and elsewhere. Consequently the Roman, Italian, and other issues must be carefully discriminated. In the city the right of striking was delegated to the monetary triumvirs, who could coin individually or together, but as a rule they acted independently. The earlier bronze and silver coins have fixed types. The obverse types are—for the as the head of Janus Bifrons, for the semis that of Jupiter, the triens Pallas, the quadrans Hercules, the sextans Mercury, and the uncia Roma. The reverse type is always a prow. The marks of value are—for the as I, for the semis S, and a certain number of balls equivalent to the value in ounces for the lower denominations. The original types of the denarius were for the obverse the head of Roma with a winged helmet and the mark of value X behind, and for the reverse the Dioscuri on horseback charging. In 100 B.C. a new type is introduced for the obverse, and a new reverse appears a century earlier, but the great abundance of types dates from 89 B.C. These are so characteristic that it is necessary to notice them particularly. The primary religious motive is to be traced in these as in the types of Greek money, but their having been selected to distinguish families instead of cities or peoples gives them a character of their own. It is this character which ultimately renders the introduction of contemporary portraits almost a matter of course. The subject of the obverse is usually the head of a divinity, or a personification, or a traditional or an historical personage, ultimately one living, and the reverse bears a mythological, symbolical, traditional, or historical subject.

The following are the chief classes to which the types may be reduced:—

1. Head or figure of a divinity worshipped at Rome; as head of Jupiter (fam. Petillia), figures of the Dioscuri (Junia) or of a divinity worshipped by the family or individual striking the coin, as head of Neptune (Pompeia, coin of Sextus Pompeius)
2. Sacred natural or artificial object; as pontifical implements (Antonia). This class is not large; sacred animals rarely occur.
3. Head or figure of a personification of a country or town; as heads of Hispania (Carisia), Roma (Julia), Alexandria (Æmilia).
4. Head or figure of an allegorical personage; as heads of Pavor (Hostilia), Pallor (id.), Honos and Virtus (Fufia, Mucia).
5. Fabulous monster; as Scylla (Pompeia).
6. Head or figure of an ancestral personage; as head of Numa (Calpurnia), Ancus Marcius (Marcia).
7. Events connected with ancestors; as figure of Marcus Lepidus, as TVTOR REG[IS], crowning Ptolemy Epiphanes (Æmilia).
8. Places connected with historical exploits, and of a votive character; as pharos of Messene (Pompeia, of Sextus, probably commemorating the sea-fight off Messene, 38 B.C.).
9. Symbolical representations of contemporary events; as a general welcomed on landing by a country or city (Minatia).
10. Heads of living personages exercising dictatorial power, or in very high authority; as head of Sulla (Cornelia).
11. Representations connected with military matters; as legionary standards (Antonia).

Besides the principal designs there are symbols and numerals generally to be regarded as having been indicative of successive issues from the mint. The inscriptions, which are in the nominative, are usually on the obverse the name of the personage represented and on the reverse the name of the person who issued the coin; the latter sometimes occurs on the obverse. Some of the most curious types strikingly illustrate Roman instinct. Being the choice of a multitude of persons of different families, they have an individuality lacking to the money of the Greek cities, which gave little choice to the coining authority or to the artist, and to the Greek royal coinages, which slipped speedily into heraldry. The family coins show a delight in recording the achievements of the house, and sometimes are so personal as to rank with modern medals, the spirit of which is even outdone in such a subject as Sulla's dream. With the Greeks the historical sense is latent until the age of the kings, and then does not pass beyond portraiture and at first a scanty symbolical commemoration of events; with the Romans, even before portraits are introduced, the desire to record events is intensely strong. Thus we have not only such legendary subjects as the rape of the Sabines and Tarpeia crushed beneath the bucklers, which may be classed with the Greek mythical types, but also past historical events, as Marcus Æmilius Lepidus crowning Ptolemy Epiphanes, to whom he was governor, and Paullus Æmilius raising a trophy, while Perseus, king of Macedon, and his two children stand before him, and also events of the present, as the reverse type of Brutus, the cap of liberty between two daggers with the inscription **EID MAR**, and on a piece of Sextus Pompey the pharos of Messene above a Roman galley and for reverse Scylla striking with a rudder. The special mythology and superstition of Rome is not less fully illustrated, as well as the coming in of Greek ideas, in such a manner that many types thoroughly Greek alternate with purely Roman ones. The art of the republican coins reflects that of contemporary Greek money, but is never equal to the better style of the late Hellenic issues.

The history of the imperial coinage is full of metrological difficulties. These arise from the conditions fixed by Augustus (16-15 B.C.), by which the emperor alone coined gold and silver, the senate alone bronze. Consequently the senate was wholly at the mercy of the emperor. Augustus struck the aureus at 40 to the pound, equal to 25 denarii at 84 to the pound. He introduced a new bronze coinage in two metals, the sestertius of 4 asses and dupondius of 2, both in fine yellow bronze (orichalcum), and the as semis and quadrans in common red bronze. The finer coins were struck on the standard of the as of a quarter of an uncia, the inferior ones on that of the half uncia. This gives the following proportionate values:—

Gold.	Silver.	Orichalcum.	Bronze.
1	11·91	333·3	666·66
	1	28	56
		1	2

The as is nearly equal in size and weight to the dupondius, but is distinguished by its metal and inferior fabric. All the bronze bears the letters S.C., *senatus consulto*. Emperors not acknowledged by the senate are without bronze money; thus we have no specimens of Otho or Pescennius Niger.

Nero reduced the aureus to $\frac{1}{45}$th of the pound, and the denarius to $\frac{1}{96}$th, its purity being officially reduced. Under Trajan there was a further debasement of the denarius. Marcus Aurelius fixed the aureus, which had recovered its weight, at $\frac{1}{45}$th of the pound; the denarius had already been further debased, and under Septimius Severus it was half alloy. Caracalla introduced a new coin, called after him the argenteus Antoninianus. It was struck at $\frac{1}{50}$th to $\frac{1}{64}$th of the pound, and seems to have been originally a double denarius struck on a lower standard. The characteristic of this coin is that the head of the emperor is radiate as Sol, that of the empress on a crescent as Luna. Under Elagabalus the taxes were paid in gold alone; this was ruinous, for the treasury paid in debased silver at nominal value, which had to be used to purchase gold by the taxpayer at real value. Under Severus Alexander there was the latest large issue of denarii and sestertii. The senate made another effort to continue a bronze currency by striking under Philip the large bronze quinarius or Philippus aereus, while the base metal argenteus had become a piece of bronze washed with silver. At length in the time of Gallienus the argenteus contained no silver whatever. Aurelian (270-275 A.D.) attempted a reform of the coinage by which the previous coin was reduced from its nominal to its intrinsic value. The coins were now of tinned bronze and marked with their real value, 20 or 21 denarii of account, the signs **XXI**, **KA** (Greek), and **XX** being used as indexes of value. These coins replace at once the base silver and the bronze, which now disappear. The moneying right of the senate had become illusory by the depreciation of silver, which had ceased to have any real value. Aurelian entirely suppressed this right; Tacitus and Florian restored it for a few years, after which the S.C. disappears from the coinage. The reform of Aurelian caused an outbreak at Rome which was of a serious character, but it was maintained by him and by Tacitus. Aurelian also suppressed all local mints but Alexandria. It was the work of Diocletian to restore the issue of relatively pure money in the three metals. Before 293 A.D. the coinage of silver recommences with the denarius of the standard of Nero, $\frac{1}{96}$th of the pound, marked with the figures **XCVI**. Between 296 and 301 A.D. two tinned bronze coins were struck, the follis and the centenionalis. The follis was marked **XXI**, like the similar but very much smaller coin of Aurelian. The denarius was the unit of reckoning.

Constantine, probably in 312 A.D., desiring to rectify the gold coinage, which had long been quite irregular in weight, reduced the chief gold piece to $\frac{1}{72}$d of the pound, and issued the solidus, a piece destined to play a great part in commercial history. It was never lowered in weight, though many centuries later it was debased, long after it had become the parent of the gold coinages of Westerns and Easterns alike throughout the civilized world. The index **LXXII** is sometimes found on the first solidi; and after 367 A.D., when the edict of Constantine was renewed, the Greek equivalent **OB** was constantly used. Under Constantius II. (360 A.D.) and Julian the silver denarius or argenteus was suppressed, and the siliqua of $\frac{1}{144}$th of the pound took its place. The follis having been withdrawn by Arcadius and Honorius, was reissued a century later by Zeno, with **XL** to indicate the value of 40 denarii. It will be seen that a fuller system of bronze was originated by Anastasius, the Byzantine emperor.

Under Augustus the Roman monetary system became the official standard of the empire, and no local mint could exist without the imperial licence. Thus the Greek imperial money is strictly Roman money coined in the provinces, with the legends and types of the towns. Many cities were allowed to strike bronze, several silver, and one, Cæsarea in Cappadocia, gold. The silver becomes limited about Nero's time, but lasts under the Antonines. Afterwards there are a few currencies of base metal. The bronze increased in mints and quantity in the second century, but, through the debasement of the Roman silver, one city after another ceased to strike about the middle of the third. Only Alexandria and Antioch survived by following the tactics of Rome with their own base metal coins. Purely Roman gold and silver was coined in certain of the provinces, in Spain and Gaul, and at the cities of Antioch and Ephesus. When the base silver had driven the Greek imperial bronze out of circulation, Gallienus established local mints which struck in pure Roman types. Diocletian increased the number of these mints, which lasted until the fall of the empire of the West, and in the East longer. These mints were, with others added later, Londinium (or Augusta), Camulodunum, Treviri, Lugdunum, Arelate (or Constantina), Ambianum, Tarraco, Carthago, Roma, Ostia, Aquileia, Mediolanum, Siscia, Serdica, Sirmium, Thessalonica, Constantinopolis, Heraclea, Nicomedia, Cyzicus, Antiochia (ultimately Theopolis), and Alexandria. A few were speedily abandoned.

The obverse type of the imperial coins is the portrait of an imperial personage, emperor, empress, or Cæsar. It begins under Julius Cæsar, though the republican money goes on under Augustus, in whose reign the privileges of the moneyers ceased. The type only varies in the treatment of the head or bust,—if male, laureate, radiate, or bare; if female, sometimes veiled, but usually bare. The reverse types of the pagan period are mythological of divinities, allegorical of personifications, historical of the acts of the emperors. Thus the coins of Hadrian, besides bearing the figures of the chief divinities of Rome, commemorate by allegorical representations of countries or cities the emperor's progresses, and by actual representations his architectural works. The inscriptions are either simply descriptive, such as the emperor's names and titles in the nominative on the obverse, or partly on the obverse and partly on the reverse, and the name of the subject on the reverse; or else they are dedicatory, the imperial names and titles being given on the obverse in the dative and the name of the type on the reverse. Sometimes the reverse bears a directly dedicatory inscription to the emperor. The inscriptions on the earlier imperial coins from Tiberius to Severus Alexander are generally chronological, usually giving the current or last consulship of the emperor and his tribunitian year. In the latter part of the third century the mints are indicated by abbreviations in the exergue of the reverse, with also the number of the issue. There are sometimes signs of value in the field of the reverse. These characteristics apply to the pagan empire; under the Christian empire there are modifications, mainly in the character of the reverse types. These are generally allegorical and free from pagan intention, though their source is pagan, as in the common types of Victory. Purely Christian types are rare. The most remarkable is the Christian monogram formed of the Greek letters **XP**. The inscriptions are simpler, and in the reverses necessarily show the same change as the types. Of great interest is the inscription **HOC SIGNO VICTOR ERIS**, on coins dating not long after the victory of Constantine over Licinius. There is some variety in both types and inscriptions, but little that is absolutely new.

The art of Roman imperial coins, although far inferior to that of Greek, is well worthy of study in its best ages, for its intrinsic merit, for its illustration of contemporary sculpture, and on account of the influence it exercised on mediæval and modern art. These coins were first designed under the revival of Greek art, during the influence of the New Attic school. The Romans had properly no art of their own. Their greatest temples and the statues of their gods were copies or imitations by Greeks of Greek originals, besides such earlier statues as were brought from Greece. The Greeks who were first called in to work for their masters were the artists of a school which was emphatically imitative, not in any way inventive, and their successors were debased by the false taste of their patrons.

There is a marked inferiority in the Roman coinage to the Græco-Asiatic work of the same times. With a tendency to follow the dramatic styles, the artists who worked at Rome had power enough to produce fine and highly characteristic portraits, of which the famous bust, miscalled Clytie, is the most striking example. Thus, though the grandeur and the purity of design and execution of the older masters are gone, we have in their place a strikingly faithful portraiture, which is deeply gratifying to the historical sense. The best age is the Augustan, which may be said to last through the rule of the Claudian emperors, and is decidedly under New Attic influence. This is succeeded by the second, that of the Antonines, from Trajan to Commodus. The Augustan work is larger and more refined, that of the Antonines more elaborate and laborious. Then follows a swift decline, with a temporary revival in the age of Diocletian and Constantine, when an attempt, necessarily weak, was made to improve the art of the coins; thenceforward it slowly declined. In the Augustan age two manners may be recognized, the Greek and the Græco-Roman, the one repeating earlier works, the other portraying living persons and events. Under the Antonines we notice, as a distinct reaction against the poor idealism of the age, which even occasionally endeavoured to treat portraits in an ideal style, a vigorous realism which looks like the actual parent of the Italian Renaissance in its classical phase. Midway between these stands the realistic style of the age. Among the finest examples of art in the Roman coinage are the portraits of Livia as Pietas, Justitia, and Salus, and that of the elder Agrippina. For stern realism the head of Nero is most remarkable, the growth of whose bad passions may be seen in the increasing brutality of his features and expression. The medallion series is full of charming subjects, though when they have been treated by Greek artists of earlier ages the contrast is trying; the most satisfactory are the representations of older statues; the purely new compositions are either poor inventions, or have a theatrical air that removes them from the province of good art.

III.—MEDIÆVAL AND MODERN COINS OF EUROPE.

The period of the mediæval and modern coins of Europe must be considered to begin about the time of the fall of the Western empire, so that its length to the present day is about 1400 years. It is impossible to separate the mediæval and modern coins, either in the entire class, because the time of change varies, or in each group, since there are usually pieces indicative of transition which display characteristics of both periods. The clearest division of the subject is to place the Byzantine coinage first, then to notice the characteristics of its descendants, and lastly to sketch the monetary history of each country.

The Byzantine money is usually held to begin in the reign of Anastasius (491-518 A.D.). The coinage is always in the three metals, but the silver money is rare, and was probably struck in small quantities. At first both the gold and the silver are fine, but towards the close of the empire they are much alloyed. The gold coin is the solidus of Constantine, with its half and its third, the so-called semissis and tremissis. The chief silver coin was the miliarision, of a lower weight than the solidus, and its half, the keration. Heraclius, in 615 A.D., coined a larger piece, the hexagram, weighing 105 grains. This coin was discontinued, and afterwards the miliarision and keration were coined until the conquest of Constantinople by the Latins. The silver money of the restored Greek empire is obscure. In 498 Anastasius introduced a new copper coinage, bearing on the reverse, at and about his time, the following indexes of value as the main type: M, K, I, E, Δ, Γ, B, and A, or 40 nummi, 20, 10, 5, 4, 3, 2, and 1. These coins bear beneath the indexes the abbreviated name of the place of issue. Justinian I. added the regnal year in 538 A.D., his twelfth year. The money of this class presents extraordinary variations of weight, which indicate the condition of the imperial finances. The Alexandrian coins of this class begin under Anastasius and end with the capture of the city by the Arabs. They have two denominations, IB and S, or 12 and 6, and there is an isolated variety of Justinian with ΛΓ (33). The Alexandrian bronze never lost its weight, while that of the empire generally fell, and thus some of the pieces of Heraclius, while associated with his sons Heraclius Constantinus and Heracleonas, have the double index IB and M. The Vandals of Carthage had a peculiar double system of their own with the indexes XLII, XXI, XII, and IIII. Under Basil I. the bronze money appears to have been reformed, but the absence of indexes of value makes the whole later history of the coinage in this metal very difficult. There was one curious change in the aspect of the money. Early in the 11th century the solidus begins to assume a cup-shaped form, and this subsequently became the shape of the whole coinage except the smaller bronze pieces. These novel coins are called nummi scyphati. The types, except when they refer simply to the sovereign, are of a religious, and consequently of a Christian character. This feeling increases to the last. Thus, on the obverse of the earlier coins the emperors are represented alone, but from about the 10th century they are generally portrayed as aided or supported by some sacred personage or saint. On the reverses of the oldest coins we have such types as a Victory holding a cross, but on those of later ones a representation of Our Saviour or of the Virgin Mary. Subsequently some allegorical religious types are introduced, as that of the Virgin Mary supporting the walls of Constantinople. The principal inscriptions for a long period almost invariably relate to the sovereign, and express his name and titles. The secondary inscriptions of the earlier coins indicate the town at which the piece was struck, and, in the case of the larger bronze pieces, the year of the emperor's reign is also given. From about the 10th century there are generally two principal inscriptions, the one relating to the emperor and the other to the sacred figure of the reverse, in the form of a prayer. The secondary inscriptions at the same time are descriptive, and are merely abbreviations of the names or titles of the sacred personages near the representations of whom they are placed. From the time of Alexius I. (Comnenus) the principal inscriptions are almost disused, and descriptive ones alone given. These are nearly always abbreviations, like the secondary ones of the earlier period. The language of the inscriptions was at first Latin with a partial use of Greek; about the time of Heraclius Greek began to take its place on a rude class of coins, probably local; by the 9th century Greek inscriptions occur in the regular coinage; and at the time of Alexius I. Latin wholly disappears. The Greek inscriptions are remarkable for their orthography, which indicates the changes of the language. Of the art of these coins little need be said. It has its importance in illustrating contemporary ecclesiastical art in the West, but is generally inferior to it both in design and in execution.

Besides the regular series of the Byzantine empire, in which we include the money assigned to the Latin emperors of Constantinople, there are several cognate groups connected with it, either because of their similarity, or because the sovereigns were of the imperial houses. There are the coinages of the barbarians to be next noticed, and the money of the emperors of Nicæa, of Thessalonica, and of Trebizond. The last group consists of small silver pieces, which were prized for their purity; they were called Comnenian aspers (*ἄσπρα Κομνήνατα*), the princes of Trebizond having sprung from the illustrious family of the Comneni.

The coinage of the other states of Christian Europe will be best understood if we view it generally in successive periods, afterwards more particularly describing the currencies of the chief countries. The periods have been well defined as—(1) transitionary period, from Roman to true mediæval coinage, from the fall of Rome (476) to the accession of Charlemagne (768); (2) true mediæval age, during which the Carlovingian money was the currency of western Europe, from Charlemagne to the fall of the Swabian house (1268); (3) early Renaissance, from the striking of the florin in Florence (1252) to the classical Renaissance (1450); (4) the classical Renaissance, from 1450 to 1600; (5) the modern period. (C. F. Keary in the *Antiquary*, 1883.)

1. The Roman money was adopted and imitated by the barbarian conquerors of the empire. They struck in gold, silver, and bronze, gold being the favourite metal. The names of the kings soon appear upon the silver and bronze, but the gold money is at first a copy of the Byzantine, then monograms of kings appear, and at last their names in full save when the money in the Frankish series is of civic issues. The currencies of this period are those of the Ostrogoths in Italy, the Vandals in Africa, the Visigoths in Spain, the Franks in Gaul, and the Lombards in Italy. The most important coinages of this age are of gold

2. The inconvenience of gold money when it represents a very large value in the necessaries of life must have caused its abandonment and the substitution of silver by the Carlovingians. The denier (denarius) or penny of about 24 grains was at first practically the sole coin. The solidus in gold was struck but very rarely, perhaps as a kind of proof of the right of coining. The Byzantine solidus or bezant was used and probably the equivalent Arab gold. The Arab silver piece, the *dirhem*, was almost exactly the double of the denier, and seems to have been widely current in the north. The new coinage spread from France, where it was first royal and then royal and feudal, to Germany, Italy, where the Byzantine types did not wholly disappear, England, Scandinavia, Castile, and Aragon. In Germany and France feudal money was soon issued, and in Italy towns and ecclesiastical foundations largely acquired the right of coinage from the empire, which was elsewhere rare. The consequence of the extended right of coinage was a depreciation in weight, and in the middle of the 12th century the one-sided pennies called bracteates appeared in Germany, which were so thin that they could only be stamped on one side. The types of this whole second coinage are new, except when the bust of the emperor is engraved. The most usual are the cross; and the church as a temple also appears, ultimately taking the form of a Gothic building. There are also sacred figures, and more rarely heads in the later age.

3. The true herald of the Renaissance was the emperor Frederick II. In restoring the gold coinage, however, he followed in the steps of the Norman dukes of Apulia. With a large Arab population, these

princes had found it convenient to continue the Oriental gold money of the country, part of the great currency at that time of all the western Moslems, and Roger II. also struck Latin coins of his own as DVX APVLIAE, the first ducats. Frederick II., continuing the Arab coinage, also struck his own Roman gold money, solidi and half solidi, with his bust as emperor of the Romans, Cæsar Augustus, and on the reverse the imperial eagle. But the calamities which overwhelmed the Swabian house and threw back the Renaissance deprived this effort of any weight, and it was left to the great republics to carry out the idea of a worthy coinage,—a necessity of their large commercial schemes. The famous gold florin was first issued in 1252. The obverse type is the standing figure of St John the Baptist, the reverse bears the lily of Florence. The weight was about 54 grains, but the breadth of the coin and the beauty of the work gave it dignity. The commercial greatness of Florence and the purity of the florin caused the issue of similar coins in almost all parts of Europe. Venice was not long in striking (in 1280) a gold coin of the same weight as the florin, but with the types of a standing figure of Christ, and the doge receiving the gonfalon at the hands of St Mark. It was first called the ducat, the name it always bears in its inscription; later it is known as the zecchino or sequin. Though not so largely imitated as the florin, the extreme purity of the sequin was unquestioned to a time within the memory of living persons. Genoa likewise had a great gold currency, and the other Italian states struck in this metal. It is significant of the power of the Italian republics that the later Mameluke sultans of Egypt found it convenient or necessary for their position between Europe and India to adopt the weight of the florin and sequin for their gold money. Many varieties of gold money appear in course of time in France, England, and to a less extent in other countries. The need for a heavier silver coinage caused the issue of the large denier (grossus denarius), afterwards called the gros and groat. This coin appears in the 14th century, and at the same time the large German bracteat are issued. The types are now very various and distinctly worthy of the art of the time, which as yet is purely decorative and conventional, so that portraits are not possible. The religious intention also is gradually giving way to the desire to produce a beautiful result, and the symbol of the cross is varied to suit the decorative needs of the coin. Heraldic subjects also appear, and in the shield, which is frequently a reverse type, we see the origin of the usual modern reverse of the most important coins.

4, 5. With the classical Renaissance we find ourselves in the presence of modern ideas. The elaborate systems of coinage of the various states of Europe are soon to begin, and the prevalence of a general currency to become for the time impossible. Silver money now gains new importance with the issue of the thaler or dollar in Germany, in 1515. This great coin speedily became the chief European piece in its metal, but as it was coined of various weights and varying purity it failed to acquire the general character of the denier. The style of this age is at first excellent. The medals gave the tone to the coinage. Art had wholly thrown off the rules of the age before and attained the faculty of portraiture and the power of simply representing objects of nature and art. Great masters now executed medals and even coins, but speedily this work became a mere matter of commerce, and by the beginning of the modern period it was fast falling into the poverty and barbarism in which it has ever since remained. The details of the numismatics of these two periods belong to the notices of the money of the several countries.

A word must be added on money of account. While the denier was the chief and practically the sole coin, the solidus passed from use as a foreign piece into a money of account. The solidus was the German schilling (shilling), which contained usually 12 deniers. As there were 20 shillings to the pound of silver, we obtain the reckoning by £ s. d., libræ, solidi, and denarii. The pound as a weight contained 12 ounces, and its two-thirds was the German mark of 8 ounces.

It would be interesting, did space permit, to notice fully the art of this entire class, to examine its growth, and to trace its decline, but, as with that of Greek and Roman coins, we must mainly limit ourselves to the best period. This is a space of about a hundred and fifty years, the age of the classical Renaissance, from the middle of the 15th century to the close of the 16th. The finest works are limited to the first half century of this period, from a little before 1450 to about 1500, in Italy, and for as long a time, beginning and ending somewhat later, in Germany. The artists were then greater than afterwards, and medal-making had not degenerated into a trade; but with the larger production of the period following the work was more mechanical, and so fell into the hands of inferior men. The medals of this first period may not unworthily be placed by the side of its sculpture and its painting. Not only have some of its medallists taken honourable places in a list where there was no room for ignoble names, but to design medals was not thought an unworthy occupation for the most famous artists. There are, as we should expect, two principal schools, the Italian and the German. The former attained a higher excellence, as possessing not merely a finer style but one especially adapted to coins or medals. The object which the artists strove to attain was to present a portrait or to commemorate an action in the best manner possible, without losing sight of the fitness of the designs to the form and use of the piece on which they were to be placed. For the successful attainment of this purpose the style of the later pre-Raphaelites was eminently suited. Its general love of truth, symmetrical grouping, hard drapery, and severely faithful portraiture were qualities especially fitted to produce a fine portrait and a good medal. It is to be noted that their idea of portraiture did not depend on such a feeling for beauty as influenced the Greeks. Rather did it set upon it the moral attainments and capabilities of the subject. The German art, a product of engravers in metal, is really goldsmith's work, except in Albert Dürer's case. Thus it is not so suitable to numismatic designs. The portraits of the German coins and medals are sometimes even more characteristic than those of the Italian, and the groups often show great vigour; but both are less appropriate. They display also too great a profusion of detail, by which the effect of the boldness of the outlines is frequently lost; yet they have much originality and vigour, and will reward an attentive study. Both these schools, but especially the Italian, afford the best foundation for a truly excellent modern medallic art. The finest coins and medals of Italy and Germany have an object similar to that which it is sought to fulfil in the English, and their nearness in time makes many details entirely appropriate. Thus, without blindly imitating them, modern artists may derive from them the greatest aid.

There are some delicately beautiful Italian medals of the 16th century, too closely imitated from the Roman style. A vigorous realistic school, the only great one of modern times, arose in France before the close of the 16th century and lasted into the next. It was rendered illustrious by Dupré and the inferior but still powerful Warin. From this age until the time of Napoleon there is nothing worthy of note. The style of his medallists is the weak classical manner then in vogue, but yet is superior to what went before and what has followed.

It is not intended here to enter in any detail into the various divisions of the subject already treated in its main outlines. The questions that would require consideration are of too complicated and technical a nature to be illustrated within reasonable limits; the principal matters of inquiry may, however, be indicated.

The money of the Iberian Peninsula begins with the Visigothic series, which consists of gold pieces. The money of Portugal is regal, and not of great interest except as affording indications of the wealth and commercial activity of the state in the early part of the 18th century. The coinage of Spain is almost without exception regal, but a more curious class than that of Portugal. The coins of the early contemporary kingdoms, such as those of Aragon, and of Castile and Leon, are especially worthy of examination. We may mention as of a very peculiar character a large gold piece in the coinage of the latter state, called the *Dobla de la Vanda*, from its bearing the shield of the famous order of knighthood of the Vanda or Band. Of this there are examples assigned to John I. (1379-90) and John II. (1406-54). The money of the sole monarchy is less worthy of notice. The city of Barcelona is represented by coins bearing the names of various kings. The medals of Spain are not important.

The coinage of France forms a large series. It begins with the money of the Merovingian dynasty. This consists almost wholly of gold pieces, imitated from those of the late Roman and Byzantine rulers, as already mentioned, the commonest denomination being the tremissis, or third part of the sou d'or (solidus). The coins are rare, and bear either the names of a king and a city or of a moneyer and a city. They are barbarous in their art. Under the princes of the Carlovingian dynasty the principal coins are deniers, and after a time oboles also, gold money being extremely rare. They bear the name of the king and that of the city where they were struck, and have a more original character than the earlier pieces, although they are still barbarous. The money of the Capetian house begins with coins like those of the line preceding it. By degrees the coinage improves. In the 13th century gold pieces were issued. There are several denominations of these and of silver coins, but to some different names are applied for various types with the same weight, as the *denier Parisis* of Paris, and the *denier Tournois* of Tours, both of base metal. At the time of Philip VI. the coins are fine. The modern coinage may be considered to begin under Henry II., whose portrait is of good work. During this period there is no very remarkable feature in the current money, except the occurrence in the 17th century of the pieces of the sort termed *pied fort*, which we must regard as a kind of pattern. The seignorial coins of France during the Middle Ages are important. The medals are far more interesting than the modern coins. Their interest begins in the age of the last Valois kings and Henri IV.; there is a long and historically important series of Louis XIV., and another of a new artistic character under the first republic and the reign of Napoleon I. Almost every great event, from the beginning of the power of that emperor until his fall, is commemorated in this last series, unequalled in its class for completeness. The designs, notwithstanding their false classical style and that mannerism which appears to be essential to modern French art, are executed with great care and skill.

The English coinage begins with two uncertain classes, which, wherever struck, certainly formed the currency of the country during the interval from the departure of the Romans, about 450 A.D., until the issue of money with royal names by the Saxon kings, towards the end of the 8th century. One of these classes consists of imitations of the latest Roman copper money, and the other of the small silver pieces to which the name of *sceattas* is applied, having rude types which are sometimes of Roman origin, but sometimes original, and occasionally with Runic inscriptions. The former were first issued and then the latter. The regular coinage begins no doubt under the so-called Heptarchy. There is money of the kingdoms of Mercia, Kent, the East Angles, and Northumbria. The chief coins are silver pennies, but sceattas also occur; and of Northumbria there are *stycas*, which are pieces of a base metal in the composition of which copper is the largest ingredient. The most interesting coins of this group are those of Offa, king of Mercia; these are silver pennies, remarkable for their quaint designs and their relatively careful execution. Of this period, but extending into the earlier part of that of the sole monarchs, there are coins issued by the archbishops of Canterbury and York. The money of the sole monarchs, whether Saxons or Danes, is strictly a continuation of that of the Heptarchy; it consists almost wholly of silver pennies, which latterly were cut into halves and quarters to form halfpennies and farthings. Under the Normans and earlier Plantagenets the same coinage continues; but under Edward III. there is regular gold money, of which the chief piece is the noble of six shillings and eightpence; and the silver groat now appears. The obverse type of the noble, representing the king in a ship, probably commemorates Edward's victory over the French fleet off Sluys in 1340. At this time there is a visible improvement in the art of the coinage, which moves with the succession of styles until the close of the Tudor age. Of Henry VIII. we have gold and silver coins of most existing denominations, as well as of earlier ones long since abandoned. The finest piece is the sovereign, a large flat coin of gold, bearing on its obverse the figure of the king (whence its name) on his throne. The reign of Queen Elizabeth marks the transition from the Gothic to the modern style and the introduction of the new method of coining with the use of the mill. The coinage of Charles I. presents great varieties owing to the civil war. The scarcity of gold in the royal treasury during the troubles induced the king to coin twenty- and ten-shilling pieces of silver, in addition to the crowns and smaller denominations. One of the most remarkable of his pieces is a crown struck at Oxford. It bears on the obverse the king on horseback, with a representation of the town beneath the horse, and on the reverse the heads of the "Oxford Declaration." Of equal interest are the siege-pieces of many castles famous in the annals of those days. The coinage of the Commonwealth is of a plainness proper to the principles of those who sanctioned it. The great Protector, however, caused money to be designed of his own bearing his head. It is not certain that this was ever sent forth, and it is therefore put in the class of patterns. Simon, the chief of English medallists, designed the coins which are unequalled in the whole series for the vigour of the portrait (a worthy presentment of the head of Cromwell) and the beauty and fitness of every portion of the work. Henceforward there is a decline in the coinage, although skill is perceived in the portrait of William III., whose grand features could scarcely have failed to stimulate an artist to more than a common effort. Queen Anne's money is also worthy of note, on account of the attempt, on Dean Swift's suggestion, to commemorate current history on the copper coinage, which led to the issue of the famous farthings. These have been the cause of an extraordinary delusion, to the effect that a very small number (some say three) of these pieces were struck, and that their value is a thousand pounds each, instead of usually some shillings. In consequence many imitations have been forged, and such are constantly brought to collectors by unfortunate labourers and the like, who imagine that they possess the greatest numismatic treasure in the world. After this there is little to remark, except the baseness of the art of the coins under the first three Georges, until the genius of Pistrucci gave a worthier form to the currency. Besides the regal coinage there is scarcely any baronial money, the class being represented by a few pieces, generally struck by personages of the royal house, and all belonging to the period of the close of the Norman line and the beginning of the Plantagenet.

The English medals are far more interesting for their bearing on events than as works of art. The best are almost all by foreigners, but the fine pieces of the Simons form notable exceptions. The medals of the Tudors are good in style, and show some excellent portraits, in particular those by Trezzo and Stephen of Holland. There is one of Mary Queen of Scots by Primavera, representing her in middle life, which is perhaps her most characteristic portrait. Elizabeth's are of historical importance, and the same is the case with the richer series of the Stuart period, often of fine style. These include works by Warin, the Simons, and the Roettiers, besides the excellent coin engravers Briot and Rawlins. The most curious pieces are those popular issues relating to current events, such as the so-called "Popish plot." From this time there are no works deserving notice except military and naval medals, the historical interest of which makes some amends for their poverty of design and execution. The English tokens form a curious class. They are of two periods: the earlier, which are generally of copper, were issued at the middle of the 17th century and somewhat later; the later, which are mainly of copper, were struck during the scarcity of the royal coinage in this metal at the end of the last century, and during the earlier years of the present century. Both were chiefly coined by tradesmen, and bear their names. The colonial money of England was until lately unimportant, but now it is not unworthy of the wealth and activity of the dependencies. The money struck by the English kings for their French dominions forms a peculiar class, mainly French in its character, termed the Anglo-Gallic. This may be used to fill some gaps in the regal series of England; for instance, it supplies us with money of Richard I., of whom no English coins bearing his name are known.

The coinage of Scotland is allied to that of England, although generally ruder; but it seems to have been more influenced in the early period from England, and towards its close from France. The oldest pieces are silver pennies or sterlings, resembling the contemporary English money, of the beginning of the 12th century. In the 15th and 16th centuries there is an important coinage, both in gold and silver, not the least interesting pieces being those of Queen Mary, many of which bear her portrait. The indifferent execution of the coins of this period is traceable to the disturbed state of the kingdom.

The money of Ireland is more scanty and of less importance than that of Scotland. The pieces most worthy of notice are the silver pennies of the early Danish kings. Of later times there is little that is interesting, except the forced currency of James II. during his attempt to maintain himself in the island.

Belgium occupies the next place in our arrangement. Its coinage comprises many pieces struck by foreign rulers, and has little of an independent character in either the regal or the seignorial class. It closely resembles the money of France and Germany. The series of Holland is similar in character until the period of the revolt of the provinces. The medals are highly interesting, more especially those which were struck by the Protestants in commemoration of current events. Most of these are of silver, but a few are in gold. There is also a remarkable series of bronze medallets or jettons, which form a continuous commentary on history during the 16th and early part of the 17th centuries. Both are interesting, as largely illustrating not only local events but also those of the chief European states. Such are the pieces recording the raising of the siege of Leyden, likened to the destruction of Sennacherib's army, the assassination of William the Silent, and the discomfiture of the Armada, affording striking indications of the zeal, the piety, and the confidence in the right which built up the great political structure of the Dutch republic. After this time the medals lose much of their interest.

The money of Switzerland illustrates the varying fortunes of this central state, and the gradual growth of the stronghold of European freedom. First we have the gold money of the Frankish kings, among whose mints Basel, Lausanne, St Maurice, Sitten (Sion), and Zurich already appear. The silver deniers, which Charlemagne made the coinage of the empire, are issued by fewer mints; the dukes of Swabia struck coins in Switzerland, and the empire granted during the 10th and to the 13th century the right of coinage to various ecclesiastical foundations, bishoprics, and abbeys. Bern and Zofingen were allowed mints by the emperor Frederick II., and the civic coinage of Switzerland then began in the period of the bracteates. Other towns gained the same right, as well as the counts of Kyburg, Hapsburg, &c. The 14th century witnessed the rise of the Swiss confederation, and by degrees the cantons struck their own money. These, together with the coins of some few sees and abbacies, form the bulk of Swiss money of the mediæval and modern periods. The separate cantonal coinage, interrupted by the French occupation, was finally suppressed in 1848, when a uniform currency was adopted by the whole republic. The monetary systems of the cantonal and ecclesiastical mints were extremely complicated. This was partly due to the variety of coins, partly to the debasement practised by the ecclesiastical mints. Geneva had a peculiar system of her own.

The most interesting coinages are those of Basel (the see, canton, and city), Bern, a large series, the see of Chur, the abbey of St Gallen, the great issue of Geneva (the bishopric, the city, and the canton), the see of Lausanne, Lucerne, the Forest Cantons, the bishopric of Sitten, and the long currency of Zurich. Some of the earlier large coins of the Middle Ages, particularly thalers, are interesting for their bold work and their sacred and heraldic subjects. Throughout the Swiss series we are awakened to a higher than archæological sentiment by the traditions and records of two great periods, the age when the Irish missionaries planted the faith in the wild valleys of the Alps, and the days when the cantons fought for freedom and smote their powerful oppressors on every side. The medals of Switzerland are mostly of modern times, and lack beauty and historical value.

Italy, with Sicily, has peculiar features. Here the barbaric coinages were mixed with the Byzantine issues which marked the recovery of the Eastern empire, and left a lasting influence in the north at Venice, and in the south at Beneventum. Later the Arab conquest left its mark in the curious Oriental coinages of the Normans of Sicily and the emperor Frederick II., mixed after his fashion with Latin coinage. The earliest money is that of the barbarians, Ostrogoths and Lombards, and local Byzantine issues in Sicily. This is followed by the deniers of Charlemagne and his successors, supplanted by the gold currencies of the Normans and Frederick II. The age of the free cities is marked by the great coinages of Florence, Venice, and Genoa, while the Angevin and Aragonese princes coined in the south, and the popes began to issue a regular currency of their own at Rome. The Italian princes of the next period coined in Savoy, and at Florence, Modena, Mantua, and other cities, while Rome and the foreign rulers of the south continued their mintages, Venice and Genoa of the republics alone surviving. The Italian monetary systems have already been touched on in the introductory notice. For art the series is invaluable. First in Italy the revival influenced the coins, and in them every step of advance found its record. The Italian medals are without rivals in the works of modern times.

Following the geographical order which is best suited to the Italian coinage, we first notice the money of Savoy, which is inferior in art to that of the rest of the country. It begins in early times, and merges in the class of the Sardinian kingdom, which becomes the kingdom of Italy. Genoa is the first of the great republics. She struck gold money from the time of the general origin of civic coinage in that metal; these are ducats and their divisions, and after a time their multiples also. In the 17th century there are very large silver pieces. In the money of Mantua there first occur really fine coins of Gianfrancesco III. (1484-1519) and Vincenzo II. (1626-1627), these last splendid examples of the late Renaissance, in large pieces of gold and silver; the portrait is fine, and the hound on the reverse a powerful design. The vicissitudes of the story of Milan find their record in no less than nine groups of money—Carlovingian deniers, money of the republic, then imperial again, next of the Visconti family, succeeded by that of the Sforza line, next of Louis XII. of France, of the restored Sforza, of Charles V. by Spanish right and his successors of Spain, and lastly of Austria. There are extremely fine coins of the 15th century, showing great beauty in their portraits. The money of Florence is disappointing in its art. The Athens of the Middle Ages had the same reason as her prototype to preserve as faithfully as might be the types and aspect of her most famous coin, the gold florin, and thus those who expect to see in this series the story of Italian art will be much disappointed. The silver florin was first struck in 1181. It is heavier than the denier, weighing about 27 grains, and bears the lily of Florence and the bust of St John the Baptist. These are thenceforward the leading types, the flower never changing, but the representation of the saint being varied. On the gold florin the Baptist is represented standing, while in the contemporary silver florins he is seated. In the 14th century the arms of a moneyer appear in the field, two such officers having had the right of striking yearly, each for six months. The coins of the duchy from 1532, in spite of their new types, are not a fine series; the best are those of Alessandro, designed by Cellini.

Venice as a mint even surpasses Florence in conservatism, and, the early style being distinctly Byzantine, this is the more striking in a great artistic city. We find Venice as an imperial mint issuing Carlovingian deniers, but the doges begin to coin, placing their own names on their currency, in the 12th century. The most famous silver coin, the matapane, was first struck in the brilliant time of Enrico Dandolo (1192-1205). This coin is a grossus weighing about 33 grains, with on the obverse St Mark giving the standard or gonfalon to the doge, both figures standing, and on the reverse the seated figure of the Saviour. The famous Venetian zecchino or sequin, the rival of the florin of Florence, appears to have been first issued under Giovanni Dandolo (1280-1289). On the obverse St Mark gives the gonfalon to the kneeling doge, and on the reverse is a standing figure of the Saviour within an oval nimbus. The matapane slightly changes after the second third of the 14th century, and at its close becomes a new coin, the grossetto. Niccolo Trono (1471-1473) introduces his portrait on most of his coins, but this custom is not continued. By the latest part of the 15th century large silver coins appear. The archaic style changes in the beginning of the 16th century, but there is no later movement. The large silver pieces increase in size, and large gold is also struck; the last doge, Ludovico Manin (1788-1797), issued the 100-sequin piece in gold, a monstrous coin, worth over £40. The doges of Venice issued a peculiar silver token or medallet, the osella, five of which they annually presented to every member of the Great Council. Antonio Grimani instituted this custom in 1521, and it lasted to the end of the republic. Two dogaressas struck similar medallets. Their types are usually allegorical; some are commemorative. As a class they resemble the Dutch copper jettons, but are less historical and hence less interesting.

The series of the coins of Rome is rather of historical than of artistic merit. The popes begin to strike money with Adrian I. (772-794 A.D.), whose deniers are in a Byzantino-Lombard style that characterizes the coinage of Beneventum. Before the papal coinage closes the senate asserts the right to a mint. We then see on the silver the style of the senate and Roman people, and ROMA CAPUT MUNDI. Some coins have the figures of St Paul and St Peter, others Rome seated and a lion. Charles of Anjon, king of Sicily, strikes as a senator. The gold ducat of about 1300 imitates the types of the Venetian sequin. St Peter here gives the gonfalon to a kneeling senator. The arms of the moneying senator next appear in the field. There are small copper pieces of the famous tribune Rienzi. The papal coinage is resumed at Avignon; and Urban V., on his return to Rome, takes the sole right of the mint. The subsequent coins, though they have an interest from their bearing on the history of art, are disappointing in style. There is indeed a silver coin of Julius II. struck at Bologna and attributed to Francia, with a very fine portrait. We have beautiful gold coins of Giovanni Bentivoglio, lord of Bologna, who employed Francia at his mint, and we know that the artist remained at his post after Julius II. had taken the city. There are also pieces of Clement VII. by Cellini, vigorous in design but careless in execution. The papal portraits are highly characteristic and interesting. It is, however, in the fine series of papal medals that we find a worthier artistic record.

The coinage of Sicily, afterwards that of the Two Sicilies, or Naples and Sicily, begins with the Normans. Theirs is a curiously mixed series. The gold money is almost wholly Arabic, though Roger II. struck the Latin ducat, the earliest of its class; the silver is Arabic, except the great Latin scyphati of Roger II. with Roger III.; the copper is both Latin and Arabic. The gold series of the emperor Frederick II. shows the first sentiment of reviving classical art, its work being far in advance of the age. These are Latin coins; he also struck small Arabic pieces in gold. Under Conrad, Conradin, and Manfred there is an insignificant coinage, copper only, but with Charles of Anjou (1266-1285) the gold money in purely mediæval style is very beautiful, quite equal to that of his brother St Louis of France. After this time there is a great issue of gigliati, silver coins with for reverse a cross fleurdelisée cantoned with fleurs-de-lis. These coins acquired a great reputation in the Levant, and were even struck by the emirs of Asia Minor. With Alphonso, the founder of the Aragonese line, we note the old style of the coins, which are in singular contrast to his fine medals. Good portraiture begins on the money of Ferdinand I., his successor. The later coinage is interesting only for its illustration of the varying fortunes of the Two Sicilies. There is a curious early gold coinage of the Lombard dukes of Beneventum, which follows the Byzantine type.

Italian medals are next in merit to the works of the Greek die-engravers. Their true beginning and highest excellence are under Vittore Pisano, the Veronese painter, who worked from 1439 to 1449. They are of two classes, the finer and more original, struck in the 15th century, and the more classical of the 16th, after which the style declines rapidly. In spite of classical influence, the earlier medals are independent works, marked by simple vigorous truthfulness. The designs are skilful and the portraits strongly characteristic, but deficient in beauty. As the art became popular the execution of medals passed into the hands of inferior artists, and by degrees striking became usual for the smaller pieces; at the same time, a slavish imitation of the classical style weakened or destroyed originality and stamped the works with the feebleness of copies. Yet the delicacy of design and technical skill of these later medals often give them an undeniable charm. The great medallists of the first age are Pisano, Matteo de' Pasti, Enzola, Boldu, Sperandio, Gentile Bellini, Bertoldo, Gambello, Filippino Lippi, and Francesco Francia, who in style belongs to the next age, in which must be mentioned Pomedello, Benvenuto Cellini, Leone Leoni, Giovanni Cavino "the Paduan," Pastorino of Siena, Giacomo da Trezzo, and Pietro Paolo Galeotto, called Romano. Among the most important works are all the medals of Pisano, particularly those of Alphonso the Magnanimous, with the reverses of the boar-hunt and the eagle and lesser birds of prey, those of Sigismondo di Malatesta, his brother surnamed Novello, Lionelle d'Este, John VIII. (Palæologus), Nicolo Piccinino, Inigo d'Avalos (marquis of Pescara), Gianfrancesco di Gonzaga (marquis of Mantua), Ludovico III. of the same family, the great humanist Vittorino da Feltre, and of the artist himself, a portrait eminently witnessing his fidelity to nature. He is great in portraiture, great in composition and design, and marvellously skilful in depicting animals. Pisano alone represents the moral qualities of his subject in their highest expression and even capability. That he has high ideal power is seen at once if we compare with his portrait Pasti's inferior though powerful head of Sigismondo di Malatesta. Pasti's medal of Isotta, wife of Sigismondo, is also noteworthy; likewise Gentile Bellini's head of Mehemet

II., the conqueror of Constantinople,—interesting works, lacking Pisano's technical skill. In the later age Cavino executed a wonderful series of imitations of Roman sestertii, which have been frequently mistaken for originals. In art these Italian works frequently surpass the originals in spite of a degree of weakness inseparable from copies. A comparison of the Italian with the Roman pieces is thus most instructive. The works of Pastorino of Siena are especially charming. Historically the Italian medals supply the defects of the coinages of Florence and Rome, and in a less degree of Venice. The papal series is invaluable as a continuous chronicle of art.

The money of Germany is like that of Italy far too various for it to be possible here to do more than sketch some of its main features. The metrological systems are Merovingian, Carlovingian, that of the bracteates, and those of the later mediæval and modern issues in a complicated form. There are several classes, the coinages of the emperors, the electors, the smaller lords, the religious houses, and the free towns. The art is behind that of Italy in time, and on the whole far inferior to it in merit. Some of the later mediæval examples are of good style, and the Renaissance is ushered in by some beautiful pieces. Yet other coins of this very time are surprisingly barbarous, and there is an immediate decline in the better works. The imperial money, even when limited to what is strictly German by the exclusion of the issues of the French and Italian mints, forms a large series. It begins with the deniers of Charlemagne; and, except the solidus of Louis I., for a long time there is no gold. The true bracteates begin under Frederick I.; the money of Frederick II. is chiefly of Sicily and Italy, and his gold Sicilian coins do not belong to the German series. Under the house of Austria there are fine dollars of Maximilian I., and a splendid double dollar on which the emperor appears as a horseman. It is after this time that art declines. Passing in review the currencies of the chief states, we are arrested by the historical dollars of Louis I., king of Bavaria, which have the merit of an excellent purpose. The series of Brandenburg, ultimately merging in that of Prussia, is not noteworthy but for some fine early medals. Brunswick shows the exceptional great mining-thalers, generally spread coins, multiples of the dollar 1½, 2, 3, 4, 5, 8, and 10. Cologne has a representative series. Striking under the Merovingian kings and the Carlovingian emperors, it continued an imperial mint until the reign of Otho IV. (1198-1218). The archbishops began to coin under Bruno (953-965), and only ceased in 1801. The city had also the right of coinage after the emperors ceased to exercise it, but her money is unimportant. The wealthy mart of Hamburg is chiefly remarkable for the great gold pieces of the 16th and 17th centuries, of the weight of 2½, 5, and 10 ducats, with the types of the city and the fleet and allegorical subjects. The city of Magdeburg shows a variety of bracteates. Mainz has the same features as Cologne, Merovingian and Carlovingian money, the imperial mint going on to the reign of Sigismund, who granted the city the right of coinage in 1420, so that a few civic coins were issued before the privilege was surrendered to the archbishops in 1462. The archbishops have a series of coins from 1021 to 1818. These comprise remarkable large bracteates of the 12th century, with curious ecclesiastical types, combining figures of saints and prelates with architectural detail. Of Nuremberg there is a long gold series, but the artistic fame of the city is not supported by her coinage. The electors palatine have a series in which we note the florin of Rupert IV. (1356-1390), followed by ducats. The money of the archbishops of Salzburg comprises some early pieces, but ranges mostly from the end of the 15th century, and is strong in gold. The Saxon lines are well represented. They begin with large bracteates of the 12th or 13th century, but the most interesting coins are of the age of the Reformation, bad in style and execution, but bearing characteristic portraits. The grandmasters of the Teutonic Order struck money second in importance to that of the knights of St John issued at Rhodes and Malta. The archbishops of Treves coined similar issues to those of their brethren of Cologne and Mainz to the year 1803.

The German medals stand in importance next to those of Italy. They have this distinctive peculiarity of origin, that their first artists, instead of being, as in Italy, painters or sculptors, were goldsmiths, the craftsmen of Nuremberg and Augsburg. Consequently minute work and love of chasing make them technically inferior as medals to the Italian works, though these qualities are balanced by great vigour and truthfulness. Later in origin than the rival school, the German dates from the early part of the 16th century. Albert Durer is the greatest medallist, and his medals are wholly superior to those of a mere worker in metal. Heinrich Reitz is next in merit. The portrait of Albert Durer's father by the artist, and a female bust in very low relief, are of high excellence. For historical interest the heads of Luther, Erasmus, Charles V., Maximilian and Mary of Burgundy are very noteworthy. The subject of German medals has not yet been sufficiently studied.

The coins of the Scandinavian states, Norway, Denmark, and Sweden, are almost wholly regal, there being few ecclesiastical and civic pieces. The origin of the types is clearly English and due to the Danish conquest of England. The Norwegian series begins with the pennies of Harold Hardrada, slain at Stamford Bridge; there are next bracteates, and then coins of the Danish kings. The money of Denmark begins with pennies of Cnut (Canute), which are like his English mintage; so also are those of Hardicanute, but Magnus and Svend Estridsen have some very Byzantine obverse types, which is curious in connexion with the relations of the Norsemen to the Byzantine emperors. Later coins are of German types and barbarous work. A good mediæval style begins with Erik of Pomerania. Later coins are not remarkable. Sweden has very few early coins, their denominations being the penny and the bracteate. There are good mediæval coins of Albert of Mecklenburg (1363-1387). The money of Gustavus Adolphus is historically interesting. Under Charles XII. there is highly curious money of necessity. The daler is struck as a small copper coin, sometimes plated. The types include the Roman divinities. At the same time and later there was a large issue of enormous plates of copper, stamped with their full value in silver money as a countermark.

The Russian coinage begins in the 15th century. It consists of very curious little silver pieces struck under Byzantine influence. Gold is common in the reign of Peter the Great and of fair style, though the silver is at first of the old barbarous type. Nicholas introduced a platinum coinage of about two-fifths the value of gold. The series of Poland begins in the 11th century with bracteates. There is a regular coinage from Uladislaus Jagello (1382-1434). The town of Dantzic, while part of the kingdom, is remarkable for the issue of large gold pieces with the kings' portraits and civic reverses, the most important being of the 16th and 17th centuries. Hungary has its own coinage from Stephen I. (1000-1038). Under Charles Robert of Anjou (1308-1342) the florin is introduced, and appears also with the type varied as a ducat. The money of the illustrious John Hunyady as regent is of high interest. The abundance of gold about this time and onwards shows the metallic wealth of the land. The Hungarian money of the house of Austria presents no noteworthy features. The coinage of the Transylvanian princes of the 16th and 17th centuries is chiefly of ducats, witnessing, like the Hungarian, to the wealth of the soil. There are early coins of the patriarchate of Aquileia and of the kingdom of Servia, now revived after four centuries and a half of subjugation, whence the only interest of the modern money as well as of that of Roumania and Greece.

There is a most interesting class of coins struck during the Middle Ages within the limits of the present Turkish empire, the money of the Crusaders and other Latin princes of the East. The multitude of states thus designated have been classed by Schlumberger, the authority on the subject, in the following order, the chief divisions of which are here given:—first group, principalities of Syria and Palestine, counts of Edessa, princes of Antioch, kings of Jerusalem, counts of Tripoli, fiefs of Jerusalem, crusaders who struck imitations of Arab coins, kings of Cyprus, lords of Rhodes, grandmasters of the order of St John at Rhodes, to which may be added the later grandmasters at Malta; second group, Latin emperors of Constantinople, Frankish princes and lords of Greece and the Archipelago whose power was due to the crusade of 1204, such as the princes of Achaia, the dukes of Athens, Neapolitan kings who struck money for their Eastern possessions, Latin lords of the Archipelago, the Genoese at Chios, the Gattilusi at Mytilene, the Genoese colonies, the Venetian colonies, the Turkoman emirs of western Asia Minor who struck Latin coins. The most important currencies are the copper of the counts of Edessa, the billon and copper of the princes of Antioch and the kings of Jerusalem, the silver and copper of the counts of Tripoli, and the gold imitations of Arab dînârs, the currency in that metal of the crusaders of Palestine. These *Bisantii Sarracenati*, or Saracen bezants, are at first imitations of Fatimite dînârs, known to have been struck by Venetian moneyers at Acre, and probably at Tyre and Tripoli also. After these coins had been current for nearly a century and a half they were forbidden on account of their Mohammedan aspect by Pope Innocent IV. The Venetians then issued gold and silver coins with the same aspect but with Christian inscriptions. The kings of Cyprus issued a really good coinage in the three metals and in billon. The last money of the kingdom is the fixed currency of the gallant Bragadin during the war which lost the island to the republic. The coinage of the order of St John begins on the conquest of the island of Rhodes and the suppression of the Templars; the earliest coins known are of Foulques de Villaret, the first grandmaster at Rhodes in the earliest years of the 14th century, and the last of the Rhodian series are of Villiers de l'Isle-Adam, the gallant defender of the island who was forced to capitulate to the Turks and sail for a new home in 1523. The coinage is of fine gold, silver, billon, and copper. On the establishment of the order at Malta in 1530 it is resumed there till the capture of the island by the French at the close of last century; it has little interest except as showing the wealth of the order. The other currencies of the crusaders, notwithstanding their great historical interest, are far less remarkable numismatically.

Of the money of America little need be said here. Neither the coinages of the Spanish and Portuguese dependencies, and of the states which succeeded them, nor those of the English colonies and of the United States, present much that is worthy of note. In style they all resemble those of the parent countries, but, originating in the decline of art, they are inferior in style and work. They are most remarkable in the south for the abundance of gold and silver. The chief coin is the dollar. Some coins are of historical interest, and there are a few rarities, such as the colonial money of Lord Baltimore struck for Maryland, the pine-tree coins of Massachusetts, and the hog-money of Bermuda.

IV.—ORIENTAL COINS.

Oriental coins may be best classed as ancient Persian, Arab, nodern Persian and Afghan, Indian, and Chinese, and other issues f the far East. The first place is held by the money of the old ersian empire, the Parthians, and the Sasanians. The conquests f the Arabs introduce a new currency, carried on by the Moslem nheritors of their empire. The modern Persian and Afghan money, though of Arab origin, is distinguished by the use of the Persian language with Arabic. The Indian currencies, though Greek, Sanskrit, Arab, and Persian in their inscriptions, must be grouped together on account of their mutual dependence. They rise with the Bactrian kings, whose Greek types are gradually debased by the Indo-Scythians and Guptas; these are followed by a group of currencies with Sanskrit legends; next follow the money of Arab conquerors and the great series of the Pathans of Delhi and subsidiary dynasties, with Arabic inscriptions; the main series is continued in the currency of the Moguls, who largely use Persian, and the last series is closed by local currencies mainly with Sanskrit or Arabic legends. The Chinese coinages form the source and centre of the group of the far East, which, however, includes certain exceptional issues. The order throughout is historical, each empire or kingdom being followed by the smaller states into which it broke up, and then by the larger ones which were formed by the union of these fragments.

The Persian coinage was originated by Darius I. (Hystaspis) about the time that he organized the empire in satrapies (516 B.C.). The regular taxation thus introduced made a uniform coinage necessary. Avoiding the complex gold system of Crœsus, which was intended to accommodate the Greek cities in commercial relation with Lydia, Darius chose two weights, the gold stater of Crœsus of 126 grains and the silver drachm of 84. He raised the weight of both, the gold to about 130 grains and the silver to 86. Thus one gold piece was equal to twenty silver. The gold coin was called the daric, the silver the siglus. The metal was very pure, especially that of the daric. Thus not only were the Lydian gold and silver coins of inferior weight thrown out of circulation, but the Persian gold, from its purity, became dominant, and was the chief gold currency of the ancient world so long as the empire lasted. The issuing of gold was a royal prerogative. Silver money was coined not only by the king but in the provinces by satraps, who used local types, and by tributary states. The following classes must be distinguished: (1) regal, (2) provincial with regal types, (3) satrapal, (4) of tributary states. The art of Persian coins varies according to the locality, from the beautiful work of the west coast of Asia Minor to the more formal style of Cilicia and the thoroughly hieratic stiffness of Phœnicia and Persia.

The regal coinage is of darics and double darics in gold and of sigli in silver. The obverse type is the king as an archer, the reverse an irregular oblong incuse. The darics show differences of style, and must extend through the whole period of the empire. The sigli no doubt run parallel with them. Both these denominations are uninscribed. The double darics are of late style, and nearly all bear either Greek letters or monograms or symbols, sometimes both. They are undoubtedly of the last age of the empire or subsequent to its fall.

The provincial coins with regal types appear to be mostly Phœnician; the most important classes have been already noticed. But they also occur beyond this territory, as at Mallus in Cilicia, where the Persian regal archer is combined with the reverse of Heracles strangling the Nemean lion, with the inscription MAΛ.

The satrapal coinage is very important and interesting. It belongs mainly to Cilicia. The most remarkable series is that with a bearded head wearing a tiara, with various reverses, certainly struck at Colophon, Cyzicus, and Lampsacus, and in one instance bearing the name of the satrap Pharnabazus, but usually the word "king" in Greek. The coin of Colophon shows a splendid portrait, one of the finest instances of Ionian work. It has been held to represent Artaxerxes II. (Mnemon), but has been lately assigned to Pharnabazus on the ground that the head-dress is not the proper regal kidaris. This is an objection, yet it seems inconceivable that the king of Persia would have countenanced the issue of the portrait of a satrap at a time when no Greek dynast dared to place his head on his own coinage. Of other satrapal issues those of Datames, of Tiribazus, and Cilician issues, struck at Tarsus, are specially noteworthy. Their inscriptions are Aramaic.

The coinages of the tributary states have been in part noticed in their geographical order; it is difficult to separate them from the provincial issues with regal types.

The conquest of Alexander did not wholly destroy the independence of Persia. Within less than a century the warlike Parthians, once subjects of Persia, revolted (249-8 B.C.) against the Seleucids and formed a kingdom which speedily became an empire, ultimately the one successful rival of Rome. Their money is Greek in standard and inscriptions, as well as in the origin of types. The coins are silver, following the Attic weight, the chief piece being the drachm, though the tetradrachm is not infrequent; there are also bronze coins, but none in gold are known. The drachm has the head of the king on the obverse, diademed or with a regal head-dress, and on the reverse the founder Arsaces seated, holding a strung bow, the later tetradrachms varying this uniformity. Every kind is styled Arsaces, to which many of the later sovereigns add their proper names. The inscriptions are usually long, reaching a climax in such as **ΒΑΣΙΛΕΩΣ ΒΑΣΙΛΕΩΝ ΑΡΣΑΚΟΥ ΜΕΓΑΛΟΥ ΔΙΚΑΙΟΥ ΕΠΙΦΑΝΟΥΣ ΘΕΟΥ ΕΥΠΑΤΟΡΟΣ ΦΙΛΕΛΛΗΝΟΣ** of the 11th Arsacid, Mithradates III., where we see the double influence of Persian and Seleucid styles and the desire to conciliate the Greek cities. Very noticeable are the coins which bear the portraits of Phraataces (14th king) and his mother, the Italian slave Musa, with the title queen (**ΘΕΑΣ ΟΥΡΑΝΙΑΣ ΜΟΥΣΗΣ ΒΑΣΙΛΙΣΣΗΣ**).

The Persian line of the Sasanians arose about 220 A.D., and wrested the empire from the Parthians in 226-7, under the leadership of Ardashir or Artaxerxes. This dynasty issued a national and thus Oriental coinage in gold and silver. The denominations follow the Roman system, and there are but two coins, equivalent to the aureus or solidus and the denarius. The obverse has the king's bust, usually wearing a very large and elaborate head-dress, varied with each sovereign, and on the reverse the sacred fire-altar, ordinarily flanked by the king and a priest. The attachment which Ardashir, the founder, bore to Zoroastrianism established this national reverse type, which endured through the four hundred years of the sovereignty of his line. The inscriptions are Pahlavi.

The Arab coinage forms the most important Oriental group. It has a duration of twelve centuries and a half, and at its widest geographical extension was coined from Morocco to the borders of China. When the Arabs made their great conquests money became a necessity. They first adopted in the East imitations of the current Persian silver pieces of the last Sasanians, but in Syria and Palestine of the Byzantine copper, in Africa of the gold of the same currency. Of these early coins the Sasanian imitations are very curious with Pahlavi inscriptions and shorter ones in Arabic (Cufic). The regular coinage with purely Moslem inscriptions begins with the issue of a silver coin at Basrah, in 40 A.H., by the caliph 'Alí; after subsequent efforts thus to replace the Sasánian currency, the orthodox mintage was finally established, in 76 A.H., by 'Abd al-Melik. The names of the denominations and the weight of that of gold are plainly indicative of Byzantine influence. There were three coins. The dinár of gold took its name from the aureus or denarius aureus, of which the solidus must have been held to be the representative, for the weight of the Arab coin, 66 grains and a fraction, is clearly derived from the Byzantine gold piece. The dirhem of silver is in name a revival of the Greek drachm; it weighs at most 45 grains and a fraction. The copper piece is the fels, taking its name from the follis of the Greek empire. Commercially the gold easily exchanged, and the silver soon passed as the double of the Carlovingian denier. For long these were the only coins issued, except, and this but rarely, half and quarter dinárs. There are properly no types. There was indeed an attempt in the early Byzantino-Arab money to represent the caliph, and in the course of ages we shall observe some deviations from the general practice of Islam, particularly in the coinage of the atábegs and in Mohammedan coinages not of the Arab group, the modern Persian and that of the Moguls of Delhi. The inscriptions are uniformly religious, save in some Tatar coinages and that of the Turks. In general the coins are for the first five centuries of their issue remarkably uniform in fabric and general appearance. They are always flat and generally thin. The whole of both sides of the coins is occupied by inscriptions in the formal Cufic character, usually arranged horizontally in the area with a single or double band around. Towards the fall of the caliphate a new type of coin begins, mainly differing in the greater size of the pieces. There are new multiples of the dinár and ultimately of the dirhem, and the silver pieces frequently have their inscriptions within and around a square, a form also used for gold. The Cufic character becomes highly ornamental, and speedily gives way to the flexuous naskhí of modern writing. The inscriptions are religious, with the addition of the year by the era of the Flight, the month sometimes being added, and the mint occurs uniformly on silver and copper, but does not appear on the gold until after the fall of the Omayyad dynasty. Subsequently the official name of the caliph occurs. The religious part of the inscriptions is various, the most usual formulæ being the profession of the Moslem faith: "There is no deity but God; Mohammed is the apostle of God," to which the Shí'ites or followers of 'Alí in Persia and Africa add "'Alí is the friend of God." The Moorish coins give long formulæ and religious citations and ejaculations, and they, like the money of the Pathans of Delhi of the Indian class, have occasionally admonitions urging or suggesting the purer use of wealth. As Arab and other dynasties arose from the dismemberment of the caliphate; the names of kings occur, but for centuries they continued to respect the authority of their religious chief by coining in his name, even in the case of the shadowy 'Abbásids of Egypt, adding their own names even when at war with the caliph, as though they were mere provincial governors. After the fall of the caliphate nine new denominations came in, chiefly of heavier weight than the dirhem and dinár, but the influence of the commercial states of Italy made the later Egyptian Mamelukes, the Turks, and the later Moors adopt the gold sequin. In more modern times the dollar found its way into the Moslem coinage of the states bordering on the Mediterranean. It can be readily seen that Arab coins have no art in the same sense as those of the Greeks. The beautiful inscriptions and the arabesque devices of the pieces of the close of the Middle Ages have, however, a distinct artistic merit.

The Omayyad coins owe their only historical value to the evidence which the silver affords of the extent of the empire at different times. The first separation of that empire dates from the overthrow of this dynasty by the 'Abbásids, speedily followed by the formation of the rival Omayyad caliphate of the West with its capital at Cordova. The 'Abbásid money has the same interest as that which it succeeded, but its information is fuller. Towards the fall of the line it becomes very handsome in the great coins, which are multiples of the dínár. The Spanish Omayyads struck silver almost exclusively. Their rise was followed by that of various lesser lines—the Edrisids (Æ) and Aghlabids (N chiefly) in western Africa, the Benî Túlún (N), and, after a short interval, the Ikhshídids (N), both of Turkish origin, in Egypt. Meanwhile a new caliphate arose in western Africa which subdued Egypt, the Fátimite of the line of 'Alí, and for a while the allegiance of the Moslems was divided between three rival lines, the Omayyads of Spain, the Fátimites of Africa, and the 'Abbásids of Baghdád. The Fáṭimites introduced a new type of dinár, with the inscriptions in concentric circles, and struck little but gold. In the interim the Persians, who had long exercised a growing influence at the court of Baghdád, revived their power in a succession of dynasties which acknowledged the supremacy of the caliphate of Baghdád, but were virtually independent. These were the Ṭáhirids, Ṣaffárids, Sámánids, Ziyárids, and Buweyhids, who mostly struck silver, but the last gold also. As the Persians had supplanted the Arabs, so they were in turn forced to give place to the Turks. The Ghaznawids formed a powerful kingdom in Afghánistan (N, Æ), and the Seljúks established an empire (N), which divided into several kingdoms, occupying the best part of the East. Of these dynasties the Seljúks of Rúm or Asia Minor first strike a modern type of Arab coinage (Æ). The Seljúk dominions separated into many small states, the central ruled by atábegs or generals, and the similar Turkoman Urtukees. The atábeg money and that of the Turks of the house of Urtuk are mainly large copper pieces bearing on one side a figure borrowed from Greek, Roman, Byzantine, and other sources. They form a most remarkable innovation. In the same age the great but short-lived empire of Kharezm arose in the far East. The first caliphate to disappear was that of Spain, which broke up into small dynasties, some claiming the prerogative of the caliphates. They chiefly struck base silver (billon) coins. The Christian kings gradually overthrew most of these lines. In the meantime various Berber families had gained power in western Africa and the Murábits (Almoravids) and Muwaḥḥids (Almohadis) crossed the straits and restored the Moslem power in Spain. They struck gold money of fine work, and that of the later Muwaḥḥids is remarkable for its size and thinness. At the fall of the Muwaḥḥids the only powerful kingdom remaining was the Arab house of Granada, which; supported by the Berbers of Africa, lingered on until the days of Ferdinand and Isabella. The Fátimite dynasty was supplanted by the Kurdish line of the Eiyúbis, the family of Saladin, who ruled Egypt, Syria, and Mesopotamia, with a number of vassal states, some governed by princes of their own family, some by the older lines of the atábeg class which they allowed to survive. In Egypt the Eiyúbi coinage is of gold, elsewhere of silver and copper. The caliphate of Baghdád, which latterly was almost limited to that town, though its abundant heavy gold coinage at this very time indicates great wealth, was overthrown by the new power of the Mongols (1263 A.D.), who established a group of empires and kingdoms, comprising the whole Eastern world eastward of the Euphrates and thence extending northward and reaching into Europe. The most important of these states for their money are that of the Mongols of Persia, founded by Hulagu, the conqueror of Baghdád, and that of the khans of the Golden Horde. Both struck silver, but there is also gold coinage of the Mongols of Persia, who more frequently use the Mongol character for their names and titles than is done under the kindred line. The power of the Mongols was held in check by the Mameluke kings of Egypt, slave-princes, who struck money in the three metals. The Mongol power waned, but was revived by Timur, who during his rule (1397) recovered all that had been lost. He and his successors struck silver, copper, and brass money. The Turks, whose power had been gradually growing, after a desperate struggle with Timur, gradually absorbed the whole Mohammedan world west of the Tigris, except only Morocco, where they had but a momentary dominion. Their money, of gold, silver, base metal, and bronze, is devoid of historical interest. In Tunis and Morocco a group of Berber lines long maintained themselves, but at length only one survived, that of the sherifs of Morocco, claiming Arab descent, now ruling as the sole independent Moslem dynasty of northern Africa. Its recent coinage is singularly barbarous. It may be remarked that Tunis and Egypt have long coined Turkish money in their own mints, the more western state latterly adding the name of its hereditary prince to that of the sultan.

The coins of the shahs of Persia have their origin with Ismá'íl (1502). They are struck in the three metals, and are remarkable for the elegance of their inscriptions, sometimes in flowing Arabic, sometimes in the still more flexuous native character. The inscriptions are at first Arabic; after a time the religious formulæ are in this language and the royal legend in Persian, usually as a poetical distich. The Persian series is also remarkable for the autonomous issues of its cities in copper, the obverse bearing some type, usually an animal. The coins of the Afghans form a class resembling in inscriptions those of the Persians, and equally using Persian distichs. They commence with Ahmad Sháh Durani.

The Indian series begins with the money of the Greek kings of western India, commonly known as Bactrian,—a misnomer, only the earlier sovereigns having ruled Bactria. Between Alexander's money and the Græco-Indian series there is a curious class, the very rare gold and silver of Andragoras, dynast of Parthia, and the silver of an Indian prince, Sophytes. The Græco-Indian weight is at first Attic; coins are struck of gold, silver, bronze, and rarely nickel. The gold stater is limited to the earlier kings; the silver tetradrachm is struck at first with divisions; the Persic didrachm and drachm ultimately supersede it; the bronze is either round or of the square form peculiar to India. The types are Greek and very various. The inscriptions are at first Greek, but at an early time a native Indian inscription appears as a concession; it occupies the reverse of bronze, and in time of silver money, and gives a translation of the Greek inscription. The character used is of two Indian alphabets, the common one being styled Bactrian Pali. Diodotus, the first Græco-Indian king, revolted against the Syrian ruler about 250 B.C.; his money is Greek in its art. Under Euthydemus I., the next king, begins that peculiar style which gives these coins their special interest. It is realistic and vigorous, in portraiture reminding us of the best Italian medals. This is in part due to the leading away of the artists from Greek models to portray another race, for the heads are unmistakably Indian; but it is also significant of an innate strength not to be traced in the portraits of the Ptolemies and the Seleucids. Here we plainly see the first impulse of Greece in the formation of Indian art, after it had been influenced by working in a new atmosphere. The portrait of Demetrius in an elephant's skin is very remarkable, and should be compared with the wholly ideal treatment of that of Alexander on the coins of Alexander IV. struck in Egypt. After one reign later the order of kings becomes obscure, but the style gives the relative ages of groups, which must be the money of contemporary lines. Agathocles is noticeable for having struck commemorative coins of Alexander the Great, Diodotus, and Euthydemus I. Another characteristic portrait is that of Antimachus in the petasus or Greek hat. Eucratides struck the only Greek gold medal known to us, the great piece weighing twenty staters, now in the French cabinet. The later Greek money is of less interest; it ends with Hermæus, perhaps about 50 B.C. Then follows a group of dynasts with barbarous names, who adhere more or less closely to Greek originals. A Parthian class breaks in in consequence of the conquests of Mithradates I. The Indo-Scythian class, which is of much interest, is fixed approximately to periods by finds in which aurei occur ranging from the earlier Roman emperors to the Antonines. This coinage is of gold and bronze, silver being almost unknown. The weights are Roman. The types are usually the figure or the bust of the king, and on the reverse a divinity. The inscriptions are first Greek and the ordinary Indian of the Græco-Indian coins, then, strangely, Greek only, barbarous enough. Cadphises strikes the double aureus and the aureus. Under Canerces and his successors we notice aurei with an uncommon variety of divinities of Indian, Persian, Greek, and Roman mythology, as well as Buddha. The Gupta series is contemporary with the Indo-Scythian. It was struck in Kanauj, in the centre of northern India. It is a remarkable gold coinage, good and debased, as well as bronze. The mythological types are Indian alone, interesting and in good native style, which now first appears on coins in a pure form. The inscriptions are in Sanskrit letters. There is a series of silver coins struck in Cacch (Cutch) by the Sáh kings of Saurastrán; they are derived from the later money of the Græco-Indian class. The types are royal portraits and Buddhist emblems, &c., of no great interest.

Quite as early as the invasion of Alexander, if not earlier, is a most curious class of square silver and bronze coins, punch-marked with a variety of devices, which circulated in northern India, and probably originated the square bronze coinage of the Græco-Indian kings.

The Arabs in the first days of conquest had subdued Sind, and founded an independent state on the banks of the Indus; but it is hard to subdue India from this direction, and the strangers decayed and disappeared. The Pathan kings came of the Ghuri stock which rose on the ruins of the empire of Ghazneh. Mohammad ibn Sám made Delhi his capital, and here he and his successors, Pathans or slave-kings, ruled in great splendour, latterly rivalled by a line of Pathans of Bengal. Of the Pathans of Delhi we have an abundant coinage, the principal pieces being the gold mohur of about 168 grains, and the silver rupee of about the same weight, besides many pieces of bronze, and at one period of base metal. The coins are large and thick, with the profession of Islam or the style of the caliph on one side, on the other the name and titles of the reigning king. Mohammad ibn Taghlak struck coins with a great variety of inscriptions, some in the name of the shadowy 'Abbásid caliphs of Egypt, whose successors were for a time similarly honoured by later sovereigns. Towards the close of the rule of the Pathans several dynasties arose in central and southern India and struck similar money, the kings of Guzerat, of Málwá, and of the Deccan. The Pathan lines closed with Shér Sháh, an Afghan, the last ruler of Bengal. Bábar, the Turki, of the family of Timur, seeking a kingdom, adventured on the conquest of Hindustan; and after long wars with Shér Sháh, carried on by Bábar's son Humáyún, the famous Sháh Akbar, grandson of the invader, was at length peaceably settled on the throne of Delhi, and he and his successors, the so-called Moguls of Delhi, practically subdued the whole of India. They retained the existing standard, but used the Arabic and Persian languages like the shahs of Persia. Akbar (1556) issued a splendid coinage in gold and silver, far more elegant than that of the Pathans, but the money of his son, Jahángir, is still more remarkable. He issued the famous zodiacal mohurs and rupees, as well as those astonishing Bacchanalian mohurs on which he is represented holding the wine-cup. Scarcely less strange is the money of the beautiful queen Núr-Jahán. Under Sháh Jahán there is a visible falling away in the merit of the coins, and an ordinary modern style is reached in the reign of Aurungzeb. To the close of the rule of Sháh 'Alam, the last Mogul who actually reigned, gold and silver money is abundant. Latterly, native states coin with Arabic and also with Sanskrit inscriptions. The most important are the kings of Oude, the nizams of the Deccan, and the kings of Mysore, besides the maharajas of Indore and the kings of Nepál. The coinage of Tipu Sultán (Tippu Ṣáhib) is extremely curious from his innovations in the calendar. Besides those there are a multitude of small states. Most of the Indian princes acknowledged the emperor of Delhi, but some struck independently. At last the English coinage of India has swept away nearly all these moneys, though some native states still issue their own, while those under English protection occasionally acknowledge on their coins the supremacy of the queen as empress.

It is not yet possible to give a full summary of the strange coinages of China and the farther East, the published researches having been generally uncritical and unsupported by the examination of native literary sources. Thus only some general facts may be safely stated.

The money of China, more certainly than the square punch-marked coinage of India, may claim an origin independent of the Lydian and Greek issues. The oldest specimens may be assigned to the 6th century before our era, a time at which the existing coins of other nations could scarcely have been known in the far East; nor is there any connexion in form, type, or metal with the other currencies. Like nearly all subsequent Chinese money, the earliest is of bronze and cast. The shapes of the coins are most eccentric, representing knives, and, in De la Couperie's opinion, mining-tools. To these succeed the well-known round pieces with a square hole in the centre for the purpose of stringing them together, the coins to which the name "cash" is applied by Europeans. The value of these coins depended on the weight, which is inscribed upon them. We must, however, bear in mind that we have frequently to deal with a merely conventional weight and value due to financial schemes. Thus the inscription always records official value, but not always true weight or true value. There is no type whatever, but always an inscription on one or both sides. The occurrence of an occasional symbol cannot be held to be a deviation from this rule. The main inscription is usually placed opposite the four sides of the central square on the obverse. As a rule this inscription at its fullest gives the emperor's official name during life, and the value of the coin and an indication of its authoritative exactness. When a reverse inscription is introduced, it gives the value of the coin. The inscriptions are in Chinese characters of different kinds, and under the present dynasty Manchu has also been employed. Some coins bear indications of mints. The most interesting Chinese coins are those of small rival dynasties and of rebels, the study of which is important for the elucidation of the obscurities of the history of the country. The Chinese medals are talismans, usually larger than the coins, and bear both subjects and inscriptions. They are distributed by Taouist and Buddhist priests of temples. The money of Corea and Annam is similar to that of China, and Chinese coins were long the currency of Java, which more recently has issued the money of its Mohammedan princes.

The empire of Japan shows in its coinage that Chinese source modified by the influence of native independence which marks all its institutions. Thus, while the copper currency closely resembles that of China, there is also a gold and silver coinage. The gold consists of plates of the form of a flattened oval with large inscriptions in indian ink painted on the surface, and small contermarks punched into it. The "cobang," which is the largest coin, was chiefly used for presents by the Japanese princes. Its intrinsic value is about £25. There are several lesser denominations in gold, and a series of silver pieces, the larger ingots, used as presents to inferiors, and the smaller, which are sometimes of a long rectangular shape, more properly a silver currency. There are also temple medals of a magical character like those already noticed as cast in China.

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Notwithstanding the general books covering many sections for which no special works are indicated, it will be felt that this list is very deficient. This is partly due to the multitude of essays in various periodicals, but mainly to the neglect of certain branches of the subject and to the want of full catalogues of the great collections of Europe. (R. S. P.)

NUMMULITE. See FORAMINIFERA, vol. ix. p. 380.

NUN. See MONACHISM, vol. xvi. p. 698.

NUNCIO, or NUNTIUS APOSTOLICUS. See LEGATE, vol. xiv. p. 412.

NUNEATON, a market-town of Warwickshire, England, is situated near the Leicestershire border, on a branch of the river Anker, on the Coventry Canal, and on three railway lines, 97 miles north-west of London, and 22 east of Birmingham. It consists principally of one long street with a cross street leading to the market-place. The church of St Nicholas is a large and handsome structure in various styles of architecture, and consists of nave, chancel, and aisles, with a square embattled tower having pinnacles at the angles. It contains several interesting monuments. The new church of St Mary the Virgin was erected in 1877 on the ruins of the old priory. A free grammar-school was founded in the reign of Edward VI., and an English free school for the instruction of forty boys and thirty girls by Richard Smith in 1712. A library and reading-room was established in 1851, and a literary institute in 1865. The ribbon industry is of less importance than formerly, but there are ironworks, cotton, hat, elastic, and worsted factories, curriers, and tanneries. Nuneaton derives its name from a priory of nuns founded here in 1150. In the reign of Henry III. a weekly market was granted to the prioress. The population of the urban sanitary district (area 6021 acres) in 1871 was 7399, and in 1881 it was 8465.

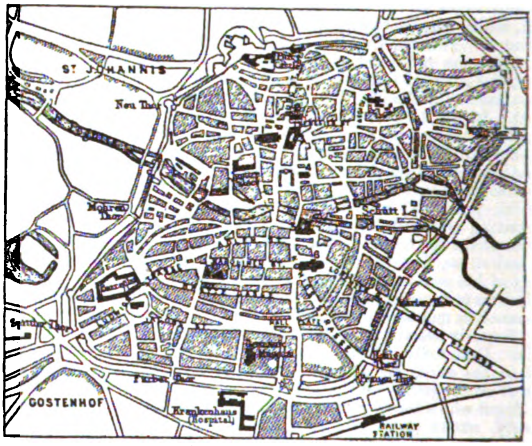
NUÑEZ or **Nonius, Pedro**, Portuguese cosmographer, was born at Alcacer do Sal in 1492, and died at Coimbra, where he was professor of mathematics, in 1577. He published several works, including a copiously-annotated translation of portions of Ptolemy (1537), and a treatise in two books, *De arte atque ratione navigandi* (1546). See Navigation.

NUÑEZ CABEZA DE VACA, Alvaro (*c.* 1490-1564), Spanish explorer, was the lieutenant of Pamfilo Narvaez (*supr.* p. 234) in the expedition which sailed from Spain in 1527; when Narvaez was lost in the Gulf of Mexico, Cabeza de Vaca succeeded in reaching the mainland somewhere to the west of the mouths of the Mississippi, and, striking inland with three companions, succeeded, after long wandering and incredible hardship, in reaching the Pacific coast in 1536. Returning to Spain in 1537, he was appointed "adelantado" or administrator of the province of Rio de la Plata in 1540. Sailing from Cadiz in the end of that year, after touching at Cananea (Brazil), he landed at the island of St Catharine in the end of March 1541. Leaving his ships to proceed to Buenos Ayres, he set out in November with about 150 men to find his way overland to Ascension (Asuncion) for the relief of his countrymen there. After an interesting journey through the country of the Guaranis, the little band reached their destination in the following year. After various successes in war and diplomacy, in his dealings with the Indians, Nuñez quarrelled with his countryman Domingo de Irala, whose jealousy he had excited, and the final result was that he was sent home under arrest in 1544, and banished to Africa by the council of the Indies. Eight years afterwards he was recalled, and appointed to a judgeship in Seville, where he died in 1564.

The *Naufragios* ("Shipwrecks") of Cabeza de Vaca, which relate to the Florida expedition and his journey through what is now New Mexico, appeared at Valladolid in 1544; the work has frequently been reprinted, and an annotated English translation was published by Buckingham Smith in 1851. His *Comentarios* chronicle the events of the South American expedition. Both works occur in Barcia's *Hist. Prim. d. l. Ind. Occ.*

NUREMBERG (in German, *Nürnberg*), the second town of Bavaria in size and the first in commercial importance, is situated in the district of Middle Franconia, in a sandy but well-cultivated plain, 95 miles to the north-west of Munich. It is divided by the small river Pegnitz into two parts, called respectively the Lorenzerseite and the Sebalderseite, after the two principal churches.

Formerly among the richest and most influential of the free imperial towns, Nuremberg is one of the few cities of Europe that have retained their mediæval aspect substantially unimpaired. It is still surrounded with its ancient feudal walls and moat, though of late several breaches have had to be made to meet the exigencies of modern traffic. Of the 365 towers which formerly strengthened the walls, nearly 100 are still *in situ*, and a few of the interesting old gateways have also been preserved. Most of the streets are narrow and crooked, and the majority of the houses have their gables turned towards the street. The general type of architecture is Gothic, but the rich details, which are lavished with especial freedom in the interior courts, are usually borrowed from the Renaissance. Most of the private dwellings date from the 16th century, and there are almost none of earlier date than the 15th century. A praiseworthy desire to maintain the quaint picturesqueness of the town has induced most of the builders of new houses to imitate the lofty peaked gables, oriel windows, and red-tiled roofs of the older dwellings; and it is easy for the visitor to Nuremberg to fancy himself carried back to the Middle Ages. Altogether it is difficult to conceive of a more piquant contrast than that afforded by the two chief towns of Bavaria—Munich, stamped with the brand-new impress of the 19th century, and Nuremberg, presenting a faithful picture of a well-to-do town of 300 years ago.



Plan of Nuremberg.

1. Church of St Sebald.
2. Library.
3. Town House.
4. Church of Our Lady.
5. Museum.
6. Church of St Lawrence.

A good survey of this interesting town may be obtained from the old burg or castle, picturesquely perched on the top of a rock on the north side of the town. It is supposed to have been founded by the emperor Conrad II. about the year 1024, and dates in its present form mainly from the reign of Frederick Barbarossa (*c.* 1158). It was restored in careful harmony with its original appearance in 1854-56, and part of the interior is fitted up as a residence for the royal family. The two Late Romanesque chapels, one above the other, are interesting; the lower was the burial-place of the burggraves. Among the instruments of torture preserved in the castle is the famous "Iron Virgin" of Nuremberg. In the court is a linden tree said to be over 700 years old. The castle of Nuremberg was a favourite residence of the emperors of Germany, and the imperial regalia were kept here from 1424 to 1806.

Nuremberg contains numerous interesting churches, the finest of which are those of St Lawrence, St Sebald, and Our Lady, three Gothic edifices of the 13-15th centuries. All three are notable for their elaborately-carved doorways, in which free play has been given to the exuberant fancy of the Gothic style, and all three enshrine valuable treasures of art. In the church of St Lawrence, the largest of the three, is the masterpiece of the sculptor

Adam Krafft, consisting of a ciborium or receptacle for the host, in the form of a florid Gothic spire 65 feet high; the carving of this work is exquisitely minute and delicate. In front of the altar hangs a curious piece of wood-carving by Veit Stoss, representing the Salutation. The shrine of St Sebald, in the church of St Sebald, consisting of a bronze sarcophagus and canopy, in the richest Gothic style, adorned with numerous statues and reliefs, is looked upon as one of the greatest achievements of German art. It was executed by Peter Vischer, the celebrated artist in bronze, who was occupied on the work for thirteen years (1506-19) and has here shown himself no unworthy rival of Lorenzo Ghiberti. The church of Our Lady possesses some fine old stained glass windows and some paintings by Wohlgemuth. The Aegidienkirche, a building of last century, contains a good altarpiece by Van Dyck.

The town-house, an edifice in the Italian style, erected in 1616-19, contains frescos by Dürer and a curious stucco relief of a tournament held at Nuremberg in 1446. The new law courts, the hospitals, and the barracks are also imposing structures, but the most interesting secular buildings in the town are the houses of the old patrician families, already referred to. Among the most characteristic of these are the old residence of the counts of Nassau, and the houses of the Tucher, Funk, and Peller families. A special interest attaches to the dwellings of Albert Dürer, Hans Sachs, the cobbler-poet, and Johann Palm, the patriotic bookseller who was shot by order of Napoleon in 1806. Statues of Dürer, Sachs, and Melanchthon (the reputed founder of the grammar-school) have been erected; and the streets are further embellished with several fountains, the most noteworthy of which are the Schöne Brunnen, in the form of a large Gothic pyramid, adorned with statues (1385-96) and the Gänsemännchen or goose-mannikin, a clever little figure by Labenwolf. On the way to the cemetery of St John, which contains the graves of Dürer, Sachs, Behaim, and other Nuremberg worthies, are Krafft's Stations, seven pillars bearing stone reliefs of the Passion, and ranked among the finest works of the well-known sculptor.

The charitable, educational, scientific, and artistic institutions of Nuremberg are on a scale worthy of its ancient dignity. The Germanic National Museum, established in an old Carthusian monastery, has one of the most important historical collections in Germany. It includes a picture-gallery with works by Holbein, Dürer, Wohlgemuth, &c. The Bavarian Industrial Museum is also a very creditable institution. The municipal library contains about 800 manuscripts and 50,000 printed books, some of which are of great rarity.

Though not of so great relative importance as of yore, Nuremberg still occupies a high place among the industrial and commercial centres of Europe. The principal manufactures are lead pencils, colours, gold and silver wire, gold and silver foil, railway plant, tobacco, playing-cards, and lastly the "Dutch" toys and fancy articles in metal, carved wood, ivory, &c., which are collectively known as "Nuremberg wares." A great proportion of the toys exported from Nuremberg are really made by the peasants of Thuringia. The pencil manufactory of Faber, the railway works of the Nuremberg Company, and Zeltner's ultramarine factory are among the most important of their class in Europe. Large quantities of Nuremberg manufactures are sent to India and America, the exports to the United States alone being valued at £800,000 in 1882. Brewing, lithography, and map-publishing are also extensively carried on. Nuremberg is the chief market on the Continent for hops, and in 188[illegible] the "turn over" in the trade in this article was £4,000,000. The bronze foundry established by Professor Burgschmiet, and now carried on by Professor Lenz, produces numerous admirable and important castings; and in the artistic handicrafts generally Nuremberg artisans are honourably distinguished. In addition to numerous railways, trade is facilitated by the Ludwig canal, connecting the Danube and the Main. The railway from Nuremberg to Fürth was the first in Germany. Nuremberg's money-market is also of some importance.

The population of Nuremberg at the height of its prosperity has been estimated at as high a figure as 150,000, but there seems good reason to believe that it did not exceed 40,000 to 50,000 souls. In 1818 it had sunk to 27,000, but since then it has steadily increased. At the census of 1880 the town contained 99,519 inhabitants, 76,886 of whom were Protestants, 19,143 Roman Catholics, and 3032 Jews. According to a local estimate the population had risen to 103,255 at the beginning of 1883. Several of the patrician families of Nuremberg can trace their descent in a direct line for four or five centuries, and still occupy the houses built by their forefathers. A few of them are said to possess very complete and interesting domestic archives.

History.—The first authentic mention of Nuremberg, which seems to have been called into existence by the foundation of the castle, occurs in a document of 1050; and about the same period it received from Henry III. permission to establish a mint, a market, and a custom-house. It is said to have been destroyed by the emperor Henry V. in 1105, but if this was the case the town must have been very speedily rebuilt, as in 1127 we find the emperor Lothair taking it from the duke of Swabia and assigning it to Henry the Proud, duke of Bavaria. We now first hear of an imperial officer styled the burggrave of Nuremberg, who, however, seems to have been merely the military governor of the castle, and to have exercised no sway over the citizens. This office came into the hands of the counts of Hohenzollern at the beginning of the 13th century, and "burggrave of Nuremberg" is still one of the titles of their descendant, the emperor of Germany. The government of the town was vested in the patrician families, who, contrary to the usual course of events in the free towns, succeeded in permanently excluding the civic guilds from all share of municipal power. Conrad III. (1138-1152) reunited Nuremberg to the empire, and for the next three or four centuries the town was specially favoured by the German monarchs, who frequently resided and held diets here. In 1219 Frederick II. conferred upon it the rights of a free imperial town, and in 1355 it witnessed the promulgation of the famous "Golden Bull" of Charles IV. At the beginning of the 15th century the burggraves of Nuremberg, who had in the meantime raised themselves to the rank of princes of the empire, were invested with the margraviate of Brandenburg, and sold the castle of Nuremberg to the town. They, however, reserved certain rights, which resulted in keenly-contested feuds between the burghers and the margraves Albert Achilles (1449), Frederick (1502), and Albert Alcibiades (1552).

The quarrel with the margraves, however, did not interfere with the growth of the town's prosperity, which reached its acme in the 16th century. Like Augsburg, Nuremberg attained great wealth as an intermediary between Italy and the East on the one hand, and northern Europe on the other. Its manufactures were so well known that it passed into a proverb—"Nuremberg's hand goes through every land." Its citizens lived in such luxury that Æneas Sylvius (Pope Pius II., 1405-1464) has left it on record that a simple burgher of Nuremberg was better lodged than the king of Scotland. The town had gradually extended its sway over a territory nearly 500 square miles in extent, and was able to furnish the emperor Maximilian with a contingent of 6000 troops. But perhaps the great glory of Nuremberg lies in its claim to be the principal font of German art. Its important architectural features have already been described. The love of its citizens for sculpture is abundantly manifest in the statues and carvings on their houses. Adam Krafft (*c.* 1455-1507), Veit Stoss (*c.* 1450-1532), and Peter Vischer (*c.* 1455-1529) form a trinity of sculptors of which any city might be proud. In painting Nuremberg is not less prominent, as the names of Wohlgemuth (1434-1519) and Albert Dürer (1471-1528) sufficiently indicate. In the decorative arts the Nuremberg handicraftsman attained great perfection in ministering to the luxurious tastes of the burghers, and a large proportion of the old German furniture, silver-plate, stoves, and the like, which we now admire in industrial museums, was made in Nuremberg workshops. Wenzel Jamnitzer (1508-1585), the worker in silver, is perhaps eminent enough to be added to the above list of artists. Its place in literary history—by no means an unimportant one—Nuremberg owes to Hans Sachs (1494-1576) and the other meistersänger. A final proof of the vigorous vitality of Nuremberg at this period may be found in the numerous inventions of its inhabitants, which include watches (at first called "Nuremberg eggs"), the air-gun, gun-locks, the terrestrial and celestial globes, the composition now called brass, and the art of wire-drawing.

Nuremberg was the first of the imperial towns to throw in its lot with the Reformation (in 1525), and it embraced Protestantism with its wonted vigour. Its name is associated with a peace concluded between Charles V. and the Protestants in 1532. The first blow to its prosperity was the discovery of the sea-route to India in 1497; and the second was inflicted by the Thirty Years' War, during which Gustavus Adolphus was besieged here in an entrenched camp by Wallenstein. During the eight or ten weeks that the blockade lasted no fewer than 10,000 inhabitants of Nuremberg are said to have died of want or disease. The downfall of the town was accelerated by the illiberal and short-sighted policy of its patrician rulers; and the French Revolution reduced it to such a degree that in 1796 it offered itself and its territories to the king of Prussia on condition that he would pay its debts (9,000,000 guldens). Prussia, however, refused the offer. In 1803 Nuremberg was allowed to maintain its nominal position as a free city, but in 1806 it was annexed to Bavaria. During this century its progress has been one of uninterrupted prosperity, and it is now the chief commercial town in South Germany.

Authorities.—Priem, *Geschichte der Stadt Nürnberg* (1874); Daniel, *Handbuch der Geographie* (new ed., 1881); *Jahresbericht der Handels- und Gewerbekammer für Mittelfranken*, 1882; Schrag, *Neuester Wegweiser durch die Stadt Nürnberg* (18th ed., 1883). Various illustrated works on the artists and art-treasures of Nuremberg have been published by Schrag of Nuremberg. (J. F. M.)

NURSIA. See SABINES.

NUT. The term nut is applied to that class of fruit which consists generally of a single kernel enclosed in a hard shell. Botanically speaking, nuts are one-celled fruits with hardened pericarps, more or less enveloped in a cupule or cup, formed by the aggregation of the bracts. In commerce, however, the term has a wider application and embraces many fruits having hard woody indehiscent shells or coverings without reference to their enclosed seeds or kernels, besides leguminous pods, and even tuberous roots. A great number of nuts enter into commerce for various purposes, principally as articles of food or sources of oil, and for several ornamental and useful purposes. For the most part the edible nuts are very rich in oil, with only a small percentage of the other carbohydrates, starch, sugar, &c., and they also contain a large proportion of nitrogenous constituents. Thus possessing rich nutrient principles in a highly-concentrated form, nuts are by themselves rather difficult of digestion, and the liability of many of them to become rancid is also a source of danger and a hindrance to their free use. Oleaginous nuts used for food are likewise employed more or less as sources of oil, but on the other hand there are many oil-nuts of commercial importance not embraced in the list of edible nuts. The following is an alphabetical enumeration of the more important nuts, and of products passing under that name, used either as articles of food or as sources of oil:—

Name.	Source.	Locality.	Remarks.
Almond	*Amygdalus communis*, var. B., *dulcis*	S. Europe....	Food, oil. See vol. i. p. 595.
Almond (bitter)	*Amygdalus communis*, var. A., *amara*	....	Oil. See vol. i. p. 595.
Ar nut	Tubers of *Bunium flexuosum* and other species	Great Britain	Food.
Bambarra ground nut	*Voandzeia subterranea* ..	W. Africa....	Food.
Ben nut	*Moringa pterygosperma*	E. Indies	Oil. See OILS.
Bitter nut	*Carya amara* (swamp hickory)	N. America ..	See HICKORY, vol. xi. p. 790.
Brasil nut	*Bertholletia excelsa*	S. America ..	Food, oil. See vol. iv. p. 241.
Bread nut	*Brosimum Alicastrum* ..	W. Indies	Food.
Butter or Souari nut	*Caryocar nuciferum*	Guiana	Food.
Cahoun nut ..	*Attalea Cohune*	Honduras....	Oil.
Candle nut	*Aleurites triloba*	S. Sea Islands	Oil. See OILS.
Cashew nut	*Anacardium occidentale*	W. Indies	Food, oil. See vol. v. p. 175.
Chestnut	*Castanea vesca*	S. Europe....	Food. See vol. v. p. 608.
Cob, filbert, or hazel	*Corylus Avellana*	England, Spain	See HAZEL, vol. xi. p. 548.
Cob nut of Jamaica	*Omphalea diandra*	W. Indies	Food.
Cocoa nut	*Cocos nucifera*	E. Indies	Food, oil. See vol. vi. p. 103.
Cola nut	*Cola acuminata*	W. Africa	Food.
Dika nut	*Irvingia Barteri*	W. Africa	Food, oil.
Gingko nut	*Salisburia adiantifolia* ..	Japan	Food, oil.
Ground nut	*Arachis hypogæa*........	Tropics	See GROUND NUT, vol. xi. p. 221.
Hickory nut ..	*Carya alba*	N. America ..	See HICKORY, vol. xi. p. 790.
Hog nut	*Carya porcina*	N. America ..	Eaten by animals.
Mocker nut	*Carya tomentosa*	N. America ..	See HICKORY, vol. xi. p. 790.
Moreton Bay chestnut	*Castanospermum australe*	Australia	Food.
Nutmeg	*Myristica moschata*	E. Indies	Spice. See NUTMEG.
Nutmeg (wild)	*Myristica fatua, M. tomentosa*, &c.	Tropics	Spice. See NUTMEG.
Olive nut	*Elæocarpus Ganitrus*, &c.	E. Indies	Food.
Palm nut	*Elæis guineensis*	W. Africa	Oil. See PALM.
Pecan nut	*Carya oliveæformis*	N. America ..	Food, oil. See HICKORY, vol. xi. p. 790.
Pekea nut	*Caryocar butyrosum*	Guiana	Food.
Physic nut	*Curcas purgans*	Tropical America	Oil. See OILS.
Pine nut	*Pinus Pinea*, &c.	Italy	Food.
Pistachio nut ..	*Pistachia vera*	Italy	Food.
Quandang nut..	*Fusanus acuminatus*	Australia	Food.
Ravensara nut	*Agathophyllum aromaticum*	Madagascar ..	Spice.
Rush nut	*Cyperus esculentus*	S. Europe....	Food.
Sapucaya nut ..	*Lecythis Ollaria*	Brazil	Food.
Tahiti chestnut	*Inocarpus edulis*	S. Sea Islands	Food.
Walnut	*Juglans regia*	Asia, Europe	Food, oil.
Water chestnut	Various species of *Trapa*	Kashmir, &c.	Food.

There remain to be enumerated a number of nuts of commercial value for turnery and ornamental purposes, for medicinal use, and for several miscellaneous applications in the arts. These include:—

Name.	Source.	Locality.	Remarks.
Betel nut	*Areca Catechu*	E. Indies	See vol. iii. p. 616.
Bladder nut ..	*Staphylea pinnata*	Cent. Europe	Necklaces.
Boomah nut ..	*Pycnocoma macrophylla*	Africa	Tanning.
Bonduc nut	*Guilandina Bonduc*	India	Medicine, beads.
Clearing nut ..	*Strychnos potatorum*	India	Clearing water.
Coquilla nut ..	*Attalea funifera*	Brazil	Turnery.
Coroso nut or vegetable ivory	*Phytelephas macrocarpa*	Brazil	See vol. xiii. p. 524.
Cumara nut ..	*Dipteris odorata*	Brazil	Perfume.
Grugru nut	*Acrocomia sclerocarpa* ..	S. America ..	Beads.
Horse chestnut	*Æsculus Hippocastanum*	Europe	Starch. See vol. v. p. 606.
Marking nut ..	*Semecarpus Anacardium*	E. Indies	Marking ink and varnish.
Nut galls	*Quercus infectoria*	Levant	Dyeing and ink making. See GALLS, vol. x. p. 45.
Poison nut	*Strychnos Nux-Vomica* ..	E. Indies	Medicine. See NUX VOMICA.
Sassafras nut ..	*Nectandra Puch.*	S. America ..	Aromatic.
Snake nut	*Ophiocaryon paradoxum*	S. America ..	Curiosity.
Soap nut	*Sapindus Saponaria*	W. Indies....	Washing; ornamental.

The application of the term nut to many of these products is purely arbitrary, and it is obvious that numerous other bodies not known commercially as nuts might with equal propriety be included in the list. Most of the nuts of real commercial importance are or will be separately noticed, and here further allusion is only made to a few which form current articles of commerce, not otherwise treated of.

The Bread nut of Jamaica is the fruit of a lofty tree, *Brosimum Alicastrum*. It is about an inch in diameter, and encloses a single seed, which, roasted or boiled, is a pleasant and nutritious article of food.

The Souari or Surahwa nut, called also the "Butter nut of Demerara," and by fruiterers the "Suwarrow nut," is the fruit of *Caryocar nuciferum* (*Rhizobolaceæ*), a native of the forests of Guiana, growing 80 feet in height. This is perhaps the finest of all the fruits called nuts. The kernel is large, soft, and even sweeter than the almond, which it somewhat resembles in taste. The few that are imported come from Demerara, and are about the size of an egg, somewhat kidney-shaped, of a rich reddish-brown colour, and covered with large rounded tubercles.

The Pekea nut, similar in appearance and properties, is the produce of *Caryocar butyrosum*, growing in the same regions of tropical America.

The Jamaica Cob nut is the produce of a euphorbiaceous tree, *Omphalea diandra*, the seeds of which resemble in taste the ordinary cob or hazel nut. The seed, however, contains a deleterious embryo, which must not be eaten.

Cola, Kola, or Goora nuts are the produce of *Cola acuminata* (*Sterculiaceæ*), a tree native of tropical Africa, now introduced into the West Indies and South America. The nuts form an important article of commerce throughout Central Africa, being used over a wide area as a kind of stimulant condiment. The nuts, of which there are numerous varieties, are found to contain a notable proportion of theine, as much as 2·13 per cent., besides theobromine and other important food-constituents, to which circumstances, doubtless, their valuable properties are due.

Coquilla nuts, the large seeds of the palm, *Attalea funifera*, the piassaba of Brazil, are highly valued for turnery purposes. They have an elongated oval form, 3 to 4 inches in length, and being intensely hard they take a fine polish, displaying a richly-streaked brown colour.

The Marking nut, *Semecarpus Anacardium*, is a fruit closely allied in its source and properties to the CASHEW NUT (*q.v.*). The marking nut is a native of the East Indies, where the extremely acrid juice of the shell of the fruit in its unripe state is mixed with quicklime, and used as a marking-ink. The juice also possesses medicinal virtues as an external application, and when dry it is the basis of a valuable caulking material and black varnish. The seeds are edible, and the source of a useful oil.

Physic nuts are the produce of the euphorbiaceous tree, *Curcas purgans*, whence a valuable oil, having similar purgative properties to castor oil, is obtained. The plant is a native of South America; but is now found throughout all tropical countries.

Pine nuts are the seeds of several species of *Pinus*, eaten in the countries of their growth, and also serving to some extent as sources of oil. Of these the most important are the Stone Pine, *Pinus Pinea*, of Italy and the Mediterranean coasts, and the Russian Stone Pine, *Pinus Cembra*. The *Pinus Sabiniana* of California and *P. Gerardiana* of the Himalayas similarly yield edible seeds. These seeds possess a pleasant, slightly resinous flavour.

The Pistachio nut is the fruit of *Pistacia vera*, L. (*Anacardiaceæ*). It is a native of Syria. Although a remarkably delicious nut and much prized by the Greeks and other Eastern nations, it is not well known in Britain. It is not so large as a hazel nut, but is rather longer and much thinner, and the shell is covered with a somewhat wrinkled skin. The small nut of *Pistacia Lentiscus*, L., not larger than a cherry stone, is also occasionally imported from Smyrna, Constantinople, and Greece.

Ravensara nuts, the fruit of *Agathophyllum aromaticum* (*Lauraceæ*), a native of Madagascar, is used as a spice under the name of the Madagascar clove nutmeg.

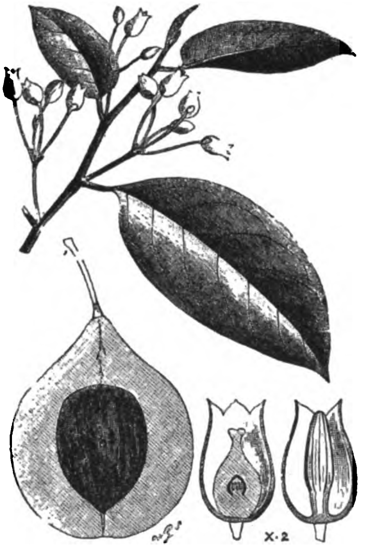
The Sapucaya nut, a Brazilian fruit, is seen occasionally in fruit-shops. It is produced by a large tree, *Lecythis Ollaria*, or "Cannon-ball tree." Its specific name is taken from the large urn-shaped capsules, called "monkey-pots" by the inhabitants, which contain the nuts. The sapucaya nut has a sweet flavour, resembling the almond, and if better known would be highly appreciated. It is, however, scarce, as the monkeys and other wild animals are said to be particularly fond of it. This nut, which is of a rich amber-brown, is not unlike the Brazil nut, but it has a smooth shell furrowed with deep longitudinal wrinkles.

Soap nuts are the fruits of various species of *Sapindus*, especially *S. Saponaria*, natives of tropical regions. They are so called because their rind or outer covering contains a principle, saponine, which lathers in water, and so is useful in washing. The pods of *Acacia concinna*, a native of India, possess the same properties, and are also known as soap nuts. (J. PA.)

NUTATION. See ASTRONOMY, vol. ii. pp. 794-5.

NUTCRACKER, the name given by Edwards in 1758 (*Gleanings*, No. 240) to a bird which had hitherto borne no English appellation, though described in 1544 by Turner, who, meeting with it in the Rhætic Alps, where it was called "Nousbrecher" (*hodie* "Nussbrecher"), translated that term into Latin as *Nucifraga*. In 1555 Gesner figured it and conferred upon it another designation, *Caryocatactes*. It is the *Corvus caryocatactes* of Linnæus and the *Nucifraga caryocatactes* of modern ornithology. Willughby and Ray obtained it on the road from Vienna to Venice as they crossed what must have been the Sömmerring Pass, 26th September 1663. The first known to have occurred in Britain was, according to Pennant, shot at Mostyn in Flintshire, 5th October 1753, and about fifteen more examples have since been procured, and others seen, in the island. In further continuation of the particulars already given (CROW, vol. vi. p. 618), it may here be stated that a careful monograph of the species by the Ritter Victor von Tschusi-Schmidhoffen was printed at Dresden in 1874 with the title of *Der Tannenheher*, which is one of its many German names. Contrary to what was for many years believed, the nest of the Nutcracker seems to be invariably built on the bough of a tree, some 20 feet from the ground, and is a comparatively large structure of sticks, lined with grass. The eggs are of a very pale bluish-green, sometimes nearly spotless, but usually more or less freckled with pale olive or ash-colour. The chief food of the Nutcracker, though it at times searches for insects on the ground, appears to be the seeds of various conifers, which it extracts as it holds the cones in its foot, and it has been questioned whether the bird has the faculty of cracking nuts—properly so called—with its bill, though that can be used with much force and, at least in confinement, with no little ingenuity. The old supposition that the Nutcrackers had any affinity to the Woodpeckers (*Picidæ*) or were intermediate in position between them and the Crows (*Corvidæ*) is now known to be wholly erroneous, for they undoubtedly belong to the latter Family. (A. N.)

NUTHATCH, in older English NUTHACK, from its habit of hacking or chipping nuts, which it cleverly fixes, as though in a vice, in a chink or crevice of the bark of a tree, and then hammers them with the point of its bill till the shell is broken. This bird was long thought to be the *Sitta europæa* of Linnæus; but that is now admitted to be the northern form, with the lower parts white, and its buff-breasted representative in central, southern, and western Europe, including England, is known as *Sitta cæsia*. It is not found in Ireland, and in Scotland its appearance is merely accidental. Without being very plentiful anywhere, it is generally distributed in suitable localities throughout its range—those localities being such as afford it a sufficient supply of food, consisting during the greater part of the year of insects, which it diligently seeks on the boles and larger limbs of old trees; but in autumn and winter it feeds on nuts, beech-mast, the stones of yew-berries, and hard seeds. Being of a bold disposition, and the trees favouring its mode of life often growing near houses, it will become on slight encouragement familiar with men; and its neat attire of ash-grey and warm buff, together with its sprightly gestures, render it an attractive visitor. It generally makes its nest in a hollow branch, plastering up the opening with clay, leaving only a circular hole just large enough to afford entrance and exit; and the interior contains a bed of dry leaves or the filmy flakes of the inner bark of a fir or cedar, on which the eggs are laid. In the Levant occurs another species, *S. syriaca*, with somewhat different habits, as it haunts rocks rather than trees; and four or five representatives of the European arboreal species have their respective ranges from Asia Minor to the Himalayas and Northern China. North America possesses nearly as many; but, curiously enough, the geographical difference of coloration is just the reverse of what it is in Europe—the species with a deep rufous breast, *S. canadensis*, being that which has the most northern range, while the white-bellied *S. carolinensis*, with its western form, *S. aculeata*, inhabits more southern latitudes. The Ethiopian Region seems to have no representative of the group, unless it be the *Hypositta corallirostris* of Madagascar. *Callisitta* and *Dendrophila* are nearly allied genera, inhabiting the Indian Region, and remarkable for their beautiful blue plumage; but some doubt may for the present be entertained as to the affinity of the Australian *Sittella*, with four or five species, found in one or another part of that continent, which doubt is increased by the late Mr Forbes's discovery (*Proc. Zool. Society*, 1882, pp. 569-571) that the genera *Acanthisitta* and *Xenicus*, peculiar to New Zealand, and hitherto generally placed in the Family *Sittidæ*, belong really to the Mesomyodian group and are therefore far removed from it. The unquestioned members of the *Sittidæ* seem to be intermediate between the *Paridæ* and the *Certhiidæ*, and some authors comprehend them in either one or the other of those groups. (A. N.)



Flowers, Fruit, and Seed of Nutmeg.

NUTMEG. The spice known in commerce under this name is the kernel of the seed of *Myristica fragrans*, Houtt., a diœcious evergreen tree, about 50 to 60 feet high, found wild in the Banda Islands and a few of the neighbouring islands, extending to New Guinea but not to the Philippines. Nutmeg and mace are almost exclusively obtained from the Banda Islands, although the cultivation has been attempted with varying success in Singapore, Penang, Bengal, Réunion, Brazil, French Guiana, and the West Indies. The trees yield fruit in eight years after sowing the seed, reach their prime in twenty-five years, and bear for sixty years or longer. Almost the whole surface of the Banda Islands is planted with nutmeg trees, which thrive under the shade of the lofty *Canarium commune*. The light volcanic soil, shade, and excessive moisture of these islands, where it rains more or less during the whole year, seem exactly to suit the requirements of the nutmeg tree. In Bencoolen the tree bears all the year round, but the chief harvest takes place in the later months of the year, and a smaller one in April, May, and June. In the Banda Islands the fruits are collected in small neatly-made oval baskets at the end of a bamboo, which prevents bruising, the baskets being open for half their length on one side and furnished with a couple of small prongs projecting from the top, by which the fruit-stalk is broken, the fruit falling into the basket. The ripe fruit is about 2 inches in diameter, of a rounded pear-shape, and when mature splits into two halves, exposing a crimson arillus surrounding a single seed. When the fruit is collected the pericarp is first removed; then the arillus is carefully stripped off and dried, in which state it forms the mace of commerce. The seed consists of a thin hard testa or shell enclosing a kernel, which, when dried, is the nutmeg. To prepare the nutmegs for use, the seed enclosing the kernel is dried at a gentle heat in a drying-house over a smouldering fire for about two months, the seeds being turned every second or third day. When thoroughly dried the shells are broken with a wooden mallet or flat board and the nutmegs picked out and sorted, the smaller and inferior ones being reserved for the expression of the fixed oil which they contain, and which forms the so-called oil of mace.

The dried nutmegs are then rubbed over with dry sifted lime. The process of liming, which originated at the time when the Dutch held a monopoly of the trade, was commenced with the view of preventing the germination of the seeds, which were formerly immersed for three months in milk of lime for this purpose, and a preference is still manifested in some countries for nutmegs so prepared. It has, however, been shown that this treatment is by no means necessary, since exposure to the sun for a week destroys the vitality of the kernel. Nor is the dry liming process needful, for nutmegs keep well in their natural shell, in which form they are usually exported to China. The weight of the shells, however, adds one-third to the cost of freight, hence this plan is not generally adopted. Penang nutmegs are never limed. The entire fruit preserved in syrup is used as a sweetmeat in the Dutch East Indies.

"Oil of mace," or nutmeg butter, is a solid fatty substance of a reddish-brown colour, obtained by grinding the refuse nutmegs to a fine powder, enclosing it in bags and steaming it over large cauldrons for five or six hours, and then compressing it while still warm between powerful wedges, the brownish fluid which flows out being afterwards allowed to solidify. Nutmegs yield about one-fourth of their weight of this substance. It is partly dissolved by cold alcohol, the remainder being soluble in ether. The latter portion, about 10 per cent. of the weight of the nutmegs, consists chiefly of *myristin*, which is a compound of *myristic acid*, $C_{14}H_{28}O_2$, with glycerin. The fat which is soluble in alcohol appears to consist, according to Schmidt and Roemer (*Arch. Pharm.* [3], xxi. pp. 34-48), of free myristic and stearic acids; the brown colouring matter has not been satisfactorily investigated. Nutmeg butter yields on distillation with water a volatile oil to the extent of about 6 per cent., consisting almost entirely of a hydrocarbon called *myristicene*, $C_{10}H_{16}$, boiling at 165° C. It is accompanied by a small quantity of an oxygenated oil, *myristicol*, isomeric with carvol, but differing from it in not forming a crystalline compound with hydrosulphuric acid. Mace contains a similar volatile oil, *macene*, boiling at 160° C., which is said by Cloëz to differ from that of nutmegs in yielding a solid compound when treated with hydrochloric acid gas.

The annual imports of nutmegs to the United Kingdom amount to from 400,000 to 800,000 ℔, each ℔ consisting of about 110 fair-sized nutmegs, and of mace from 60,000 to 80,000 ℔ per annum. The former are valued at from three to five shillings per ℔, and mace at from one to three shillings per ℔.[1] Long, wild, or male nutmegs, the produce of *M. tomentosa* and *M. fatua*, are sometimes imported in small quantities. Several species of *Myristica* yield fatty oils, which form commercial products, but none of these are remarkable for fragrance.

The name nutmeg is also applied to other fruits or seeds in different countries. The Jamaica or calabash nutmeg is derived from *Monodora Myristica*, the Brazilian from *Cryptocarya moschata*, the Peruvian from *Laurelia sempervirens*, the New Holland or plume nutmeg from *Atherosperma moschata*, the Madagascar or clove nutmeg from *Agathophyllum aromaticum*, and the Californian or stinking nutmeg from *Torreya myristica*. The cotyledons of *Nectandra Puchury* were at one time offered in England as nutmegs.

Seemann, in *Hooker's Journ. Bot.*, 1852, p. 83; Collingwood, *Journ. Lin. Soc. Bot.*, 1869, p. 45; Lumsdaine, *Pharm. Journ.* [1], xi. p. 516; Wallace, *Malay Archipelago*, i. p. 452, 1869; Bickmore, *Travels in E. Indian Archipelago*, 1868, p. 225; *Pharmacographia* (2d. ed.), p. 502; *Journ. Pharm. Soc.* [3], xiii. p. 304.

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[1] This spice seems to be an especial favourite with the people of the United States, since the export to that country exceeds that to all Europe combined.

NUTRITION

By the term nutrition, employed in its widest sense, is understood the process, or rather the assemblage of processes, concerned in the maintenance and repair of the living body as a whole, or of its constituent parts or organs. The term has, however, usually been limited in systematic treatises on physiology to a study, mainly statistical, of the relations which exist between a living being and the medium which it inhabits, embracing a determination of the gains and losses of the organism under the different conditions to which it may be exposed. Such a statistical study has already been pursued in the article Dietetics, and we shall therefore in the present article, restricting our attention to the animal kingdom, consider nutrition in the more general sense above referred to, including—(1) a study of the function of digestion; (2) a sketch of the processes concerned in the absorption of matter into the blood; (3) an account of the chemical processes which have their seat in the tissues and organs of the body; (4) an account of the processes whereby redundant matters, or such as are the products of waste, are removed from the animal economy; (5) a reference to the transformations of energy which are associated with the exchange of the matters of the body; (6) a brief reference to the processes of growth, decay, and death.

With the exception of the chemical processes concerned in respiration, which will be treated of at length under that head, this article will therefore include a short discussion of the chemical operations of the body generally, and particularly as they are exemplified in the case of man.

General Introductory Considerations.—There is no conception which we can form in reference to a living being, however rudimentary its structure, which is so general as the following:—a living animal, so long as it manifests those attributes which characterize it as living, is the seat of continual transformations of potential into kinetic energy.

Such transformations are connected with oxidation of organic matters which, primarily derived from the vegetable kingdom, have been *assimilated*, *i.e.*, have been converted into the substance of the animal, and are effected through the agency of oxygen gas introduced into the body in the process of respiration. The act of living is an act of combustion in which the animal body actually burns, and the energy at the disposal of the body, and which is employed in raising its temperature or effecting the movements which are essential to its continued life, is energy which was potential in the organic constituents burned. The main products of the combustion of the body are carbonic acid and water, besides certain other less completely oxidized substances, which are the analogues of the sooty and tarry products of combustion in a furnace. Of these products some, as carbonic acid and a part of the water formed, are removed from the body almost as soon as they are formed, while others are thrown off at intervals.

It follows from what has been stated that the act of living necessarily implies not only transformation of energy but actual waste of the matter of the body, and that if an animal is continuously to manifest the phenomena of life it must be supplied with oxidizable organic matter to take the place of that which has been oxidized. Accordingly, animal life is impossible unless the creature, besides receiving continual supplies of oxygen gas, receives at intervals supplies of food. The food of an animal consists (1) of oxidizable organic matters which, although they may have been derived in part or wholly from some other animal body, have primarily been built up through the instrumentality of vegetable organisms,—these organic matters belong to a few well-defined groups; (2) of mineral matters, including large quantities of water, which form an important part of the substance of the body, and the presence in and passage of which through the organism is essential to the physical processes which have their seat in it.

In brief, the animal body is the seat of processes of disintegration associated with the manifestation of kinetic energy, and of processes of integration in which oxidizable matters take the place of the oxidized constituents. If life is to continue, in a sense, indefinitely it is essential that the processes of integration and disintegration should balance, *i.e.*, that the receipts of the body in assimilable oxidizable matter should balance the expenditure of the body both in matter and energy. There are, it will be observed, very close analogies between an animal and such a mechanism as a steam-engine, the energy at the disposal of both being primarily derived from the oxidation of combustible matters. Some of the most salient points of difference must, however, not be lost sight of. (1) The waste of the essential parts of such a machine as a steam-engine is insignificant, and bears no definite relation to the work done. The kinetic energy of the machine is primarily due to oxidation processes taking place in the furnace, and in no respect to changes in the substance of the machine. The animal, on the other hand, wastes continuously in all its parts and organs, and much of its energy is derived immediately from material which has become part and parcel of the various mechanisms. (2) Any substance capable of being rapidly oxidized (burned), and thus of generating heat, may be used as fuel for a steam-engine, provided its combustion admits of being conducted with safety in its furnace, whilst the substances which can form the food of animals belong to a limited number of groups, which include but a comparatively small number of bodies. The constituents of food have not only to supply energy to the body, but they must further be capable of prior conversion into the very substance of the animal body, into its very "flesh and blood."

Moreover, the constituents of food must be free from all traces of the peculiar substances which we term "poisons," and which by their presence have the power of impairing and arresting the action of various organs of the body.

I.—Function of Digestion.

Hunger and Thirst.—These terms are used to express peculiar sensations which are produced by and give expression to general wants of the system, satisfied respectively by the ingestion of organic solids containing substances capable of acting as food, and by water or liquids and solids containing water.

Hunger is a peculiarly indefinite sensation of craving or want which is referred to the stomach, but with which is often combined, always indeed in its most pronounced stages, a general feeling of weakness or faintness. The earliest stages are unattended with suffering, and, leading the animal to wish and seek for food, are characterized as "appetite for food." Hunger is normally appeased by the introduction of solid or semi-solid nutriment into the stomach, and it is probable that the almost immediate alleviation of the sensation under these circumstances is in part due to a local influence, perhaps connected with a free secretion of gastric juice. Essentially, however, the sensation of hunger is a mere local expression of a general want, and this local expression ceases when the want is satisfied, even though only liquid and no solid food is introduced into the stomach, or even though no food be introduced into the stomach, the needs of the economy being satisfied by the introduction of food through other channels, as, for example, when food which admits of being readily absorbed is injected into the large intestine.

Thirst is a peculiar sensation of dryness and heat localised in the tongue and throat. Although thirst may be artificially produced by drying, as by the passage of a current of air over the mucous membrane of the above parts, normally it depends upon an impoverishment of the system in water. And, when this impoverishment ceases, in whichever way this be effected, the sensation likewise ceases. The injection of water into the blood, the stomach, or the large intestine appeases thirst, though no fluid is brought in contact with the part to which the sensation is referred.

The sensations the causes of which we have briefly attempted to trace lead us, or when urgent compel us, to take food and drink into the mouth. Once in the mouth, the entrance to the alimentary canal, the food begins to undergo a series of processes, the object of which is to extract from it as much as possible of its nutritive constituents. It cannot be sufficiently emphasized that food in the alimentary canal is, strictly speaking, outside the confines of the body; as much so as the fly grasped in the leaves of the insectivorous *Dionea* is outside of the plant itself. The mechanical and chemical processes to which the food is subjected in the stomach and intestines are processes which have their seat and conditions outside the body which it is destined to nourish, though unquestionably the body is no passive agent, and innumerable glands have to come into action in order to supply the chemical agents which shall dissolve and render assimilable those constituents of the food which are capable of being absorbed into the organism, and of forming part and parcel of its substance.

Structure of the Organs of Digestion in Relation to their Function.—The processes to which the food is subjected, though manifold, are divisible into two great groups: (1) the food must be subjected to the action of certain juices which dissolve insoluble alimentary matters, and modify these no less than certain of the soluble alimentary substances; and (2) it must be mechanically mixed with those juices, and propelled more or less slowly from beginning to end of the alimentary canal. In accordance with this twofold function the alimentary canal is divisible into two distinct but intercalated anatomical tubes,—(1) an internal tube of mucous membrane, and (2), investing this closely, an external muscular tube.

The musculo-membranous double tube thus formed is not, indeed, regularly tubular throughout. At the beginning it forms the irregular cavity of the *mouth*, which contains the *tongue* and the masticatory *teeth*. Thence it passes through the *fauces* and beneath the pendulous *uvula* and *soft palate* into the *pharynx*. Afterwards it proceeds as a regular tube, the *œsophagus*, or gullet, until the level of the diaphragm is reached,—the muscular partition between the thorax and the abdomen. Having passed through this structure, the narrow tube of the œsophagus suddenly dilates at the cardiac orifice into the bag called the *stomach*, at the further or *pyloric orifice* of which the tube resumes its narrow uniform calibre, and forms successively the *duodenum*, the *jejunum*, and the *ileum*,—parts of the small intestine, of which, in man, the duodenum takes up twelve fingers' breadth, the ileum the lower three-fifths, and the jejunum the remainder of the total length of 20 feet. The small intestine diminishes somewhat in calibre from duodenum to ileum, and at the lower end of the latter opens suddenly into the much wider large intestine, which it joins, not at the extreme end, which is a cul-de-sac, the *caput cæcum coli*, but at a point a little lower down. The margins of the aperture by which the small opens into the large intestine point or project into the latter in such a manner that, while they readily permit the passage of matters from small to large intestine, any backward movement of the contents of the large intestine would have the effect of compressing the lips of the opening and closing it; this arrangement constitutes the so-called *ilio-cæcal valve*. Connected with the *caput cæcum coli* is a small diverticulum like a narrow glove finger, called the *vermiform appendage*. The first and greater part of the large intestine is known as the *colon*, the last as the *rectum*. The total length is from 5 to 6 feet. Its lower orifice is called the *anus*.

Both muscular and membranous (mucous) tubes are continuous from mouth to anus, and at these, the superior and inferior orifices, the mucous membrane which constitutes what we have hitherto termed the membranous tube is continuous with the skin which covers the general surface of the body. This mucous membrane is covered throughout at its free surface by an epithelium, and gives lodgment to glands, whose characters differ in different parts of the tube in accordance with the function of the part. Below the epithelium is a connective tissue analogous to the *cutis vera* of the skin, which in parts has the character of ordinary fibro-areolar tissue, but in all parts from the stomach downwards has the character of so-called adenoid connective tissue, as it is found in the follicles of lymphatic glands. Its meshes support a rich supply of fine blood-vessels, lymphatic vessels, and, doubtless also of delicate nervous filaments. Besides these elements there are found numerous small bundles, or in parts even sheets, of involuntary muscular fibres, which probably give to the mucous membrane the power of limited self-contraction, of such a nature as to further the flux and reflux of fluids in the myriad lymphatic vessels of the part, and perhaps to influence in no small degree the outpouring of the secretion of certain of the glands. To the fairly continuous tract or sheet of involuntary muscle which lies at the base or deepest part of the mucous membrane or *mucosa* the term of *muscularis mucosæ* (*tunica*) is applied.

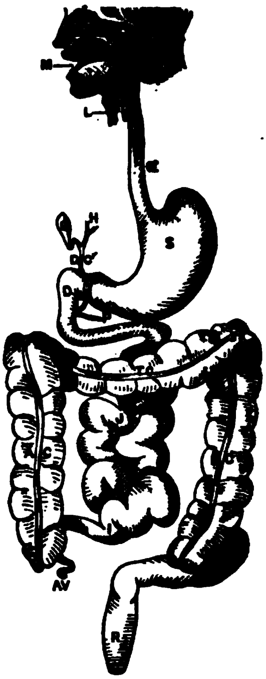


Fig. 1.—Divisions of the Alimentary Canal. M, mouth; Ph, pharynx; Œ, œsophagus; S, stomach; D, duodenum; J, jejunum; I, ileum; AV, appendix vermiformis; AC, ascending colon; HF, hepatic flexure; TC, transverse colon; SF, splenic flexure; DC, descending colon; *Sg*, sigmoid flexure; R, rectum; L, larynx; *e*, Eustachian tube; G, gall-bladder; H, hepatic duct; DC', common bile-duct; P, pancreatic duct. (From Turner's *Anatomy*, fig. 177.)

In addition to the glands which lie embedded in and open upon the surface of the mucous membrane of the alimentary canal, others of larger size and not in immediate relation with its walls communicate with the interior of the tube by ducts which open into it, and which pour into it their secretion; such glands are the salivary glands, the pancreas, and the liver.

The muscular tube in the greater part of its extent consists of two layers of involuntary, non-striated, pale, muscular fibres,—an inner layer whose fibres encircle the tube, and an outer one whose fibres run parallel to the long axis of the tube. But this is not the arrangement of every part. There is an apparent rather than a real exception in the stomach, where some layers of fibres of the circular coat course over the dilated walls of the alimentary tube in an oblique direction, giving rise to an oblique layer. In the œsophagus or gullet, besides the typical circular and longitudinal layers, there is at the upper part a second longitudinal layer which takes up a position internal to—that is, nearer the mucous membrane than—the circular layers. In the upper part of the gullet also the muscular fibres are not unstriped, but, although certainly involuntary, are striated like voluntary muscles.

In the mouth the muscular tube is most irregular and most defective, for the mucosa is in parts directly applied to the bony boundaries, as over the hard palate and gums; in another part it invests the muscular prominence of the tongue; whilst in other regions it lies upon the constrictors of the pharynx and the inner aspect of certain other muscles, as those of the cheeks, lips, and floor of the mouth. The membranous tube is united to the muscular tube by a loose layer of connective tissue containing many blood-vessels and lymphatic vessels and nerves for the supply of the mucosa; it is often called the *submucosa*.

The mucous membrane is the seat of various secreting glands, which lie embedded in its substance and open upon its surface,—simple or branched tubular recesses running through the depth of the layer, lined by epithelium, continuous with, though not always resembling, that of the surface, and opening at the surface by minute pores. In the mouth, pharynx, and œsophagus these form the *acinous* or *racemose* glands, which, according to certain subordinate features which they present, and also according to certain of the characters of the fluids which they secrete, are separated into mucous and serous glands. In the stomach they are represented by the simple or branched tubular gastric glands. In the duodenum we find them as simple tubular deep sockets, the glands or *crypts of Lieberkühn*, and also as the compound acinous glands of Brunner, which dip below the level of the mucosa and lie in the submucosa. In the jejunum, ileum, and large intestine they appear again as the crypts or follicles of Lieberkühn.

The membranous tube is not everywhere exactly concentric and conterminous with the muscular tube. In the mouth and pharynx it is almost entirely so, but at the gullet the muscular tube so tightly encloses the membranous that the latter is forced into longitudinal plications to find room for itself. In the stomach the membranous layer is raised into ridges or *rugæ*, which intersect and give the surface a honeycomb-like aspect. In the upper part of the small intestine the membranous tube is raised into deep annular or, more correctly, crescentic folds, running across the direction of the gut like incomplete diaphragms, or a series of membranous ledges; these are the *valvulæ conniventes*. In the colon the two tubes are so disposed as to form a regular series of saccules or pouches, adding largely to the capacity of the gut. All these foldings greatly increase the superficies of the membranous tube. A further enlargement is effected in the small intestine in an exceedingly interesting fashion; the surface of the mucosa is thickly studded with innumerable fine short projections resembling the pile of velvet. These are invested by surface epithelium, and amongst them, at their feet, open the before-mentioned crypts of Lieberkühn. They are the so-called *villi*. Each contains a lymphatic vessel, blood-vessels, and involuntary muscular fibres, all supported by adenoid connective tissue like that of the mucosa below; the lymphatic is in the axis of the villus, the muscles form the next layer, and the blood-vessels lie immediately beneath the epithelium. When the muscular layer of the villus contracts it must of necessity compress the lymph-vessel, whilst causing no impediment to the flow of blood.

We have described the mucosa of the stomach and intestines as containing a framework of adenoid reticular tissue like the tissue of lymphatic follicles. It is, indeed, identical with this,—a network of branched cells with oval nuclei, the meshes of which are crowded with lymph-corpuscles with round nuclei. At certain points in the intestines the adenoid tissue of the mucosa presents local nodular enlargements; the mucosa at these points becomes so much thicker that it swells up at the free surface beneath the epithelium into rounded eminences about as large as millet-seeds or the heads of small pins; and at the under surface of the mucosa it dips into the submucous tissue in a similar manner. At the base of this nodule of adenoid tissue in the submucosa there is usually a network of wide, thin-walled, lymphatic vessels. Many of these rounded masses are scattered irregularly over the small and large intestines as the *solitary follicles* or *glands*, but at the lower end of the ileum they form little colonies, often covering an area an inch or more in length, situated at that part of the intestine which is remote from the attachment of the mesentery. They then constitute the so-called *Peyer's patches*.

Nodular adenoid masses are, however, not limited to the adenoid mucosa of the intestines. They are occasionally, though rarely, found in the stomach; they exist beneath the mucous membrane of the tongue, and a colony of them forms the mass of the tonsil on each side,—the almond-shaped body situated between the posterior and anterior pillars of the fauces.

The intrinsic nerves of the alimentary tube consist of two systems of nervous networks with ganglion-cells lying at the nodes; one is found in the submucous layer (*plexus of Meissner*), the other lies between the longitudinal and circular muscles (*plexus of Auerbach*, or *plexus myentericus*).

The whole of the intestines, and the stomach as well, are sustained in the abdominal cavity by sheets of delicate membrane, formed by folds of peritoneum, and called, in the case of the intestinal portion of the tube, the *mesentery*. Between the layers of the mesentery run the vessels and nerves for the supply of the bowel. In addition to blood-vessels there are numerous thin-walled lymphatic vessels called *lacteals*, which are fed by the rich network of lymphatic vessels of the mucosa and submucosa, and which run in the mesentery to the back of the abdominal cavity. Here they are collected into a large lymphatic reservoir, the *receptaculum chyli*, from which a duct, the *thoracic duct*, proceeds along the side of the vertebral column to open into the venous system at the junction of the subclavian and jugular veins on the left side of the neck. The lacteal and lymphatic vessels, whose course has been briefly sketched, are interrupted at many points by the presence of lymphatic glands. These may be simply regarded as labyrinthine systems of vessels into which the simple afferent lymphatic or lacteal vessels open, and each of which is surrounded and penetrated by adenoid connective tissue, like that of the intestinal mucosa. After a meal the lacteal vessels are filled with a milky fluid, the *chyle*. They were discovered by Aselli in the year 1626.

It must not be thought that the glands of the mucous membrane of the alimentary canal are alone engaged in the preparation of the solvent digestive fluids. Other organs there are lying away from the alimentary canal which pour their secretions into it by ducts at various points. In the neighbourhood of the mouth there are three pairs of *salivary glands*. The *parotid* glands lie outside the cheek over the lower jaw, just in front of the meatus of the ear. The ducts of this pair course along the cheeks and pierce them opposite the second upper molar tooth on each side; these are the two ducts of Stenson. A second pair of glands, the *submaxillary*, lies beneath the ramus of the lower jaw and beneath the floor of the mouth; their ducts run forward to open beneath the tongue; these are the ducts of Wharton. The third pair, the *sublingual*, lies on the floor of the mouth, beneath the mucous membrane anterior to the openings of the ducts of Wharton. The ducts of these glands are numerous and open by many apertures on the floor of the mouth, some opening into the ducts of Wharton. These constitute the ducts of Rivinus.

About three or four inches below the pylorus the ducts of two large glands open into the small intestine by a common orifice; these are the ducts of Wirsung, or *pancreatic ducts*, from the pancreas on the left, and the common bile-duct from the liver on the right.

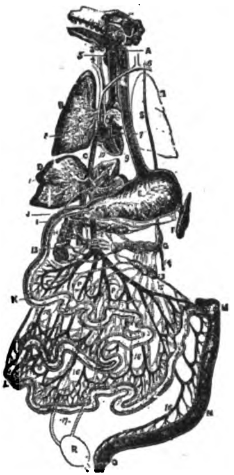


Fig. 2.—Nutritive System of Dog. A, œsophagus or gullet; B, lungs; C, vena cava; D, liver; E, stomach; F, spleen; G, receptaculum chyli; H, pancreas; I, duodenum; J, entrance of biliary and hepatic ducts; K, jejunum; L, ileum; M, cæcum; N, colon; O, rectum; P, kidneys, with the supra-renal capsules above; R, urinary bladder; S, thoracic duct; 1, parotid gland; 2, salivary gland of neck; 3, submaxillary and other salivary glands; 4, jugular and subclavian veins; 5, situation of thymus and thyroid glands; 6, entrance of thoracic duct into left subclavian vein, near the jugular; 7, left auricle; 8, right auricle; 9, left ventricle; 10, right ventricle; 11, gall-bladder; 12, vena portæ; 13, mesenteric glands; 14, lymphatic vessels; 15, lacteal vessels; 16, branches of the portal vein; 17, ureters.

Movements of the Alimentary Canal.—When food is introduced into the mouth it is submitted to the operation of mastication. The incisors or cutting teeth divide it into portions of suitable size, which are thrust under the broad faces of the molar or grinding teeth by the alternate movements of tongue and cheeks. Softer portions of food are crushed between tongue and hard palate, especially such as are taken for their sapid properties to please the palate and increase the flow of saliva. Mastication consists of movements of the lower jaw upon the upper, viz., (1) vertical movements brought about by the temporal and the internal pterygoid and masseter muscles on the one hand, and by the digastric, mylo-hyoid, and other depressor muscles attached to the lower jaw on the other; (2) horizontal movements, forwards and backwards, effected by the external pterygoid muscles; when one of these muscles alone contracts, the forward movement of the chin is changed to a forward and lateral movement by the rotation of the jaw around the opposite condyle as a pivot; after being moved forward the jaw is retracted by the horizontal fibres of the temporal muscle; (3) grinding movements effected by a combination of the various muscles already mentioned.

That the tongue and cheeks are not frequently nipped between the teeth is an indication of the perfect co-ordination of a very complex series of movements. The controlling sensations are chiefly conveyed along the fibres of the fifth cranial nerve. The motor fibres of the same nerve supply the chief but not all the muscles of mastication.

After the food has been reduced to a proper consistency by the combined influence of the mechanical movements of the jaws, tongue, and cheeks, and the action of the saliva, it is rolled into a mass or bolus ready for swallowing. The bolus is pushed on the dorsum of the tongue, which is hollowed into a shallow trough to receive it. It is easy to conceive how this shape of the tongue is brought about when we consider that the tongue is provided with vertical fibres, with horizontal antero-posterior fibres, and with horizontal lateral fibres, in addition to its extrinsic muscles. The tip of the tongue is then raised against the hard palate in such a manner as to form an angle in which the bolus lies. By the approximation of the tongue to the palate the angle is lessened and the bolus is, in consequence, driven backwards. This constitutes the first stage in the act of swallowing, and is a voluntary act. At the end of the first stage the morsel of food has passed beyond the level of the anterior pillars of the fauces. The acts of the second stage are very complicated, and probably are entirely involuntary. The posterior pillars of the fauces approach one another in the middle line, and the uvula falls into the space left between them. The fleshy curtain thus extemporized is then drawn up towards the hind wall of the pharynx, which is drawn a little forwards and upwards to meet it. Thus the passage into the nose is completely shut. Meanwhile the vocal cords of the larynx draw near to one another; the epiglottis is pushed backwards over the larynx, and the whole larynx is drawn suddenly upwards and forwards beneath the root of the tongue. In this manner the entrance into the respiratory passages is protected. Finally, the anterior pillars of the fauces are made to meet over the tongue in order to prevent the regurgitation of the food. There is but one way open to the bolus; the sudden drawing forward of the larynx and the base of the tongue in fact "cuts the ground" from under the ball of food, which thereupon falls into the grasp of the "constrictors" and enters upon the third and final stage in the act of deglutition. This, even more certainly than the second stage, is purely involuntary. The constrictors contract from above downwards and force the morsel of food into the upper portion of the œsophagus. Once in the gullet, the mass of food is driven downwards by the so-called "peristaltic" movements of the tube—the circular fibres contract one after another from above downwards, lessening the calibre of the tube in successive stages, whilst the longitudinal fibres seem to have the function of drawing the tube over the bolus as a stocking is drawn over the foot.

Deglutition is a reflex act, in so far as it is involuntary, the centre for which lies in the medulla oblongata; destruction of this centre implies incapacity to swallow. The centre, though normally under the influence of the higher centres, may, however, act quite independently of these, as is evidenced by the fact that animals in which the cerebral hemispheres were absent have occasionally survived for a short time, and have still been able to suck and swallow. Although the excised gullet often exhibits a true peristalsis, which doubtless depends upon a local nervous mechanism, the normal movements in the body seem to be regulated from the medulla oblongata.

At the entrance of the stomach the food meets the barrier opposed by the contracted cardiac orifice; the contraction must be overcome before the food can gain admittance. The relaxation is certainly an active process under the control of the medulla oblongata through the vagus nerve, since section of the vagi causes a block to the progress of food from the œsophagus into the stomach.

In the stomach the food is detained for a period which varies very greatly with its digestibility, but which in the human subject is not often longer than four or five hours. It is subjected to a rubbing and rolling action of the stomach-walls and a modified peristalsis, which causes the food to move slowly from the cardiac orifice along the greater curvature to the pylorus, whence it returns along the small curvature to the cardiac end again. The gastric movements are slight at first, but gradually increase in vigour. The pylorus is tightly closed at the beginning of a meal, but becomes more and more relaxed as digestion proceeds, so that, whilst at first only the finer parts of the gastric contents can pass, afterwards the coarser parts and even solid lumps of imperfectly-digested aliments are permitted to escape into the duodenum. We possess little accurate knowledge as to the nervous mechanism of the stomach. Are the movements caused immediately by the local nervous ganglia situated in its walls? Or does the impulse to move descend directly from the encephalic centre along the pneumogastric nerves? All that we know is (1) that movements of an excised stomach are induced with great difficulty, (2) that stimulation of the vagus will often cause movements of the stomach, and (3) that section of the vagi impedes the passage of food out of the stomach. The movements of the stomach have been said to cease altogether during sleep.

When the gastric contents, to which the term chyme is often applied, pass through the pylorus into the duodenum, they begin to move onward by the pure peristaltic action of the small intestines. The powerful annular fibres contract one after another, driving the food onward, as water may be squeezed along an india-rubber tube by the compression of the hand. The longitudinal fibres contract in such a manner that the intestine is drawn over the advancing mass. The movements always occur (in health at least) in a direction from the stomach to the ileo-cæcal valve; here they stop and never pass as a continuous wave to the large intestine.

Peristalsis may be exhibited by an excised intestine independently of any extrinsic nervous apparatus. Stimulation of the vagus nerve, as a rule, excites the intestinal movements, while excitation of the splanchnic nerves tends to still them. When the blood stagnates in the intestinal vessels active peristalsis ensues. As the splanchnic nerves are also the vaso-motor nerves of the intestines, excitation of them produces constriction of the blood-vessels and comparative bloodlessness.

After passing through the ileo-cæcal valve the intestinal contents, which have been very greatly diminished in amount owing to the process of absorption that has gone on, quickly assume the characteristic appearance of fæces. The undigested and insoluble parts of the food, mixed with mucus, with epithelial débris, and with some substances derived from the secretions of the alimentary canal, notably with some biliary products, must be cast out; this is effected by the act of defæcation. The anus is normally kept firmly closed by the contraction of two sphincter muscles,—the external, which is one of the skeletal muscles, and the internal, which is formed by a special development of the lowest rings of the circular layer of muscles of the intestine. In the act of defæcation these sphincters are relaxed, while the contraction of the rectum forces its contents downwards. The levatores ani are brought into play by the will and exert an action similar to that previously referred to as performed by the longitudinal fibres of the intestine. Of special influence in aiding the expulsion of the contents of the bowel is the contraction of the abdominal muscles which follows a preliminary fixation of the diaphragm by a deep inspiration.

The act of defæcation is essentially a reflex act. The centre which presides over the sphincters of the anus lies in the lumbar portion of the spinal cord. This centre is under the control of the brain, under the influence of which its activity is either increased or inhibited.

Vomiting, or the ejection of the contents of the stomach through the mouth, is an act of considerable complexity; (1) the cardiac orifice of the stomach is relaxed or, to be accurate, thrown open by the operation of some reflex nervous mechanism with which the vagus is connected; (2) contraction of the muscular coat of the stomach occurs; (3) the abdominal walls are powerfully compressed, and the diaphragm is at the same time strongly fixed by closure of the glottis. As concurrent phenomena in ordinary vomiting may be mentioned the sense of nausea and the free flow of saliva which occurs during and indeed before the act.

Vomiting may, within certain limits, be inhibited by taking a series of deep and rapid inspirations at a time when the sense of nausea is becoming unbearable.

True vomiting seems to be impossible without the aid of the abdominal muscles, as, for example, when the abdomen is laid open. In such conditions emetics cause active opening of the cardiac orifice and movements of the stomach-walls, but not the full and free expulsion of the contents. Vomiting is usually a reflex act, the centre for which lies in the medulla oblongata near the centre for respiration, though it is reasonable to suppose that it may occur not only as a reflex act but as a result of direct stimulation of the centre or centres associated with it.

Secretions of the Alimentary Canal.—Production of the Alimentary Juices.—We have described the movements of the alimentary tube by which the food is triturated and agitated, and finally propelled from mouth to anus. One object of these movements is to mix together the food and certain solvent juices which are poured upon the food at various points. We have now to give an account of these juices and their properties. They are produced in, or by the agency of, the epithelium cells lining the interior of glands which are either situated in the walls of the alimentary canal or which empty their secretion into it. Though these cells derive the materials necessary to their metabolic activity from the blood, the substances which they elaborate and which are characteristic of the secretions that they help to form are not found in the blood, but are products of the activity of the protoplasm of the cells themselves. The act of secretion is a function of the living cell, and not a mere act of filtration or diffusion through the vascular walls to the cell-substance. It often involves the elaboration of entirely new substances. The act of secretion is, or may be, under the control of the nervous system; it may be started, inhibited, and the products of the secretion may be variously modified, by the stimulation of distant nerves. In some glands certainly, and possibly in all, the elaboration of the specific secretion of the gland takes place in two well-defined stages, and the two stages are indicated by differences in the anatomical appearances of the gland-cells.

The characteristic constituents of the several juices which are specially concerned in the chemical changes of the alimentary canal are certain so-called "unorganized" ferments, which we shall, following the suggestion of Kühne, denominate *enzymes*. Like all ferments, these are capable, under suitable circumstances, of initiating specific changes in certain bodies with which they are brought into contact, changes which may be incommensurably great when contrasted with the magnitude of the mass of the ferment engaged. "Unorganized" or, as they have also been called, "unformed" ferments differ, however, from the "organized" or "formed" in that, whilst they are the products of the activity of living cells, when once formed they cease to be living, are unconnected with any organized form, and have no power of reproduction or increase.

The enzymes for the most part exert their action unimpaired in the presence of certain bodies which kill the great majority of organized ferments; thus salicylic acid does not hinder peptic and tryptic digestion, whilst it prevents the putrefactive changes which are very apt to occur in the latter case, and which are connected with the development of organized ferments. Certain enzymes, as the diastatic ferment of saliva and pancreatic juice, are, however, destroyed by salicylic acid.

As will be shown in detail in the sequel, the secreting cells of glands which produce enzymes exhibit marked differences corresponding to different states of activity. In the case of the secreting cells of the pancreas the cells appear to produce and store up for a time a body, a *zymogen*, from which subsequently the tryptic enzyme *trypsin* is set free. The progress of research may perhaps establish the existence of zymogens corresponding to the other enzymes.

Usually the glandular organs which produce the alimentary juices contain stored up within them their characteristic enzymes, which may be extracted by digesting the comminuted organ in water, or still better in glycerin, which dissolves them nearly all, and furnishes solutions which preserve their activity long unimpaired. Enzymes are all insoluble in strong alcohol, so that the tissues from which they are to be extracted may be first dehydrated by digestion in absolute alcohol and afterwards extracted with glycerin. Solutions of enzymes are rendered inactive by boiling or by exposure to a temperature above 70° C. The principal enzymes of the alimentary canal belong either to the group of *proteolytic* or to that of *diastatic* or amylolytic ferments: the enzymes of the first group (pepsin and trypsin) dissolve proteids and effect their more or less perfect decomposition; the enzymes of the second class (as ptyalin and the diastatic ferment of the pancreas) dissolve starch and produce from it a series of bodies which will be discussed in reference to the action of saliva on starch.

Besides the proteolytic and amylolytic ferments, there occur in the alimentary canal a *curdling* ferment, an *inverting* ferment, and perhaps a *fat-decomposing* ferment.

All enzymes exert a more energetic action at a moderately high than at a low temperature, though the influence of a rise in temperature is more marked in some cases than in others. The reaction of the medium in which they are placed influences remarkably the activity of certain enzymes; thus pepsin, the proteolytic ferment of the stomach, is inactive in neutral or alkaline solutions, the presence of a free acid being essential to its activity, whilst trypsin, the proteolytic ferment of the pancreas, acts with feebleness in solutions which are neutral or faintly acid, since it needs for the full exercise of its powers a decidedly alkaline medium. The enzymes appear to possess the power of rapidly inducing, at the temperature of the animal body, in bodies subjected to them similar chemical operations to those which can be brought about with great slowness by prolonged heating with dilute mineral acids, or by the prolonged action of boiling water or superheated steam. These operations are of the nature of *hydrolytic* decompositions, that is to say, such as are connected with the union of the elements of water with the decomposing body.

Salivary Glands and Secretion of Saliva.—There are no secreting glands in the body which have been subjected to so elaborate a study as the salivary glands, whether we consider their structure or the circumstances which influence or accompany the act of secretion. We shall therefore give the results of researches on these glands at much greater length than those referring to the other glands concerned in the preparation of the alimentary juices.

As has been already said, the saliva is secreted by several glands of which the ducts pour their secretion into the cavity of the mouth, where it is mingled and constitutes the "mixed saliva." The chief of these glands are the parotid, the submaxillary, and the sublingual glands, though their secretion is mixed with that of small glands (mucous and serous) scattered through the mucous membrane of the mouth and tongue, which are included under the term "buccal" glands.

The salivary glands all belong to the group of acinous or compound racemose glands. According to the researches of Heidenhain, they may, however, be divided into two groups, which he has denominated serous or albuminous and mucous glands, according to the structure of the cells of their acini, their chemical characters, and the nature of the secretion which they elaborate.

To the group of serous glands belong the parotid of man and the majority of animals, the submaxillary gland of the rabbit, and some of the glands of the tongue; to that of mucous glands belong the submaxillary and sublingual glands in most animals. some of the glands of the tongue, and the œsophageal glands. Glands belonging to the former of these classes secrete a fluid containing some, though it may be only a small quantity, of a proteid coagulable by heat, and resembling, if not identical with, serum-albumin; the mucous glands, on the other hand, as their name implies, secrete a liquid free from albumin, but containing more or less mucin.

In the serous glands the epithelium lining the acini is composed of comparatively small, rounded, or polygonal cells, of which the outlines are not very distinct until acted upon by certain reagents. No cell-wall is present; the protoplasm, which is not coloured by carmine, presents many dark granules, and surrounds an irregularly saccular or rounded nucleus which is coloured by carmine.

In the mucous glands the characteristic (mucous) cells of the alveoli are large and clear, very faintly granular, with a rounded or oval nucleus near their periphery surrounded by a trace of protoplasm. They possess a cell-wall, and a strongly refracting process which springs from the cell in the neighbourhood of the nucleus.

In addition to the characteristic mucous cells there are found in the alveoli of most mucous salivary glands when examined in a state of rest, situated at some parts of the periphery, *i.e.*, lying more internal than, or nearer to, the membrana propria than the mucous cells, half-moon-shaped aggregations of small cells, possessed of a round nucleus easily stained with carmine, and containing albumin; to these aggregations the term of *demilunes* or *lunulæ* of *Gianuzzi* has been applied. In some cases we find alveoli in which these small cells are not arranged in demilunes, but form a row of cells lying external to the mucous cells, and completely encircling them (see fig. 3).

As has been said, in certain mucous glands the mucous cells are supplemented by the cells of the demilunes, though there are other mucous glands, as those of the tongue, where the typical mucous cells alone occur. There are glands, and the submaxillary of man is an example, which are termed mixed glands, inasmuch as some of the acini have all the characters of serous, others of mucous glands. The submaxillary gland of the guinea-pig possesses, according to Klein, a structure undistinguishable from that of the pancreas.

We shall not enter, in this place, into a detailed description of the innervation of any one of the salivary glands. but shall confine ourselves to the following statements.

Each salivary gland is supplied by at least three classes of fibres, viz., secretory, vaso-constrictor, and vaso-dilator fibres, of which the first and the third are conveyed to the glands in branches of cerebral nerves; these are, the chorda tympani for the submaxillary and sublingual, and the auriculo-temporal (which, however, derives them through communications with the otic ganglion from the glosso-pharyngeal nerve) for the parotid. The second class, the vaso-constrictor or vaso-motor fibres, run in sympathetic trunks. When, therefore, one of the cranial branches supplying a gland is stimulated there occur two acts, viz., secretion and simultaneous dilatation of blood-vessels; that these two acts are not absolutely interdependent is proved by the fact that certain drugs paralyse the one set of fibres, but leave the other intact. When, on the other hand, the sympathetic filaments supplying the gland are stimulated, the blood-vessels of the gland contract, and there is produced a small quantity of saliva differing in physical characters and chemical composition from that obtained under the circumstances first referred to. According to Heidenhain, however, in each of the two kinds of nerves supplying a salivary gland there exist, besides the vascular nerve-fibres, secretory and trophic fibres, though the number of one or other of these classes may be insignificant,—the secretory predominating in the cranial nerve branches, the trophic in the sympathetic. Stimulation of secretory fibres leads according to Heidenhain, to an increased flow of water, stimulation of the trophic to an increased secretion of specific substances and to an increased production of protoplasm.

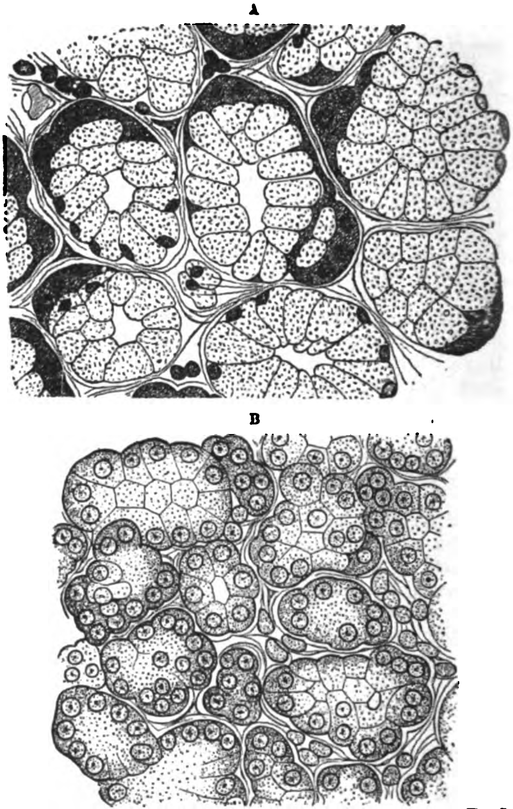


Fig. 2.—Sections of a Mucous Gland of the Dog. A, during rest; B, after activity. (From Quain's *Anatomy*, fig. 505.)

When a salivary gland passes from the state of rest into that of activity it is at once the seat of an increased blood flow, which is associated with the dilatation of the blood-vessels of the organ. Under these circumstances, the blood leaving the gland presents a florid arterial colour, instead of the venous colour which characterizes the blood of the organ when at rest. This vascular dilatation is explained by the coming into action of the before-mentioned vaso-dilator fibres; it is independent of the act of secretion.

As was shown in a now classical investigation of Ludwig, when the salivary glands are thrown into activity there is a rise in temperature, so that the temperature of the saliva leaving the submaxillary gland may exceed by 1°·5 C. that of the blood flowing to the gland. This rise in temperature cannot be explained by a study of the chemical characters of the salivary secretion, but is doubtless the result of the increased metabolic changes which necessarily accompany the act of secretion in the gland-cells, and which chiefly affect their protoplasm.

That the secretion of saliva (and indeed secretion in general) is not a mere act of filtration was proved by Carl Ludwig when he showed that saliva can be secreted by a gland though the pressure within it is many times higher than that of the blood circulating through the arteries which supply it. On many grounds it may be positively asserted that the secreting cells are the primary agents in the withdrawal from the blood of the water necessary for the secretion, though the exact nature of the process is yet unknown; similarly, on the grounds stated below, we know that within the protoplasm of the gland-cells are formed the characteristic soluble constituents of the secretion.

The researches made during the last few years by Heidenhain, and fully confirmed by a large number of observers, have demonstrated that in the salivary glands, as indeed in all sccreting glands, structural and perfectly obvious microscopic changes occur, which stand in close relation to the different conditions of functional activity.

The resting gland-cell is large, but possesses comparatively little protoplasm, and therefore comparatively little matter which can be stained by colouring bodies, especially by carmine; it contains instead a store of material which has been elaborated in, or at the expense of, the protoplasm. This material does not constitute the specific matter of the secretion, but is its antecedent. That it differs chemically in the case of the mucous glands is proved by the fact cited by Heidenhain, and discovered by Watney and Klein, viz., that, whilst mucin is stained by hæmatoxylin, its antecedent (mucigen) is not affected by that colouring matter; in all other respects the two bodies are identical. When, however, a gland passes into a state of activity, as, for example, by the irritation of its so-called secretory (trophic?) nerves, the gland-cells undergo the following changes, which may proceed simultaneously though not necessarily so:—the stored-up matter previously referred to is converted into soluble constituents of the secretion, and at the same time there occurs a growth of the protoplasm of the cells, at the expense doubtless of the richer supply of lymph which during the secretory act bathes the gland.

The period of activity in so far as the gland-cell is concerned is indeed a period of removal of ready-made constituents of secretion, in some cases, as in the mucus-bearing cells of the mucous glands, a period of destruction of cells laden with such constituents; but at the same time in all cases a period in which the protoplasmic constituents of the cells generally increase, and active proliferation of secreting cells occurs.

Whilst we have in a few sentences sketched the general characters of the changes which glands undergo during secretion, our picture is wanting in all details, and the reader is referred for further information to works on histology and physiology.

Glands of the Stomach and Secretion of Gastric Juice.—In vol. vii. p. 225 a brief description has been given of two kinds of glands which are found embedded in the mucous membrane of the stomach, and which are concerned in the preparation of the secretion of this organ, the so-called *gastric juice*. The first kind of glands, the "mucous glands of the stomach," so called from their having been formerly erroneously supposed to be engaged in the secretion of mucus only, are situated chiefly at the pyloric end (figs. 4, 5) of the stomach. The second kind, the so-called "peptic glands," owe their name to the view that they alone secreted the digestive gastric juice, and are found in most animals in the mucous membrane of other parts of the stomach than the pylorus. The pyloric glands are tubular glands, simple or compound, composed of a basement membrane lined by two kinds of epithelium-cells, (1) cylindrical epithelium-cells confined to the neck of the gland, (2) cylindrical or cubical epithelium-cells lining the part of the tube below the neck, and which, though not very different in form from the cells of the neck, possess an entirely different function. The peptic glands of the older writers, now usually called "glands of the fundus," present three varieties of epithelium-cells. Their "neck" is lined by cylindrical epithelium similar to that of the neck of the pyloric glands. The deeper part of the glands is lined by small cubical "central" cells, below which and interposed between them and the basement membrane is a discontinuous layer of large ovoid "border" cells, the so-called "peptic cells" of older writers.

During active digestion the cubical cells of both pyloric glands and glands of the fundus become swollen and granular; after a period of rest they return to their original size and assume a comparatively clear appearance. The ovoid cells also swell during digestion, but in other respects remain unchanged.

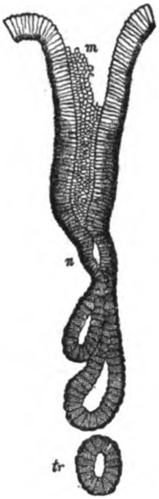


Fig. 4.

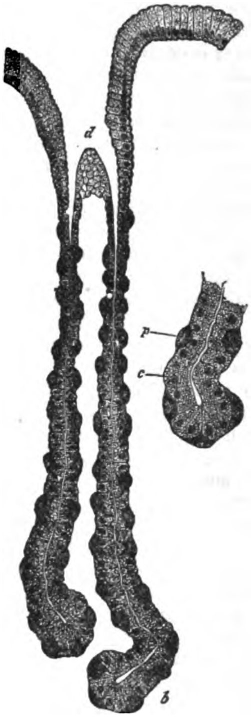


Fig. 5.

Fig. 4.—Pyloric Gland, from a section of the Dog's stomach (Ebstein). *m*, mouth; *n*, neck; *tr*, deep portion of a tubule cut transversely. (From Quain's *Anatomy*, fig. 515.)

Fig. 5.—Cardiac Gland, from the Dog's stomach (Klein and Noble Smith). Highly magnified. *b*, base or fundus of a tubule; *d*, duct or mouth of gland; *c*, central cells; *p*, parietal cells. (From Quain's *Anatomy*, fig. 517.)

When the stomach is inactive, *i.e.*, in the fasting condition, its mucous membrane is pale and the organ contains no fluid; the mucous membrane in the pyloric region presents an alkaline reaction. When, however, food enters the stomach, or the mucous membrane is subjected to mechanical stimulation, an acid juice, the so-called gastric juice, is poured out, the act of secretion being accompanied by a reddening of the mucous membrane.

Evidence appears to be most conclusive in support of the view that the three kinds of epithelium-cells found in the stomach and its glands possess entirely separate functions. The epithelium-cells which line the interior of the stomach, and which, like those of the neck of both kinds of glands, are cylindrical in shape, appear to be mucus-forming cells. The cubical cells which are found in the deeper parts of the pyloric glands appear functionally to be identical with the central cells of the glands of the fundus, both being engaged in forming the chief ferment of the gastric juice, viz., pepsin, whilst the ovoid cells of the glands of the fundus are the sole elaborators of the acid of the gastric juice. The glands which possess these acid-forming cells have of late been termed (Langley) oxyntic glands (ὀξύνειν, to render acid).

No accurate estimate can be formed of the amount of gastric juice secreted during twenty-four hours. It has been calculated to be between 20 and 30 pints.

Secretion of the gastric juice may occur after all the nerves going to the stomach have been divided, though it is for a time arrested after division of the pneumogastric nerves. It is probable that the process of gastric digestion is essentially under the control of an intrinsic nervous mechanism situated in the mucous membrane, though this is normally influenced by the higher nerve centres.

Liver and Secretion of Bile.—The structure of the liver has already been sufficiently described (vol. vii. p. 229 *sq.*), and need not be further alluded to in this place. The secretion of the liver, the bile, is being continually formed, though not always at the same rate. In animals possessed of a gall-bladder it is stored in the intervals of digestion in this reservoir. When food is taken into the stomach the bile begins to be secreted in larger quantities, the maximum being reached about six hours after the meal. As the so-called acid "chyme," to be afterwards referred to, passes the opening of the bile-duct in the duodenum, it is probable that a stream of bile is poured upon it by the reflex contraction of the gall-bladder. During the time when bile is being secreted much heat is evolved in the liver. The bile, as will be shown in the sequel, should be looked upon as a liquid containing only certain, for the most part useless, by-products resulting from great chemical operations going on in the liver. Little is known as yet of the exact changes which occur in the liver-cells during activity, nor of the manner in which the nervous system influences the secretion of bile.

Pancreas and the Secretion of Pancreatic Juice.—The pancreas possesses a structure which presents great resemblance to that of serous salivary glands, and its alkaline secretion was until lately looked upon as closely resembling the saliva.

The secreting cells of the pancreas, which differ but little microscopically from those of such a salivary gland as the parotid, exhibit very marked differences, which correspond to different states of functional activity. During a period of glandular repose the cells contain innumerable granules, which are congregated at that side of the cell which lies towards the centre of the acini (fig. 6, B). The outer or peripheral portion of the cells—the smaller part of the resting cell—is clear. After a period of glandular activity the granular half of each cell is found to have diminished greatly (fig. 6, A); the whole cell is clear and distinctly smaller than before, and its behaviour towards colouring matters is very different. The pancreas, when perfectly fresh and just removed from the yet warm body of an animal which is killed, does not contain, ready formed, all ferments which will in the sequel be referred to as characterizing the pancreatic juice. If we treat the gland, for instance, with glycerin, which possesses the power of extracting and dissolving all the ferments, we fail to obtain a solution which possesses the power of digesting proteids; but, instead, we find a substance in the solution from which, by the addition of a little acetic acid, the proteolytic ferment may be formed.

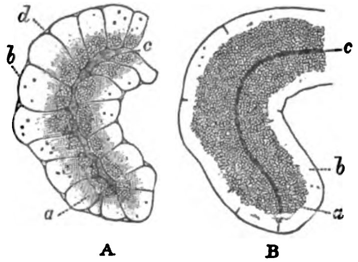


FIG. 6.—Pancreas of Rabbit. A, during rest; B, in activity. *a*, inner granular zone; *b*, outer transparent zone; *c*, lumen; *d*, indentation at junction of two cells. (From Foster's *Physiology*, fig. 43.)

The cells of the pancreas thus elaborate a substance which is the antecedent of the proteolytic ferment, and which yields it when it passes into the pancreatic ducts; it is customary to speak of this body as *zymogen* or ferment-former, because it gives rise to one of the chief enzymes or ferments of the juice. The secretion of pancreatic fluid is slight except during digestion. After the taking of a full meal the secretion is suddenly exalted, reaching its maximum two or three hours afterwards. The secretion then diminishes until a period which extends from the fifth to the seventh hours, when a rise occurs, which lasts to between the ninth and eleventh hours after food. The secretion then gradually sinks, until it absolutely ceases. Stimulation of the gastric mucous membrane starts the secretion of pancreatic juice; it is arrested during nausea and vomiting, as also when the central end of the divided pneumogastric is stimulated.

Intestinal Glands and their Secretion.—The mucous membrane of both the small and the large intestine contains embedded in its substance innumerable simple tubular glands, the so-called crypts or glands of Lieberkühn, which are lined by a single layer of cylindrical epithelium continuous with and resembling that covering the exposed surface of the intestine. Very little is known as to the function of these glands, whose office is probably widely different in different sections of the intestinal tube, particularly in the large as distinguished from the small intestine. We do know that the epithelium-cells of these glands are capable of forming mucus, and that in the small intestine they are doubtless the source whence is derived the so-called intestinal juice or "succus entericus" which is poured into the intestine in large quantities under particular circumstances, as, for instance, when all the nerves supplying the gut are divided.

Physical and Chemical Properties of the Several Alimentary Juices.

The mixed saliva of man is, when perfectly fresh, a clear, transparent, viscid liquid, which, on microscopic examination, is found to contain cells of squamous epithelium derived from the mouth, besides certain globular cells derived from the salivary glands and called "salivary corpuscles." Its reaction is alkaline; it has a specific gravity of about 1·003, and contains about five or six parts per thousand of solid matters. Its solid constituents consist (1) of certain saline matters transuded from the blood and, in addition, of a small quantity of a soluble *sulphocyanide*, detected by the reddish tinge caused by the addition of solution of ferric chloride to the saliva; (2) small quantities of *soluble proteids*, coagulable by heat; (3) *mucin*, to which saliva owes its viscidity, and which is thrown down when the liquid is acidulated with acetic acid; (4) a ferment or enzyme called *ptyalin*, *salivary diastase*, or *the diastatic ferment of saliva*. The last-mentioned is the most important constituent. It possesses the power of rapidly rendering cooked starch soluble, though its action on raw starch is but very slight. Not only does it dissolve starch, but it progressively decomposes the complex starch molecules into isomeric bodies of less complexity. Starch has a chemical composition which may be represented by the empirical formula $(C_{12}H_{10}O_{10})_n$, the exact value of n being yet a matter of doubt. The salivary diastase, under suitable conditions, as has been said, first converts insoluble into soluble starch (hence it is sometimes termed an amylolytic ferment) which, it has been surmised, probably has the composition $(C_{12}H_{10}O_{10})_{10}$. This soluble starch, like the insoluble body, gives a beautiful blue colour with iodine. By the further action of the ferment the soluble starch yields a series of dextrins which are isomeric with starch, though they possess smaller molecular weights and different reactions, and at the same time a sugar which, from its identity with that which is produced in the process of malting of barley, is called "maltose," and which, though possessing many of the reactions of grape-sugar, is an isomer of cane-sugar; when crystallized it has the composition $C_{12}H_{22}O_{11} + H_2O$.

The changes which are brought about by the action of the salivary ferment on the starchy constituents of food are hastened by a temperature near that of the mammalian body. Boiling destroys the diastatic power, as also does the presence of strong acids or alkalies. A very feeble acid reaction does not absolutely stop the characteristic action.

Whilst the saliva of man and some few animals possesses the remarkable diastatic ferment just referred to, this is absent from the saliva of the majority of animals, so that we are forced to conclude that the saliva is an alimentary juice which subserves mechanical rather than essential chemical functions.

Gastric Juice.—This is a thin colourless or straw-coloured liquid of strongly acid reaction, and of a mawkish taste. Its specific gravity varies between 1·001 and 1·010, and it contains from ½ to 1 per cent. of solid matters.

The gastric juice contains (1) free hydrochloric acid, (2) certain mineral matters, and (3) a ferment or enzyme called pepsin. It has been much disputed whether the gastric juice contains the hydrochloric acid in a free condition, but the question may be considered to have been settled in the affirmative by many facts, amongst which one of the most striking is that the gastric juice behaves towards certain organic colouring matters as only liquids do which contain free mineral acids. The pepsin, which has never been separated in a pure condition, is soluble in water, weak spirit, and glycerin, and confers upon all these solvents its characteristic property, viz., that of dissolving, in the presence of a dilute free acid, and at a suitable temperature, insoluble proteids, and of converting these into soluble and diffusible modifications termed peptones. Peptones differ from other albuminous or proteid bodies in their greater diffusibility, as well as in their much higher solubility in pure water. They are not coagulated by heat or by nitric acid, and are not thrown down by many mineral salts which precipitate other soluble proteids.

Gelatin under the same conditions is converted into an ungelatinizable modification, the so-called gelatin-peptone. Boiling destroys the activity of solutions of pepsin. If their reaction ceases to be acid, and, further, if the acid reaction be not due to a free acid, no action is exerted upon proteids. A temperature approximately the same as that of the mammalian body is that most favourable to gastric digestion. The accumulation of the products of gastric digestion, viz., peptones, hinders the continued activity of the juice. Pepsin, though probably containing nitrogen, is not a proteid body.

In addition to pepsin the gastric juice contains an entirely independent ferment which is called the "curdling ferment" or the "rennet ferment," because of its power of rapidly inducing at the temperature of the body the coagulation of the casein of milk, which it converts into cheese. Unlike pepsin, this ferment will act in solutions which contain no trace of free acid.

The following table (Hermann) shows the average composition of the gastric juice of man, the dog, and the sheep.

	Man.	Dog.		Sheep.
Water	994·4	973·1	971·2	986·1
Hydrochloric acid	0·2	3·3	2·4	1·2
Organic constituents (pepsin, &c.)	3·2	17·1	17·3	4·1
Mineral matters	2·2	6·5	9·1	8·6

Bile.—Bile is a bitter liquid of golden-red colour in man and carnivorous animals, but green in herbivorous animals. It is commonly viscid owing to admixture with mucus derived from the walls of the gall-bladder and hepatic ducts. Its reaction is neutral or faintly alkaline. It contains about 14 per cent. of solid constituents. (1) It includes the sodium salts of certain so-called bile-acids, which in man are glycocholic and taurocholic acids. The former has the formula $C_{26}H_{43}NO_6$, and is readily decomposed into glycin, $C_2H_5NO_2$, and an acid termed cholic acid, $C_{24}H_{40}O_5$; the latter has the formula $C_{26}H_{45}NSO_7$, and can be split up into a base called taurin, $C_2H_7NSO_3$, and into cholic acid. (2) It contains bile-colouring matters, of which the chief is a red one termed bilirubin, $C_{16}H_{18}N_2O_3$, with which is closely connected the green colouring matter of the bile of herbivores, termed biliviridin, $C_{16}H_{18}N_2O_4$; bilirubin is unquestionably derived from the decomposition of the blood-colouring matter or hæmoglobin. (3) It has fats, and a body called cholesterin, which belongs to the class of alcohols and has the composition $C_{26}H_{44}O + H_2O$. (4) It includes saline matters which are rich in sodium salts. Whilst the bile-acids and the bile-colouring matters are formed in the liver itself, the cholesterin of the bile is probably derived entirely from the blood, which obtains it from the nervous organs, in the white matter of which it is abundantly present.

The proportion of the constituents of the bile present in this liquid is shown by the following analyses.

Composition of Human Bile.

	(1)	(2)
Water	860·0	822·7
Sodium glycocholate and taurocholate	102·0	107·9
Mucin and colouring matters	26·6	22·1
Cholesterin	1·6	47·3
Fatty matters and lecithin	3·2	
Mineral matters	6·5	10·8

The amount of bile secreted by man has been estimated at from about 136 grains to about 309 grains per kilogramme (2·20 ℔) of body-weight; but in certain cases, through abnormal circumstances, the total amount of bile secreted in twenty-four hours has been found to be less than this, viz., to vary between about 16 and 21 oz.

The action of the bile in digestion, it must be admitted, seems trifling and out of proportion to the size of the gland and the amount of the secretion. It is a weak solvent for fats; it has the power of emulsifying fats, especially, perhaps, when added to the pancreatic juice; and it may help the passage of fat through animal membranes. At least it is certain that, when filter-paper is wetted with bile, oils filter through it more readily than when it is wetted with water. The most important use of the bile is, however, as an adjuvant to pancreatic digestion. The pancreatic juice, as will be stated more particularly below, contains a ferment which is either a proteid body or inseparably connected with a proteid body. Strangely, though this ferment possesses the power of dissolving proteids under suitable circumstances, in the presence of pepsin and any free acid it is itself destroyed. It would then be acted upon by the pepsin passing into the duodenum from the stomach if the conditions were favourable. To prevent this untoward accident the alkaline bile is poured over the acid contents of the stomach as they pass the duodenum; these are neutralized, and a precipitate is thrown down which mechanically entangles the pepsin that may be in the mixture. Although the definable uses of the bile are small, the part which it plays in the economy is of essential importance. Animals whose bile is allowed to escape externally soon grow lean and ill-conditioned. The fat which should be absorbed in the alimentary canal remains in part in the fæces, which acquire a peculiar putrescent odour.

Pancreatic Juice.—If we except the gastric juice, the chemical action exerted by the pancreatic juice is the most potent and useful of any of the digestive secretions.

When freshly secreted and perfectly normal, the pancreatic juice is a clear viscid liquid of strongly alkaline reaction and highly coagulable by heat. Its solid constituents may reach the proportion of 10 per cent.

It contains (1) water, (2) various albuminous bodies which cause the liquid to be coagulable by heat, and of which one is intimately connected, or indeed perhaps identical, with the ferment trypsin, (3) a number of ferments, (4) traces of products of digestion, as leucin and tyrosin, (5) salts. The ferments of the pancreatic juice are the following:—(1) a proteolytic ferment termed trypsin, (2) a diastatic ferment, (3) a ferment which acts on fats, (4) a curdling ferment (?).

The first-named ferment, unlike pepsin, which is quite inactive under this condition, acts most energetically in solutions which contain a free alkali or an alkaline carbonate, although it possesses some action when the reaction is neutral or even faintly acid. Like pepsin, trypsin dissolves insoluble proteids and converts them into peptones; it possesses, however, an activity which surpasses that of pepsin, inasmuch as it splits up certain of the peptones formed into simpler bodies, such as leucin, $C_6H_{13}NO_2$, and tyrosin, $C_9H_{11}NO_3$, the former of which is an organic body allied to the fatty acid group, and the latter to the aromatic group. According to the views of Kühne, the molecule of an albuminous or proteid body is capable of being broken up under the influences of such ferments as pepsin and trypsin into the allied bodies of smaller molecular weight, the peptones, which, though possessing general and common reactions, may by their behaviour towards certain chemical agents as well as towards ferments be subdivided into two groups, a *hemi*-group and an *anti*-group. Kühne believes that both pepsin and trypsin decompose the proteids with the production of so-called *hemi-peptones* and *anti-peptones*, and that, whilst neither pepsin nor trypsin can further decompose anti-peptones, trypsin possesses the power of splitting up hemi-peptones into simpler bodies.

The amylolytic or diastatic ferment of the pancreatic juice resembles that of the saliva in its action. Whilst the saliva of most animals contains no such ferment, the pancreatic juice of all animals is very rich in diastatic ferment, so that the action of the pancreatic juice on starch is much greater than that of saliva.

The fat-decomposing ferment—sometimes, though erroneously, called the "emulsifying ferment"—of the pancreas is present in exceedingly small quantity and is very readily destroyed, so that its existence has sometimes, though erroneously, been denied. It breaks up the neutral fats in part into their respective fatty acids and glycerin. This slight acidification unquestionably facilitates the formation of an emulsion of the remaining fats.

All these ferments are influenced by temperature in nearly the same manner as the ferments of saliva and gastric juice. Boiling destroys them absolutely, cold retards their activity, the body temperature is very favourable to them. The most suitable medium for them is the alkaline juice in which they occur, and the alkalinity of which is due to sodium carbonate.

The following is an analysis of the pancreatic juice of the dog:—

Water (in 1000 parts)	900·8
Solids	99·2
Organic matters	90·4
Inorganic matters	8·8

Intestinal Juice.—This juice, which is also called not unfrequently by its Latin name *succus entericus*, is a thin, yellowish, alkaline, albuminous liquid of specific gravity 1·01, concerning which we possess very little certain information. It has been said to act upon fibrin alone of the albuminous bodies; it not only contains a small quantity of a diastatic ferment but probably also a so-called inverting ferment, possessing the power of converting cane-sugar into grape-sugar.

Fate of Food-Stuffs in the Alimentary Canal.—The food which is introduced into the mouth is an exceedingly complex substance. Leaving out of account those substances which are insoluble and incapable of absorption, and which are also not amenable to the influences of the digestive juices, we may classify the true food-stuffs as follows.

(1) *Albuminous matters*, including (*a*) the true *proteids*, such as albumen of egg, casein of milk, myosin of muscle, fibrin of blood, &c., and (*b*) the *albuminoid bodies*, such as gelatin from tendons and bones, chondrin from cartilages, and elastin from various elastic structures; (2) *hydrocarbons* or *fats*, of which those chiefly used for food are stearin, olein, and palmitin; (3) *carbohydrates*; (4) the various *inorganic salts*; (5) *water*. The third group includes the *amyloids* or starch-like bodies, the *saccharoses* like cane-sugar, the *glucoses* like the grape-sugar and fruit-sugar found in honey and in ripe fruits, the sugar of milk, &c. In addition to these may be mentioned allied bodies, cellulose, pectin, arabin, mucilage, &c., which in some animals, or in some conditions, are certainly digestible. In a subdivision of the same group we may place the various vegetable acids, lactic, acetic, citric, malic, &c., which are essentially foods.

It may be premised that the fate which befalls a given example of ingested food does not depend solely upon the theoretical power of the digestive juices to act upon it. Thus digestible food may be imperfectly digested owing to being passed into the stomach in lumps and masses, which the juices cannot permeate and the stomach cannot crush; or starch may be so incorporated and encapsuled with fat that the saliva and even the pancreatic juice may fail to reach it; or digestion from one cause or another may be so prolonged that fermentative changes, to which most samples of food are inevitably liable from containing organized ferments or "germs," may have time to begin and to alter materially the sequence of events. Hence we shall feel no surprise that much food escapes altogether the action of digestion. The most perfect and economical feeding is that in which the least quantity of food is passed through the alimentary canal unchanged. When, however, the just quantity is taken, and the digestive organs are sound, the following is the order of the changes which occur

Food placed in the mouth at once excites the flow of mixed saliva and mucus. Solid food is broken up, rubbed together with the juices of the mouth and entangled air-bubbles, and rolled into a slimy bolus. Soluble constituents of it thus have an opportunity of becoming dissolved at once; sugar, dextrin, vegetable acids, and many inorganic salts would, in part at least, pass into solution in the mixed saliva. The process of mastication, besides triturating the food and mixing it with the alkaline saliva, permits it to become raised nearly to the body-temperature, in which condition the dextrin and the starches readily fall a prey to the ptyalin, and begin to be converted into dextrins and maltose. This change is very rapidly effected —it begins instantly if the starch is already boiled; so that, unless the food is "bolted," a considerable quantity of soluble dextrin and sugar is formed before the bolus is swallowed. The act of deglutition passes the softened bolus into the stomach, where already a certain quantity of acid gastric juice is ready to receive it. The presence of food in the stomach is a greater stimulus to the gastric flow than its presence in the mouth: the juice is more rapidly secreted, but still it is comparatively poor in pepsin and still more so in free acid; but after a time, as more food is added, and as the first-coming food begins to be dissolved and absorbed, the proportion of pepsin is increased. The movements of the stomach mix intimately the acid juice and the alkaline food; the first effect of this is a neutralization of the mass, but, as the secretion of juice goes on for some time after the last portion of an ordinary meal has been swallowed, the mass becomes more and more acid. The amylolytic action of the swallowed saliva is gradually checked, and the still unchanged starch remains unchanged so long as it lingers in the stomach.

Such saline and other dissolved matters as are still soluble in slightly acid solutions remain dissolved, and, with the water which is swallowed, may pass at once into the blood-vessels by absorption. Other salts, as the carbonates and phosphates of the alkaline earths, become dissolved in the presence of an acid. The gelatigenous tissues—connective tissue holding together in its meshes fibres of muscle, globules of fat, strands of nerve, &c.—are dissolved. The skins or pellicles of the fat-vesicles suffer the same fate. The elastic sarcolemma is now thought to be similarly affected. As a consequence the proteid and fatty portions of the organs referred to escape and fall into smaller fragments. Muscular fibres readily split into fibrillæ and disks, and are then in the very best physical condition for the free play of the gastric juice. The fat escapes, flows together to form larger globules, but is otherwise unchanged. Cane-sugar, which is of no use to the organism until it is converted into maltose or glucose, finds in some slight degree the condition for this conversion in the combined action of the gastric juice and the gastric mucus, although we are still in great doubt as to where the greatest conversion takes place. The all-important change which the food undergoes in the stomach is, however, the change of its proteid element into the more diffusible form of peptones, about which it will be enough to say that it is not a mere solution of proteid in a dilute acid, although this may be the first step in the operation, but probably a decomposition of the original proteid molecule. The obvious effect of gastric digestion is to reduce the food to a grey pulpy mass called chyme, in which condition it passes into the duodenum along with more refractory or less perfectly digested portions of food such as may still remain in the stomach at the end of the normal period of gastric digestion.

The presence of food in the stomach, as has been remarked, is of itself a stimulus to the secretion of bile and pancreatic fluid; by the time, therefore, that the chyme passes into the duodenum, a considerable quantity of the fresh juices is prepared for it. Not only so; the contact of the acid chyme with the duodenal membrane at once brings on a reflex contraction of the ducts and gall-bladder of the liver, by which a sharp stream of alkaline fluid is at once poured out, wherewith the chyme is drenched. So far as the mixture is made perfect and the point of neutralization is reached, a precipitate of parapeptones and peptones is formed, carrying down with it the active pepsin. But the acidity of the chyme is not at once overcome; not until the middle of the small intestine is reached does the acid reaction entirely disappear; and we may therefore assume that a kind of exotic gastric digestion may go on in the parts of chyme which still remain acid. But whenever the reaction ceases to be strongly acid the pancreatic juice takes up the work of digestion. Proteids are changed into soluble peptones, and the conversion of starch into dextrin and maltose begins again with redoubled vigour. Fats are seized upon, resolved into glycerin and their fatty acids, and emulsified both by bile and by pancreatic fluid. The resulting fatty acids combine with the alkalies of the mass to form soaps, which in turn aid the process of emulsification. The chyme, which, from being grey, became of a golden-orange colour when saturated with bile, acquires a decidedly cream-like appearance from the emulsion that is formed.

It is still an interesting question whether pancreatic proteolysis ever, in health, goes beyond the formation of peptones, as it may certainly do in artificial digestion in the laboratory. Some leucin and tyrosin undoubtedly appear in the small intestine; but, inasmuch as they are bodies which, if formed, would be rapidly absorbed, it is impossible to say whether any considerable amount of proteid matter suffers this fate, or whether leucin and tyrosin are formed, as it were, accidentally, from the too long staying of an excess of proteid in the alimentary canal. Leucin and tyrosin are never found in the fæces.

As the remnant of food passes down the intestine, changes allied to putrefaction invariably occur. Lactic acid is always to be detected in the small intestine, and the amount of it increases as the ileo-cæcal valve is approached. Possibly the butyric acid fermentation likewise occurs as a constant, if not an essential, phenomenon of intestinal digestion. At least the gases of the small intestine always contain a small amount of hydrogen; but if we are to gauge the butyric acid fermentation by the amount of hydrogen detected, we must assume it to be of very small proportions. We are so ignorant of the nature of the enteric or intestinal juice that we need not here speculate as to the changes in the remnant of food which the addition of it may bring about. Let it suffice to say that the intestinal contents pass through the ileo-cæcal valve with none of the odour and little of the appearance of fæcal matter. While in the large intestine they become reduced in bulk, and approach a solid consistency by the abstraction of water from them. Their reaction becomes distinctly acid once more; but now, from inward processes of putrefaction and fermentation which were started already in the small intestine, putrefactive gases may arise, light carburetted hydrogen, carbonic acid, sulphuretted hydrogen, nitrogen, and hydrogen. The fæces themselves are commonly acid; besides the indigestible parts of food, such as horny matter and cellulose (the denser sorts at least), and the undigested but digestible overplus of starch, proteid, &c., they contain derivatives from the bile which cause the characteristic colour, and some final decomposition products of elements of food, such as indol.

II.—Absorption of Nutritive Matters into the Blood.

The complex processes of digestion result in the conversion of insoluble and indiffusible food-stuffs into soluble and diffusible sugars and peptones. These, with the soluble saline matters, the finely-divided or emulsified fats and water, are (if we except the small quantity of soaps formed in the course of pancreatic digestion, and the small amount of soluble leucin and tyrosin evolved in the same process) the only contents of the alimentary canal capable of entering the organism from the outer world. They are not indeed the only soluble and absorbable bodies in the intestine; a large part of the digestive juices themselves are reabsorbed, and may possibly do duty over again in their respective secretions. But these are not foods. How, it may now be asked, do these soluble or finely-divided substances pass the confines of the body? From what has already been said about the organs of digestion it will be evident that, from the stomach downwards, the alimentary cavity is separated from an infinite number of thin-walled vessels by a delicate layer of columnar epithelium and a filmy basement membrane. There seems at first sight to be no difficulty in understanding how water and dissolved and diffusible matters may pass these barriers with the greatest readiness by physical processes of diffusion which are so simply imitated in the laboratory. We know also that, in fact, solutions do with the greatest ease and rapidity pass through such a membrane as the conjunctiva, by the readiness with which the pupil may be dilated on putting a drop of atropinized fluid beneath the eyelid. But it is by no means clear that the process is so simple in the living intestine. A fresh specimen of epithelium scraped from the interior of the mouth of a pig may be bathed in a solution of colouring matter and yet admit no trace of the colour into the substance of its cells so long as they remain alive. It is only when they cease to be living protoplasm that the physical processes of diffusion come into play and that the cell-substance takes up the colour. Guided by this simple observation we shall hesitate to assume, because we have water containing soluble sugars, salts, and peptones on one side of the epithelium of the alimentary tract, while on the other we have fluids differently constituted, that therefore we must needs have a process of transfusion tending to the passage of the dissolved substances from one side to the other. This "absorption" of matters, even simple saline solutions, at the surface of the intestine may be, and most probably is, a vital operation. Be the nature of the process what it may, it is easy to conceive how fluids at least arrive at the interior of the blood and the lymph capillaries of the alimentary mucous membranes. The case of the particles of emulsified fat presents more difficulty; but even here there are only two possibilities open to us. Either the fine globules pass *through* the columnar cells, or they pass *between* them; if they pass through them they must traverse the thick striated inelastic end of the cells in a manner which it is somewhat difficult for us to picture; if they only pass between the cells it is difficult to explain why so many of the acutest observers have described the occurrence of fat-particles within the epithelial cells of recent preparations of intestinal mucous membranes.

Once through the epithelial layer the absorbed matters pass into the blood-vessels or the lymphatics in some way the details of which are as yet mere matters of speculation. The axial lymphatic vessels of the villi—the so-called lacteal radicles—have a special interest, since villi are pre-eminently the absorbent rootlets of the body. As soon as they become filled, the layer of muscular fibres investing them contracts and empties the contents of the lacteal towards the deeper vessels of the mucosa. The subsequent expansion of the radicle will evidently favour the refilling of it.

It is very disputable where absorption takes place. The filtrate obtained from the contents of the stomach yields very little peptones, the inference being that much has already become absorbed by the gastric capillaries, hæmic or lymphatic. There seems to be no reason why water, salines, and dissolved sugars should not also be taken up at the same place. In the large intestine water at least is absorbed, for the contents become drier as they pass along the bowel. But it is the small intestine chiefly which is the scene of most extensive absorption of digested products; here fats are demonstrably taken into the organism; and here, doubtless, more than elsewhere, peptones, sugars, and other soluble bodies suffer the same fate.

Blood-vessels and lymph-vessels are both sharers of the work, though to what extent each is employed is a matter of surmise rather than of observation. The lacteals certainly absorb the largest part of the fat, though, as the relative amount of fat in the portal vein increases after a meal, fat must also be absorbed by the blood-capillaries. The material absorbed into the portal vein is at once submitted to the smaller circulation of the liver and the activity of the liver-cells; that absorbed into the lacteals traverses many lymphatic glands before it reaches the thoracic duct and the general circulation at the root of the neck. Thus in both ways of absorption the raw material is immediately passed into certain organs before it reaches the common stock of blood. That changes are effected in the constitution of the just-received food-stuffs during their stay in these organs there is every reason to believe; for, on the one hand, the blood issuing from the liver in the hepatic veins differs from the blood entering it by the portal vein; and, on the other, the contents of the thoracic duct differ from the contents of vessels nearer the absorbent radicles, as, for example, the contents of the mesenteric lacteals. The nature of these changes must be discussed in the next section.

III.—Chemical Processes in the Tissues and Organs of the Body.

While it is probable that the liver modifies the recently-digested raw material of food before it reaches the common stock of the blood, it is quite unknown what (or, indeed, if any) difference exists between the action of the liver on blood laden with raw material immediately after a meal and its action on blood traversing its capillaries during a fast. Does the liver exert an action on recently-imported fat, peptones, and sugar in any sense different from the action it exerts on fatty, albuminous, and sugary matters as they exist in the common stock of blood? Or—which is the same question—do the fats, albuminous matters, and sugars of the portal blood differ at all from the fats, albuminous matters, and sugars of ordinary blood? While this question remains unanswered it will be well to consider the liver as like any other tissue drawing on the common source of nutriment, the blood, for its own particular purposes, and not as an organ akin to the special digestive organs, devoted to the elaboration of food for the benefit of the other tissues.

It need not be so, however, with the lymphatic structures with which the chyle of the lacteals comes into contact before it is poured into the blood. Chyle from the thoracic duct at its entrance into the veins is of course mixed with the general lymph of the body,—the juice of the tissues which is collected in the lymph-vessels and carried back to the blood. It is a milky fluid which coagulates on standing, the clot of which after some time becomes tinted red at the surface from the presence of immature red corpuscles. The coagulum consists of fibrin resembling that of the blood. Other constituents of chyle are white corpuscles, oil-globules coated with albuminous matter, *i.e.*, emulsified, and exceedingly fine fatty granules usually spoken of as the "molecular basis of chyle." Chyle obtained from vessels nearer the intestines has very little fibrin, very few white corpuscles, and no red corpuscles. It is probable, therefore, that the raw matters of digested food are undergoing a process of manufacture into blood during their passage through the lymphatic glands to reach the thoracic duct.

When once they arrive at the blood, the imported materials of food are lost beyond our power to follow them individually. The question now becomes one of the interchanges between the blood generally and the tissues. That such an interchange occurs there can be no doubt; for if all food be withheld from an animal the tissues rapidly grow less in quantity, while the blood maintains a fairly constant composition. If such an animal be fed, the tissues regain their former weight, and may even store up an overplus of matters, while again the blood remains of approximately constant composition. The tissues can both take away from the blood and give to the blood such matters as are necessary. But the matters taken from the blood are not in the same form as the matters given up to the blood. When blood is made to circulate through living tissues of whatever kind the blood entering the tissue always has a different composition from the blood which leaves it. The tissues, therefore, are laboratories in which materials abstracted from the blood are transformed. To these chemical operations of transformation which occur in living tissues the term "metabolic" has been applied, a term first used by Schwann, and happily reintroduced by Michael Foster.

What now becomes of the products of the metabolic activity of the tissues? We have hitherto considered the tissues as taking matter from the blood, changing the form of it, and giving it back to the blood; but this is far from being the true account of the process. It does indeed represent all that we know of the metabolism of many tissues. In muscle, for example, matters are drawn from the blood, converted to other shapes within the tissue, and sooner or later cast out into the blood-current again. The same may be said of nerve-tissue and possibly of some other tissues. In secreting glands the case is different. Some only of the products of tissue-metabolism are returned to the blood; others are poured into the ducts of the glands as the glandular secretion, and so leave the body altogether. This happens, for example, in the digestive glands, the milk-glands, and the kidneys. In a third order of tissues the case is different again, for here some of the products of metabolism may be retained in the tissue for an indefinite time. This occurs in certain tissues which have been called storage tissues, and of which fat is a typical example. Lastly, the liver is a complex organ whose metabolic products are disposed of in all three ways,—part being cast at once into the blood, part being accumulated in the tissue itself as glycogen and passing into the blood at intervals as the body needs it, and a third part being poured into the biliary ducts in order that it may escape into the intestine. It will be well, therefore, to recognize three methods of the disposal of metabolic products, and to classify the tissues accordingly.

Metabolism of Muscular Tissue.—To arrive at a knowledge of the chemico-vital changes occurring in any tissue we must compare the matters entering the tissue with the matters issuing from it. It is only from such a comparison that we can infer the changes which go on within the tissue. In the case of muscle there is yet another method by which we can obtain inferences as to the nature of the metabolic changes. We have reason to believe that the tissue-changes of active muscles are simply the exaggerated form of changes which constantly occur. If we may assume this, a comparison of the chemical composition of muscle before and after a period of activity will help us to a knowledge of the changes that occur in muscular action, and, by implication, a knowledge also of the common metabolic changes of the tissue. Now a comparison of muscle before and after action shows that during activity the quantity of CO_2 becomes very largely increased; at the same time the muscle becomes of acid reaction from the development of lactic acid; the amount of bodies soluble in water decreases, while the amount of bodies soluble in alcohol increases; the amount of glycogen decreases, while that of sugar increases; and, finally, bodies develop which have a strong affinity for oxygen. If we compare the matters entering and issuing from muscular tissue we shall find that muscle gives up much CO_2 during activity, that the issuing blood is rich in reducing substances, and that it acquires sarcolactic acid. The circumstance of most importance in this comparison is that carbon dioxide is liberated in large amount without the immediate interaction of oxygen; the CO_2 is produced from some body in the muscle which already contains within itself the O necessary for its formation. The fact of next importance is the absence of all indications of a large expenditure of nitrogen. Relying on these discoveries, physiologists have supposed that the metabolic changes of muscle follow some such course as the following. Non-nitrogenous organic material, along with oxygen, is absorbed into the tissue from the blood. In the tissue-cells it is elaborated with nitrogenous matter already in the tissue into a complex body called *inogene substance*, containing a nitrogenous factor linked to carbon, hydrogen, and oxygen. During the life of the tissue, and to a much greater extent during muscular activity, this inogene substance is split up into a nitrogenous portion and a non-nitrogenous portion, of which the former is retained in the tissue to be again worked up into inogene substance, while the latter is resolved into more stable bodies which escape. The full number of the effete bodies is not at present known to us; it doubtless includes more than carbon dioxide and sarcolactic acid, but these are the only bodies whose existence has been definitely determined.

Metabolism of Glandular Organs.—Of late years very much light has been shed on the processes of glandular cells, but it has been chiefly on their anatomical aspect. We know very little, indeed, of the nature of the chemical changes going on within the glandular cells, because, although we can ascertain approximately the composition of those products of the changes which escape into the glandular duct, we as yet know so little of those products which escape into the blood. We know, however, that mucin is capable of being formed in the interior of epithelial cells out of some non-mucous antecedent. We also have some reason for supposing that the gastric glandular cells—the border-cells—select phosphate of sodium and sodium chloride from the blood, and these bodies have been shown to be capable of interacting in such a way as to yield free hydrochloric acid. In the secretion of milk it is tolerably certain that the fat and the casein are both formed out of proteid matter within the glandular cells. Even the milk-sugar has been thought to be elaborated out of some non-saccharine substance, or even out of some substance that is not a carbohydrate. In the case of the pancreas we know nothing of the actual chemical decompositions that occur, but we do know that they occur in two well-marked stages. In the first a body is formed which is stored in the gland-cells, as the inogene substance is supposed to be stored in muscle; in the second this body is resolved into other but still complex bodies, of which the trypsin ferment of the secretion is one. Among the glandular organs we may mention the kidney, respecting whose secretive activity it is far from certain that it entirely consists of physical filtration or powers of mere selection. No doubt many of the constituents of urine are simply filtered off from the blood, while others are undoubtedly abstracted owing to some peculiar attraction which the renal cells exert upon them. But there is some reason to think that others may be formed within the kidney-tissues as products of cell-metabolism. As yet we have no definite knowledge concerning the nature of the metabolic changes.

Metabolism in the Storage Tissues.—Of these the first that we shall describe is adipose tissue or fat. Fat appears to be accumulated in ordinary connective-tissue corpuscles. What metabolic changes occur in connective-tissue corpuscles which are not accumulating fat we do not know; but under certain conditions of overfeeding the metabolism is so varied that fat is deposited within the cell. At first it appears in the form of fine granules; these soon coalesce to globules, which afterwards enlarge by the confluence of granules subsequently formed. The exact changes of which this fat is the outcome, or one of the products, are entirely obscure. It is enough if we can establish the probability that fat may be derived from the proteid protoplasmic matter of the fat-cell. We are not here guided, as in the case of muscle, by analysis of the blood approaching the adipose tissue and the blood leaving it. Nevertheless, there is little doubt that fat may be derived from the proteid elements of food through the activity of living tissue-cells. That proteid matter readily lends itself to a decomposition of which fat is one product is seen in the formation of fat-like "adipocere" in the nitrogenous tissues of dead bodies which have been for some time buried or immersed in water; and it is likewise seen in the process of "ripening" in cheese, in which the fat increases while the albuminous matter diminishes. But in addition to these general facts, suggestive though they are, there are not wanting proofs of a more particular kind that fat may result from proteid decompositions. If dogs are fed on starch and fat with no proteid food at all, the carbon stored up in the body can all be accounted for by reference to the fat of the food and the proteid matter of the body which, in the state of starvation, came to be disintegrated. In many other cases it seems clear that the fat stored up by animals during fattening unquestionably comes in part from the nitrogenous matters of food. But a consideration of the relative amount of carbon and nitrogen contained in proteids and in urea, which is the final product of the oxidation of proteid matter, would alone lead us strongly to suspect such an origin of fat. If all its nitrogen reappeared in the form of urea, 300 grains of proteid would give rise to 100 grains of urea. But 100 grains of urea contain but 20 grains of carbon, whereas 300 grains of proteid matter yield 159 grains of carbon. What has become of the deficit of carbon? If it has not been burnt off as carbon dioxide, it must remain within the body in some non-nitrogenous form.

If fat may be derived from proteids in the body, it is now equally certain that in some animals at least fat may come from carbohydrates of the food. Lawes and Gilbert have conclusively shown that as much as 40 per cent. of the stored-up fat in well-fattened pigs could not possibly have come from the nitrogenous parts of the food, and that it must have been derived from the carbohydrates.

All these facts render it very probable that the fat-forming tissues pick out from the blood albuminous or non-nitrogenous matter, transform it, retain the fatty element and discharge the rest. But it must not be forgotten that fat of food may, on finding itself in the blood, be taken up by appropriate tissue-cells and stored up without undergoing further change. Even this, although it seems so probable, may not at once be assumed to occur in such a simple manner. It is true that, if an animal be fed on fat resembling the fat of its own tissues, it might be assumed that the fat which it stores is simply absorbed by the tissue-corpuscles as an amœba absorbs its food. But if this were really the manner of the process we should expect that allied fats substituted for the natural fat would be equally well taken up and stored. This, however, is not at all the case. Dogs fed on a mixture of palmitin and olein, but no stearin, are found on analysis to have stearin in their body-fat; just as dogs fed on palmitin and stearin, but no olein, are found to have an abundance of olein stored up. And, even when fed on spermaceti, a dog was found to present mere traces of it in the fat accumulated in its tissues during the experiment. In short, all facts go to show that the accumulation of fat does not take place without some display of formative or transformative energy.

The last tissue whose metabolism we shall discuss is the hepatic tissue of the liver. Hitherto we have considered the liver as a digestive gland secreting the bile for the purposes of digestion; but the liver has other functions which overshadow entirely its function as a digestive organ. It seems to have the power of accumulating amyloid material very much as adipose tissue accumulates fat. It would probably be a mistake to regard these two functions of the liver as altogether independent of one another, although it is necessary to state that a direct dependence has not yet been established. There can, however, be little doubt that the hepatic tissue draws to itself a variety of matters from the blood flowing into it by the portal vein and hepatic artery, and elaborates these constituents into various products, some of which escape into the blood again, others of which appear as the bile, while a third order remain in store within the substance of the liver. But, although these products are probably associated more or less intimately in their origin, they have, in the natural development of physiology, been studied indeoendently of one another for the most part.

If an animal be richly fed on starchy or saccharine food it is found, within a short time of the digestion of the food, that the liver contains a large quantity of a starchy body called glycogen $(C_6H_{10}O_5)_n$. In order to obtain glycogen from liver-substance it is necessary to make use of the tissue of an animal just killed, for the starchy body undergoes an extremely rapid *post-mortem* conversion into a sugar. Liver taken quickly from the still warm body of a rabbit is rapidly divided into small pieces and plunged at once into briskly boiling water. The high temperature prevents the *post-mortem* change and leaves the glycogen in a condition to be separated. The pieces of liver may then be pounded with sand and water, and the mixture acidulated and filtered. From the filtrate the glycogen may be precipitated by alcohol, and the precipitate may be purified by boiling in caustic potash and afterwards neutralizing and reprecipitating with alcohol. Or the albuminous matters may be thrown down by a solution of mercuric iodide in iodide of potassium before precipitating the glycogen with alcohol. Glycogen so prepared is a white amorphous powder resembling starch in chemical composition; it is colourless and tasteless. Its aqueous solution is milky, and generally opalescent.

Other tissues and organs besides the liver have been found to contain glycogen. For example, muscles contain some glycogen, which diminishes during muscular activity, while it has been detected in the tissues of embryos and of young animals, as well as in newly-formed pathological growths.

There can be little doubt that glycogen is manufactured mainly out of carbohydrates conveyed to it in the portal vein. If a rabbit be starved for some days, the whole of the glycogen disappears from the liver; but the store is at once, in the course of a few hours, replenished if starch or sugar of whatever sort (cane, grape, or milk) be introduced into the alimentary canal. The metabolic powers of the liver-cells in respect of glycogen-production are not, however, limited to starches or sugars. If glycerin be injected into the intestines the amount of glycogen in the liver is at once increased. But some preparation of the glycerin is necessary before the liver-cells are able to appropriate it; and this preparation is accomplished in the true digestive organs, since glycerin introduced into the blood by subcutaneous injection does not bring about any increase in the glycogen of the liver. Even albuminous bodies, such as fibrin and albumin, freed from all trace of amyloid matter, seem in the case of carnivorous animals to yield glycogen in the laboratory of the hepatic tissue. The same may be said of gelatin. Now it is easy to form a chemical conception of the manner in which such a body as grape-sugar leads to the storing of glycogen, for the dehydration of the sugar would be all the change required for the conversion. But we can at present form no picture of the operation in the case of glycerin and of the albuminous matters; and the fact that these substances also are amenable to the liver cells should make us hesitate to assume at once that in the case of sugar the process is the simple one of dehydration. We must wait for further light to be shed upon the interdependence of what we may for the moment call the biliary metabolism and the glycogenic metabolism of liver-cell before we speculate as to the exact nature of the changes.

The liver has, beyond a doubt, the faculty of manufacturing an amyloid body out of various raw matters brought within the range of its activity, and of storing it up for future use. The use to which it is put has been the subject of much speculation and experimental inquiry. The amyloid matter when drawn upon may leave the liver in the form in which it exists there, or it may be converted into some other modification and afterwards transferred to the blood. The fact that other tissues besides the liver contain glycogen, and the fact that some, as muscle, seem to make use of glycogen in the act of contraction, have been thought to support the hypothesis that the glycogen is conveyed by the blood to their tissues and then consumed. According to this theory the hepatic metabolism ends in the production of glycogen, which merely waits to be cast out into the blood-current at the call of the body generally. Against this hypothesis, as a complete explanation of the use of liver-glycogen, it may be urged that the glycogen of muscle at least disappears on starvation long before the store of glycogen in the liver has been used up. Moreover, the glycogen of muscle is by no means invariably present, and is certainly not indispensable to the activity of the tissue. We may therefore conclude that the use of glycogen by the tissues (when we judge of it by the case of muscle) is not constant enough or important enough to account for the large store of glycogen in the liver. But, if the hepatic glycogen does not leave the liver as such, it must undergo some other change in the liver; and the circumstance above referred to, that glycogen so readily becomes converted into sugar *post mortem*, at once leads us to inquire whether a similar conversion is not normally effected during life. The inquiry becomes of especial value when we remember that the blood contains a constant proportion of sugar in its composition, which argues such a constancy of supply as could not be due to the direct importation of sugar during the irregular periods of the daily meals. As the amount of sugar in the blood is constant, the periodic introduction of carbohydrate into the organism must be followed by some temporary storing of it in some organ from which it may be constantly, and without intermission, doled out. Now the body contains in many parts the means of the conversion of starches into sugar. The salivary or pancreatic juices with the utmost readiness at the body-temperature change glycogen into a sugar. Many tissues, as well as blood, are said to effect the same conversion, although it is denied that the blood does so unless the blood-corpuscles have been first destroyed. The liver itself, as we have already seen, may bring about the same change, at least after death; but the activity of the converting substance may be prevented by subjecting it to a temperature of boiling water. If the liver contain the ferment-like body during life, unless its activity be restrained in some way or other, the glycogen which is formed in the liver will be speedily changed into sugar. In regard to the existence of this starch-converting body it is significant that, while it certainly may arise in the blood when the blood-corpuscles are destroyed, the liver is known to be the seat of an extensive destruction of blood-corpuscles. Considerations of this sort, however, are of little cogency; it would be a strong presumption of the existence of the ferment in question if sugar could be proved to be normally present in the hepatic tissue during life, but the experimental proof of this is beset by great difficulties, and discordant results have been obtained by the different observers. Claude Bernard, to whose researches we owe so much of our knowledge on this interesting question, detected small but perceptible quantities of sugar in quite fresh liver-substance; but other observers, among whom Dr Pavy is to be reckoned the first, have failed to find even a trace. Further, Bernard was able to make out a decided difference between the amount of sugar contained in the portal vein and the hepatic vein respectively when there was no starch or sugar in the food to load the portal vein. In such circumstances the blood issuing from the liver by the hepatic vein was found to contain a small quantity of sugar in excess of the blood entering the portal vessels. The most accurate and reliable investigations have, however, conclusively proved that this difference does not exist. The matter, therefore, still awaits some crucial test not yet devised. In the meantime we may accept the hypothesis of a conversion of liver-glycogen into soluble sugar as one which, however probable, is not supported by sufficient evidence. Amongst those who have rejected this hypothesis some have had recourse to other assumptions to account for the fate of glycogen in the body; and it has been suggested that glycogen undergoes conversion into fat either in the liver itself or partly there and partly in some other tissue. This suggestion has little direct evidence to support it. It is true that animals, especially the pig, have the power of storing up fat in their bodies which they cannot have obtained otherwise than from the carbohydraceous constituents of their food. It is also true that the hepatic tissue is often found to contain fat in considerable quantities. But it is easy to see how these facts admit of simple explanation without assuming a conversion of glycogen into fat within the liver-cells. The chemical nature of such a conversion is difficult to imagine; but it would be rash to assume that the metabolic powers of animal protoplasm are not sufficient to accomplish it.

With regard to the metabolism of liver-tissue which leads to the production of bile we possess but little direct knowledge. The secretion of bile is not a mère act of filtration of already-formed matters from the blood; but we have at present no conception of the chemical changes which occur in the interior of the liver-cells in the elaboration of bile. There is strong reason to think that the bile-pigments are derived from the colouring matter of blood, not only from the circumstance of the large destruction of blood-corpuscles which takes place in the liver but also from the resemblance or identity of bilirubin and hæmatoidin, a body derived from extravasated blood. A large number of facts point very clearly to the conclusions (1) that the liver is an organ in which chemical changes of great magnitude and importance have their seat, (2) that their operation consists in great part in decomposition of proteids.

The high temperature of the blood which leaves the liver, and which is the hottest blood of the body, is the chief proof of the correctness of the first of these conclusions, whilst the second rests upon many considerations. The bile-acids unquestionably do not exist in the blood, but are the results of proteid metabolism within the liver-cells. There are strong grounds for believing that urea, $CH_4N_2O_1$, as well as uric acid, has its principal origin in the liver, which is equivalent to localizing the chief seat of proteid metabolism in this organ.

Diabetes.—In connexion with the glycogenic function of the liver it is necessary to refer to a disease which is of special interest to physiologists, from the ease with which the symptoms may be artificially reproduced. The disease itself may be defined as the appearance of large quantities of sugar in the urine, while the total amount of the urine excreted is also increased. Now diabetes of a temporary nature may be produced in animals in a variety of ways. If certain fibres of the medulla oblongata near what is known as the vaso-motor centre be divided, as they may be by means of a special instrument, without producing any serious abnormal motor or sensory symptoms, there follows very speedily the excretion of large quantities of sugar in the urine. It is evident that this result is due in some way to an abnormal influence of the nervous system. The path by which the abnormal influence is transmitted has been carefully traced down the spinal cord to the first thoracic sympathetic ganglion; if this path be interrupted at any point symptoms follow similar to those caused by the local injury to the medulla oblongata. The circumstance that interruption of this nervous pathway at any point causes the appearance of sugar in the urine at once leads to the suspicion that the escape of sugar is not directly caused by the shock of the operation or injury. We are rather brought to the conclusion that the natural absence of sugar from the urine is due to a restraining influence of the nervous system acting continually in a manner to be discussed hereafter, and that the division of the path by which the continual restraint is exercised merely intercepts the inhibitory influence. This is confirmed by the observation that the medulla is in communication with certain afferent nerves, through which also the restraint may be removed. These nerves are the vagi; division of them leads to a transient appearance of sugar in small amount in the urine; but stimulation of their cerebral ends brings about the escape of sugar to a remarkable degree. This clearly can only be due to an inhibition by afferent nerves very similar to the inhibition of the heart which follows stimulation of the cerebral end of the abdominal sympathetic nerve in the frog.

The intercepting of this hypothetical restraint by the anatomical section of nerves is not the only way of artificially bringing about diabetes. Sugar may appear in the urine during the action of curare and after a suitable dose of morphia, and also after the injection of dilute saline solutions into the blood-vessels. The probable relationship of these various methods of causing diabetes will be referred to later.

There can be no question that diabetes is a disease affecting the glycogenic function of the liver. In many cases of natural or pathological diabetes, if all carbohydrates be withheld from the patient, the urine becomes free or almost free from sugar; and in like manner, if an animal be starved until there is every reason to suppose that its liver has become free from glycogen, and afterwards it be subjected to the operation for producing artificial diabetes, no sugar appears in the urine. Similarly, if an animal be drugged with arsenic, which leads to a rapid loss of all the glycogen of the liver, and afterwards poisoned with curare, the latter drug no longer brings about diabetes. In short, if the liver contains no glycogen no sugar can appear in the urine. This being so, in what special way is the glycogenic function modified in diabetes? If we assume that the function of the liver is to seize upon all sugar passing along the portal veins from the intestinal canal and store it up as glycogen, in order that it may be piecemeal returned to the blood to be burnt off in distant organs, we can easily review the various conceivable ways in which diabetes might be caused. It must, in the first place, be premised that the blood is unable to contain more than a certain percentage of sugar. When this percentage is overtopped the excess of sugar escapes in the urine. Of this there is direct experimental proof in the facts that if sugar be *slowly* injected into the jugular vein, no escape of it by the kidneys takes place, because the organism can make use of a small excess of sugar; but if it be injected *quickly* diabetes ensues from the too rapid accumulation of it in the blood. Accepting this, we can readily see that diabetes might be caused (1) by the failure of the liver to pick out the sugar in the portal vein in order to store it, (2) by an unusually large escape of glycogen from the liver in the form of sugar, (3) by the failure of the distant organs whose function it is to burn off the daily quantum of sugar.

It is not improbable that there may be different sorts of diabetes arising from different causes. Thus it has been said that the diabetes of curare-poisoning appears even when the liver has previously been emptied of glycogen by starving the animal. When we reflect that muscles are the organs especially affected by curare, the fact (if it be a fact) just mentioned at once suggests that the sugar which appears in the urine during curare-poisoning is due to some defect in the muscular tissue, in consequence of which the glycogen normally used up by it fails to be used and passes back into the blood. Further, the failure of glycogen-using organs may be due to no disqualification of theirs for the work of utilizing normal glycogen, but to some abnormal constitution of the glycogen (or the sugar) offered to them. Again, the diabetes caused by copious injection of dilute saline solutions into the blood-vessels may be due to the large destruction of blood-corpuscles which follows such injections, and the consequent production of a large quantity of the starch-converting substance which is known to arise in the disintegration of blood-cells. But the common form of artificial diabetes—"puncture diabetes," as it is sometimes called—the diabetes of anatomical nervous lesions, is undoubtedly due to defects in the hepatic apparatus brought about by the injury. Thus the puncture of the medulla oblongata is of no avail to cause diabetes if the liver has first been deprived of its glycogen by starving the animal experimented upon. It is, however, far from necessary to suppose that the puncture diabetes is due to any incapacity of the liver-cells for their usual metabolic changes; this may be the cause of some kinds of pathological diabetes, but it is almost certainly not the cause of the traumatic variety, and for the following reason. If sugar be freely administered to an animal in which the diabetic nervous lesion has been established, although it is impossible to load the liver with glycogen as, in such conditions, it would become loaded during health, yet a certain amount of glycogen does become stored in the liver. The liver seems still to possess the power of converting the sugar of food into a store of starch, but not the fulness of opportunity which it has in health.

The conditions which deprive the liver of the opportunity of storing glycogen are to be sought in an altered vaso-motor mechanism. The circumstance that the "diabetic centre" in the medulla coincides with part of the general vaso-motor centre at once leads to the vaso-motor theory of diabetes; but it may be admitted that this consideration is almost the strongest support of the theory. How a vaso-motor paralysis brings about diabetes we have as yet no clear picture. Perhaps it is by permitting such a rapid current of blood through the vessels that there is not time enough for the usual transmutations. If we may assume this to be the method by which diabetes is produced, then the vaso-motor theory receives much support from the following consideration. Inasmuch as diabetes is caused by a local (hepatic) dilatation of blood-vessels leading to a superabundant torrent of blood, if means be taken to provide other channels for the blood and so relieve the superabundance, diabetes should be prevented. This may be done by dividing the splanchnic nerves and dilating the enormous vascular tracts of the abdominal organs. In these circumstances the diabetic puncture makes but a trivial change in the circulation of the liver compared with that which it makes when the blood-pressure is normal; and, as might have been foretold from the vaso-motor theory, no diabetes follows. If diabetes from nervous lesions is a vaso-motor phenomenon, other forms of artificial diabetes are not so. Arsenic and antimony seem to destroy the power of the hepatic cells to manufacture glycogen; sugar ingested with the food passes, in consequence of the failure, directly into the blood and out of it into the urine. Ligature of the bile-duct also rapidly leads to profound disorganization of the hepatic tissues, in consequence of which imported sugar passes the portal system unheeded and escapes by the kidneys.

Metabolism of the Blood.—We have hitherto regarded the blood as subordinately related to the great processes of the body, as playing the mechanical part of a carrier, and as if it had no *direct* interest in the metabolic operations themselves; the reader, however, need scarcely be reminded that, but for the respiratory exchanges between the blood on the one hand and the anatomical elements of the tissues on the other, all metabolic processes would be impossible. In the article RESPIRATION, and in treating the particular section "the respiration of the tissues," the influence of those exchanges on metabolism will be carefully considered.

The older physiologists regarded the blood as the very seat of the chemical changes of the body,—a view which is almost entirely opposed to that which we now hold, and which is disproved by many facts.

We have little or no evidence that the blood exhibits transformations of matter such as we have been discussing in the case of the tissues generally. There are few such transformations known to us in which carbonic acid is not one of the most abundant end-products of the change, and therefore, when we find that blood removed from contact with the tissues and freed from carbon dioxide produces very little of this body, although an abundance of oxygen be supplied to it, we have the right to suspect strongly that it is due to the absence of any active metabolism.

It is not certain that blood (or lymph), without the intervention of some other tissue, has even the power of converting non-coagulating albumins fresh from the digestive organs into the characteristic fibrin-formers. It is true that when lactate or caprate of soda is injected into the blood of an animal it is readily oxidized; but this may easily be due to the operation of some organ through which the blood passes, and which finds the bodies referred to suitable to its own metabolic processes; and this view of the case is further strengthened when we find that formiate of sodium, which also is a readily oxidized body, passes through the same ordeal unchanged.

Nevertheless, the blood is to a certain extent an active living tissue. The white corpuscles, at least, are definite living structures whose life-history, could we but decipher it, would be found to be a history of constant metabolic processes. Towards these elements of the blood the fluid plasma must behave as towards any other tissue-element, supplying them with raw material, and receiving from them the end-products of their internal chemical decomposition; and therefore the blood, as a whole, must be classed among the metabolic tissues. The production of the anatomical elements of the blood does not concern us here; it may suffice to say that the white cells are added to the blood or lymph from certain structures of which the spleen, thymus body, lymphatic glands, and mucosa of the alimentary canal are the chief, and that probably the red corpuscles are developed from the white ones. It may also be pointed out that there are certain parts of the body—*e.g.*, the spleen, liver, marrow of bones, &c.—where there is evidence to show that red corpuscles undergo rapid and wholesale destruction, either for the production of some secretion, or possibly because the corpuscles have become old and unfit for work, and their invaluable constituent, iron, is wanted for younger and more active corpuscles.

IV.—PROCESSES OF EXCRETION.

The blood, as has been more than once said, is subject to continual additions and subtractions on the part of the tissues. The subtractions effected by the tissues are made good in part by the importation of fresh material of food from the alimentary canal. The analogous counterbalancing operations which serve to check the accumulation of used-up tissue-substance in the blood take place in certain organs called *excretory*. In a strict sense, all organs which cast out material from the body are excretory; the digestive glands, for example, pour their secretions into the alimentary canal, *i.e.*, outside the strict limits of the body. But so much of their constituents are reabsorbed before the alimentary canal is traversed that they may, for practical purposes, be regarded as never having left the body. Even the constituents of tears, when these do not fall over the cheeks or escape at the nose, are reabsorbed from the nasal mucous membrane. With respect to the alimentary secretion, it is merely a small proportion of the bile which remains in the fæces that is to be regarded as truly excretory in the sense of being utterly lost to the organism. If excreta are those substances which the body rejects utterly, then we may reckon as excreta (1) the urine, (2) the sweat and oily secretions of the skin, (3) the milk, (4) certain elements of bile contained in the fæces, (5) the gaseous and watery losses at the lungs, (6) the exuviated horny scales of skin and nails and hair, (7) the products of the generative organs, but not those constituents of fæces which are but the undigested remains of food. Among these (if we except the milk and the generative secretions whose elaboration is so peculiar and exceptional) the urine and the excretory products of the lungs and skin are those of paramount importance. The excretion from the lungs will be treated under Respiration; we shall therefore here concern ourselves with the excretion of kidneys and skin.

Kidneys and their Excretion.—Urine is a clear amber-coloured fluid, somewhat acid in reaction, with a peculiar aromatic odour and bitter saline taste. Its specific gravity varies, consistently with health, within wide limits, being affected very greatly (*a*) by the quantity of liquid consumed by the individual in a given time, (*b*) by the greater or less activity of the secretion of sweat. Whilst the average specific gravity may be stated to be about 1·020, it is often temporarily much lower and occasionally considerably higher. As a rule the specific gravity is higher in summer than in winter. The average quantity of urine passed by a healthy adult may be reckoned at 52 fluid ounces, though it is affected by the same causes as those which influence the specific gravity no less than by individual peculiarity and other circumstances.

The urine is essentially a watery solution of certain organic matters, of which much the most abundant and important is urea, and of mineral salts, of which the most abundant is common salt (sodium chloride).

Urea.—A well-nourished man passes, on an average, about 33 grammes (500 grains) of urea in twenty-four hours. This body, which has the composition CH_4N_2O, is looked upon by chemists as carbamide, *i.e.*, it is the amide of carbonic acid, and on this view may be written $CO(NH_2)_2$. It is isomeric with ammonium cyanate. This body represents the chief product of the metamorphosis of albuminous or proteid substances in the body.

Even during starvation the destruction of proteid matter continues, and the amount of urea may reach about 230 to 310 grains. The quantity is, however, specially and directly affected by the amount of proteid matter contained in the food; so that, for instance, by consuming a sufficient quantity of meat certain persons have excreted as much as 1540 grains of urea. The excretion of urea, which is a measure of the metamorphosis of proteids in the body, is not, as was formerly supposed, *directly* influenced by the amount of mechanical work done by the body, the greater activity of the muscles not being *necessarily* accompanied by their greater waste; *indirectly*, however, the excretion of urea is increased by bodily exertion, inasmuch as man and other animals appear instinctively to desire and to need a larger quantity of proteid food when much work is to be done than when the body is comparatively at rest.

It was formerly believed that urea was a direct result of the oxidation of proteids in the body. The view actually held is, that it is the product of a synthesis occurring in the body in which a body or bodies resulting from the oxidation of the proteids take part. It has recently been shown that when salts of ammonia are introduced into the system the nitrogen of the ammonia is excreted as urea; in this case it is obvious that a synthesis must have occurred in which the ammoniacal salt introduced has taken a part no less than some other body. It has, for instance, been surmised that in the oxidation of the proteid molecule cyanic acid arises, and that in the presence of ammonia ammonium cyanate is formed, which in the organism, as outside, may be changed into urea; or, again, that cyanic acid is formed, which, uniting with the elements of water, gives rise to urea, carbonic acid being separated in the reaction.

Uric acid combined with bases exists in small quantities in the urine of man, about 7 to 10 grains being passed by an adult in twenty-four hours, though individual peculiarities appear to affect in a remarkable manner the excretion of this constituent (maximum limits of quantity ·3086 to 15·43 grains). In some animals, as in snakes and birds, uric acid and its salts represent the chief nitrogenous excretory product, *i.e.*, take the place of the urea of the urine of man and carnivorous animals.

Uric acid has the composition $C_5H_4N_4O_3$. Its constitution is yet involved in great doubt, in spite of the most profound and extensive researches which have been made on its more or less immediate relations, and in spite of the fact that its synthesis has recently been effected. It may be looked upon in all probability as a derivative of cyanic acid, CNOH, and glycocin, $C_2H_5NO_2$, and there are many facts which seem conclusively to show that in the system it does not arise directly from a decomposition of proteids, but is the result of a synthesis in which derivatives of these bodies take a part.

Xanthin, $C_5H_4N_4O_2$, *hypoxanthin*, $C_5H_4N_4O$, and *guanin*, $C_5H_5H_5O$, are immediate derivatives of uric acid, of which the first is a constant constituent of urine, and the second occurs in certain states of disease.

Hippuric acid, $C_9H_9NO_3$, benzo-amido-acetic acid, is present in small quantities in the urine of man (about 15 grains a day), but is the chief nitrogenous constituent of the urine of herbivorous animals. It is formed whenever benzoic acid, or a body which can yield benzoic acid in the organism, is ingested.

In addition to the organic matters already enumerated the urine contains small quantities of other bodies, amongst which may be mentioned (1) colouring matters, of which one alone is known with any degree of accuracy, and is termed *urobilin*, a derivative proximately of the biliary colouring matters, and more remotely of the blood-colouring matter, and (2) minute traces of ferments.

As has already been said, the chief salt of the urine is common salt; there are, however, also excreted in the urine considerable quantities of phosphates and sulphates. The two latter salts represent in part similar salts introduced as such into the system, but in part they are the products of oxidation of organic bodies which contain sulphur and phosphorus respectively; to the former belong the proteids, to the latter certain phosphorus-containing fatty bodies of great complexity, which occur widely diffused throughout the body, but particularly in the white matter of the great nerve-centres and in the nerves.

The changes which urine undergoes after it is passed may be briefly referred to. The faint acid reaction proper to freshly-drawn urine is increased, probably in consequence of an acid-fermentation process started by the mucus accidentally present. The visible effect of this is the deposit of acid urates or free uric acid. In a short time, especially if the urine be kept at a warm temperature, the acid-fermentation is overwhelmed by a fermentation for which organic germs are needed, and which leads to the resolution of urea into carbonate of ammonia. The reaction becomes alkaline, and the smell strongly ammoniacal. Precipitates of ammonia, urate, and ammonio-magnesian phosphate are deposited, the odour becomes putrefactive and multitudes of micro-organisms develop whose germs have been derived from the surrounding air.

Kidney.—The urine is excreted continuously in the *kidneys*, two organs situated at the back of the abdominal cavity. The fluid is continuously poured by two ducts called *ureters* into a common reservoir situated in the pelvis, and known as the *urinary bladder*. From this reservoir the urine is intermittently ejected by the *urethra*. The two kidneys never secrete symmetrically; they exhibit an alternation of vascular and secretory activity. Similar variations have been observed in the different portions of one kidney,—first one and then another region of the kidney will be found to be in full activity. Nevertheless, when one kidney is extirpated or unfitted for its function, the other may be capable of the whole work of excretion.

The excretory portion of the kidney, like the secretory portion of all glandular organs, consists of tubes of basement membrane lined with cells of peculiar attributes and surrounded by capillaries for blood and lymph, which allow their fluids to come into close communication with the secreting cells. The complex disposition of the tubes, of which there are hundreds in each kidney, has been traced after an infinite amount of patient research. An account of the arrangement of the tubuli uriniferi falls beyond the scope of the present article.

Excretion of Urine.—A review of the constituents of the urine discloses that the function of the kidneys is to separate from the blood chiefly (1) nitrogenous crystalline bodies which are undoubtedly the end-products of the oxidation of nitrogenous bodies, and (2) inorganic salts and water. We have now to describe the probable manner in which this separation is effected. Ever since the whole course and form of the renal tubules became mapped out, and the existence of a double system of capillaries was established, it has been the habit of physiologists to regard the excretion of urine as a twofold operation. Sir William Bowman, so long ago as 1842, in the course of a histological investigation of the structure of the kidney, came to the conclusion that the watery portions of the urine are excreted in the capsule, while the solid parts are removed from the blood surrounding the lower parts of the renal tubule. Ludwig, about the same time, advanced the theory that the whole of the urine is separated from the blood in the glomeruli, but that it is separated in an extremely watery condition, the object of the complicated renal tubules being to permit of the reabsorption of the water, and to bring the urine into a suitable state of concentration for removal from the body. The progress of investigation has completely vindicated the theory proposed by Bowman, which now rests not merely on inference from anatomical structure, but upon a sound basis of physiological facts.

Not only is the process twofold in respect of the two classes of constituents secreted; it may be twofold also in respect of the processes of the act. There is at least much reason for thinking that the water is separated from the blood mainly, though not entirely, by a physical process of filtration, while some, if not all, of the specific elements of the urine are secreted by a peculiar selective or elaborative action of living epithelial cells. The reason for supposing that the excretion of water is mainly a process of filtration is the simple one that the flow of urine seems, in a general way, to obey the same laws of pressure as the flow of water through a filter. For example, whatever tends to increase the blood-pressure in the branches of the renal artery tends to increase the flow of urine in a given time. If the heart beats more quickly than usual more urine is excreted. If cold contracts the superficial vessels of the skin, and drives a larger quantity of blood upon the kidney, or if the same result ensues from moderate stimulation of the splanchnic nerves, the blood-pressure in the renal artery becomes raised, and an enlarged secretion follows. If the spinal cord be divided in the lower part of the cervical region, the great fall of blood-pressure which results is associated with suppression of the excretion of urine. Further, if the pressure in the ureters be allowed to reach the value of 10 to 40 mm. (·3937 to 1·5748 inches) of mercury the transfusion of fluid from the blood is prevented. Now the blood-pressure in the renal artery is about 120 to 140 mm. (4·7244 to 5·5118 inches) of mercury. Secretion stops, therefore, long before the pressure in the glandular ducts reaches that of the glandular vessels,—a relationship between pressure and secretion the very reverse of that which obtains in the case of the salivary gland. These facts sufficiently justify the conclusion that the secretion of water in the kidney is a process of filtration. But there are other facts which demand the assumption that even the separation of water is in part an act of living protoplasm. The free ingestion of water by drinking is one of the most certain ways of producing a copious flow of urine; and yet there is no evidence to show that in most cases this effect is brought about by a raising of the blood-pressure. On the contrary, if one animal be bled into the veins of another there is no increase produced in the amount of urine excreted, and it is difficult to imagine that the blood-pressure may be more easily raised by the drinking of water, however freely, than by introducing into the blood-vessels of one animal the quantity of blood proper to two. In such cases we must assume that the outflow of water from the blood is due to the activity of living cells aiding the normal influence of pressure.

While the secretion of water cannot wholly be ascribed to physical processes, there is no doubt that the secretion of some other bodies is a selective act of living protoplasm taking place independently of, or it may be in opposition to, physical processes. The first substance whose secretion was experimentally proved to be due to the renal epithelium was sulphindigotate of soda, or indigo-carmine. If this substance be injected into the blood-vessels of an animal in which the blood-pressure has been so far lowered by division of the spinal cord below the medulla that the flow of urine has stopped altogether, it can be traced in a short time into the epithelium of the renal tubules, and through them into the lumen of the duct. The absence of the usual flow of water has left the granules stranded at the place where they entered the renal system of tubes. No trace of the substance was found by the original observer, Heidenhain, in the glomeruli or capsules; but it may be stated that later experimenters have succeeded, by injecting the drug freely and pursuing it over longer intervals, in tracing it into the glomerular cells also.

Sulphindigotate of soda is not a normal constituent of the urine; but there is little doubt that what happens in the case of this body happens also in the case of some of the usual constituents. Thus, uric acid has been detected within the epithelium of the renal tubules; and by a comparatively new and beautiful observation it is placed beyond doubt that urea also enters the secretion at the same cells rather than through the glomeruli. This proof was rendered practicable by the discovery that in the frog the kidney is supplied with blood from two separate and distinct sources. The renal artery supplies the glomeruli with blood, while the so-called renal portal vein, a branch from the femoral vein which runs along the outer border of the kidney, supplies the capillary network surrounding the uriniferous tubules. If the renal artery be tied and the blood-supply shut off from the glomeruli, sugar when introduced into the circulation is not excreted with urine, although it readily is when the vascular supply of the kidney is untouched. But in the same circumstances, when the action of the glomeruli is eliminated, urea is readily excreted. Urea and sugar are therefore removed from the blood by different organs; or at least the renal epithelium of the tubules can excrete urea, although it cannot excrete sugar. At the same time that urea is being excreted a copious flow of water is determined, which most presumably escapes at the point where the urea is excreted. This fact is significant when we remember that ligature of the renal artery usually stops the flow of water, and that sulphindigotate of soda injected into the circulation when the glomeruli are tied out of it may be traced into the same epithelium, but gives rise to no flow into the bladder.

The renal epithelium, then, has the power of attracting to itself and removing from the blood certain elements which the latter already contains. It may now be asked whether the kidney has the power of elaborating any of the components of its excretion from antecedent forms which it obtains from the blood. In other words, is the kidney a simple separating or straining mechanism, or are the constituents of the urine, like the constituents of bile or saliva, elaborated in the course of metabolic changes going on within the secreting epithelium?

This question has already been touched in discussing the metabolism of liver-cells. There is little doubt that the kidney exhibits some metabolic activity. Inasmuch as the blood of herbivorous animals contains no trace of hippuric acid, this must presumably be formed within the kidney. If blood containing sodium benzoate and glycocin be passed through the vessels of a fresh kidney, hippuric acid arises. The kidney, therefore, must be assumed to be capable of elaborating hippuric acid out of simpler antecedent forms. But it is not certain that it has any further power. With regard to urea, it appears certain that the activity of the kidney is confined to straining it off from the blood. Normal blood contains about 1 part of urea in 4000, while the blood of the renal vein contains less than this. Urea, therefore, is separated from the blood in the kidney. If the kidneys be extirpated, or if their blood-vessels be ligatured so as to exclude them from the circulation, or if the ureters be tied (the effect of which is speedily to unfit the kidney-epithelium for the work of excretion), then the amount of urea increases in the blood up to 1 part in 300 or 400, while much urea is voided in the fluids ejected from the stomach and intestines during such experiments. Similar experiments in birds have led to similar results in the case of uric acid. All these facts point to the conclusion that urea and the allied bodies in urine are derived proximately from the blood rather than elaborated in the kidney itself. We are therefore justified in regarding the kidneys as almost exclusively an apparatus for purifying the blood from the injurious products of the cell-metabolism of other organs and tissues.

Excretions of the Sweat-Glands.—The second great excretory system is that of the skin, which supplements in important particulars the excretory functions of the kidneys. This function of the skin is effected in great measure by certain glands, called sweat-glands, opening on the surface of the skin. There are, indeed, other glands besides the sweat-glands connected with the skin, viz., the sebaceous glands, which open chiefly into the sacs of hair-follicles and secrete an oily material which keeps the surface of the skin supple and water-tight. The sebaceous secretion resembles in its formation the secretion of milk. Inasmuch as it is not reabsorbed, it is a true excretion; but there is reason to believe that the material removed from the blood is elaborated out of complex fat-yielding molecules contained in the blood very much as the milk is secreted. We know very little either of the nature of the bodies excreted or of the processes of their formation. The chief excretory products of the skin are furnished by the sweat-glands, and constitute sweat. In addition, however, there is constantly being thrown off from the skin a certain quantity of carbonic acid.

Nature of Sweat.—It is impossible to collect sweat for analysis under perfectly normal conditions; either the body must be subjected to great heat to adduce a copious flow, or a part of the body must be enclosed in an air-tight bag of india-rubber. In both cases the conditions are abnormal. So far as can be ascertained, sweat is a colourless clear fluid of acid reaction and characteristic odour. The odour varies with the part of the skin from which the sweat is obtained. It consists of water containing 1·81 per cent. of solids. The solids are (1) sodium chloride and other inorganic salts, (2) urea and other nitrogenous bodies, (3) fats and cholesterin (which are not altogether due to contamination with sebaceous matter), (4) fatty acids (formic, acetic, butyric, &c., but not lactic), (5) a trace of pigment. In addition to these bodies the skin excretes a small amount of carbon dioxide. Although the excretion of the skin is small in amount (if we except the water), if the escape of it be prevented by varnishing the skin death very quickly ensues. This is probably due to the retention of some poisonous substance, the nature and production of which are very little understood.

In concluding these remarks on excretory organs it may be pointed out that the lungs (looked at as excretory organs), the kidneys, and the skin are all engaged in the great task of ridding the system of its superfluous matters, and that each supplements the action of the others. The lungs are the great excretors of carbonic acid, which is the chief oxidation product of the body, though they share with the kidneys and skin the task of getting rid of water. The kidneys have thrown upon them the task of removing from the system nearly the whole of the nitrogenous waste products and the superabundant salts, besides being the greatest excretors of water. The skin, on the other hand, looked upon as an excretory organ, is second in importance to the kidneys as a remover of water, and comes next to the lungs in separating carbonic acid. The skin, it must be remembered, however, has many functions besides those of an excretory organ, for, besides being an organ of sense, it takes the chief part in regulating the temperature of the animal body.

V.—Transformations of Energy associated with the Exchange of the Matters of the Body.

The chemical changes which occur in all the tissues and organs of the body are, it has been stated, in the main, processes of oxidation, in which energy that was potential in the organic compounds and the oxygen that takes part in them become in great part kinetic. This energy takes the form of mechanical work and heat; the mechanical work is in part expended within the body itself and ultimately takes the form of heat; in part, however, it is expended upon the objects of the external world, and, though even then ultimately transformed into heat, this is not heat which is available for the purposes of the body. There can be no doubt, however, that a large portion of the total heat evolved in the body is the immediate result of chemical operations, and has not in the first instance taken the form of mechanical work.

In the article Dietetics (*q.v.*) attention has been drawn to the amount of energy which is stored up in the organic matters constituting the food of animals, and which can approximately be estimated by determining the amount of heat which the organic matters evolve when burned in a calorimeter. An approximate estimate is thus formed of the energy which is at the disposal of the animal or man whose diet is subjected to study. Thus it has been calculated that the available energy derived from the oxidation of the organic matters of the food of a well-fed man amounts to about 2,700,000 units of heat, the unit chosen being the amount required to heat 1 gramme of water 1° C. When the man is doing no external work this energy is dissipated from the body almost entirely as heat, and, according to the calculations of Helmholtz, the losses of heat are approximately distributed as follows:—

	Units of Heat.	Percentage of total Heat produced.
Employed in raising the temperature of matters introduced into the alimentary canal	70,157	2·6
Employed in warming inspired air	70,032	2·6
Employed in bringing about the vaporization of water in the lungs	397,536	14·7
Lost by radiation, conduction, and evaporation from the skin	2,162,275	80·1
	2,700,000	100·0

The total income and expenditure of energy of an average man in twenty-four hours is thus calculated to correspond to the amount of heat required to raise 595 lbs of water from the temperature of melting ice to that of boiling water.

Where, it will be asked, does this transformation of energy chiefly have its seat? The answer to this question is that it is firstly in the muscles, then in the glands of the body. At all times, whether in rest or activity, heat is evolved, but the quantity increases in the case both of glands and of muscles as they pass from the former into the latter condition. In the resting body, it has been remarked, the losses of energy are represented by the loss of heat, for the mechanical work done within it takes the form of heat within the body itself. It is difficult, nay, impossible, to calculate the amount of energy which in the first instance takes the form of mechanical work in the body, and which is always transformed into heat. The case of the heart is one in which, however, an approximate calculation can be made. Upon fairly reliable data it has been calculated that the work expended by the heart of a man in twenty-four hours amounts to not less than 627,768 foot-pounds, an amount of work which is equivalent to nearly 45 pound-units of heat, and which represents the energy evolved as heat in the complete combustion of about 386 grains of carbon.

These calculations enable one to form some idea of the magnitude of the nutritive processes which have their seat in the muscular substance of the heart; and to a less degree the same is the case with all the other muscles which are engaged in so-called *opus vitale*, that is, in the performance of internal work absolutely essential to the continuance of the life of the organism.

The proportion of the total energy of the body which takes the form of mechanical work varies within very wide limits. Assuming that the conversion of potential into kinetic energy in equal times were a constant quantity, it would follow that all external work done diminished the amount of heat set free from the body. To a certain extent it is probable that such a relation exists. It is, however, to be remembered that when external work has to be done there is invariably an increased consumption of organic constituents of food, and therefore an increased store of available energy. The working animal consumes more O and produces more CO_2 than the resting animal. Different animals, like steam-engines of different construction, vary in the proportion borne by the external work they are capable of performing to the total energy which becomes kinetic. Experiments made with the separate muscles of animals, no less than observations on the relation between the external mechanical work done by and the total heat evolved in the body of animals, have, however, shown that animals are more economical machines than the most perfect steam-engines. Whilst the latter cannot convert more than one-eighth of their available energy into work, the animal may yield as much as one-fifth of its energy in the form of available external work.

VI.—Growth, Decay, and Death.

In the adult body in a state of health the income of matter balances as nearly as possible the expenditure, and therefore the weight of the body and its dimensions remain nearly constant, and the same is approximately true of the different organs and tissues which compose the body, as well as of the anatomical elements which enter into their formation. Even when the conditions to which the organism is subjected undergo great variations—as, for instance, when from a state of rest it passes into a state of great activity, or when the temperature of the medium which it inhabits undergoes great changes—and when, to meet these variations in external circumstances, the rate of the exchanges of matter has to undergo great fluctuations, the weight of the body remains nearly constant. This remarkable result is one which doubtless depends upon a great many factors which are for the most part hidden from us.

In the growing body matters are, however, very different; in it normally the income must be always so much in excess of the expenditure that an accumulation of capital may occur, and that the body may increase in weight and in dimensions. The growing body is always the seat of a more active exchange of matter than the fully-developed body, *i.e.*, weight for weight, it requires more food and oxidizes it more rapidly.

The increase of weight and of dimensions occurs in part by addition of matter to, and increase in weight and in dimensions of, individual organs and their constituent anatomical elements; in part, however, it is due to an actual multiplication of anatomical elements occurring at a rate which greatly exceeds that which occurs in the adult body. To what an extent this multiplication occurs and how it gradually diminishes is evident when we reflect that the whole organism was originally derived from a single cell, the ovum.

Upon what depends this tendency to multiplication of anatomical elements, and this tendency to increase in size of individual anatomical elements or of organs, until a certain approximate limit has been attained, is absolutely unknown. We know to a certain extent that the process of *growth* depends upon and is influenced by certain circumstances, as amount of food, temperature, blood-supply to the particular organ, and so on, but yet the knowledge is wanting which would tell us why, when a certain limit has been attained, the processes of income and expenditure balance and growth ceases.

That the nervous system has a great influence upon nutrition and therefore upon growth is certainly known, and in great measure explicable. By its control over the blood-supply to organs and tissues the nervous system exerts a remarkable influence, as well as by its relations more or less direct upon the anatomical elements through nerve-fibres, which, inasmuch as they appear to influence in a direct manner the nutrition of anatomical elements, have been surmised to exist, and have received the name of "trophic fibres." Yet, even apart from the influence exerted by the nervous system, it appears to be a property of individual anatomical elements that, consistently with health, they shall only develop at a certain rate and attain a certain magnitude.

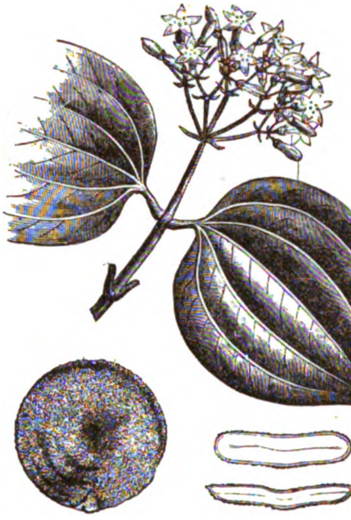
Scarcely less mysterious than the primary causes of growth is the fact that every organism having arrived at maturity remains in a state of apparent structural and functional integrity for a term which possesses an approximately constant mean value for each species, and then sooner or later necessarily passes into a condition of gradually lessening efficiency, which ultimately terminates in death. Were the animal organism a machine undergoing a constant though very slow process of waste, its decay and ultimately its death would be more obvious than they actually are. The organism, however, differs from the machine in that its matter is continually the seat of change, and that during long periods (*i.e.*, during healthy adult life) the processes of gain and loss of matter appear to be going on with perfect evenness and equality. Why, then, the ultimate deterioration resulting in waste and then in death? The answer is that the organ as a whole unquestionably does suffer by work, and, though at first the degree of impairment is so slow as to be imperceptible, it doubtless is a continuous process.

A general impairment of the mechanism of the body as it passes from the age of mature or adult life into old age is evidenced (1) by a diminished rate in the exchange of matter of the body; (2) by a diminished power manifested by the organism as a whole, as well as by each of its individual organs, to accomplish work; (3) by a general loss of weight of the body and of its essential tissues and organs, though the weight of the body as a whole may increase by the development and storage of fat; (4) by a tendency to structural change of organs or parts of organs whose proper function is essential to life, as, for example, of the circulatory, respiratory, and nervous apparatuses; (5) by a readiness to be injuriously affected by external circumstances, which at an earlier period produce no obvious effect upon the body or only temporary impairment of its functions. The gradual and general deterioration of the organism thus evidenced is usually interrupted by the supervention of some process impairing so greatly the functions of a vital organ that the organism as a whole ceases to perform the functions which characterize it as living, and death results. Whatever the remote cause of death, the proximate cause is in every case an arrest of the circulation of the blood, putting an end to the exchanges of matter and energy which are the most characteristic of the accompaniments of life. (A. G.*)

NUTTALL, THOMAS (1786-1859), botanist and ornithologist in the United States of America, where he lived and worked from 1808 until 1842, was born at Settle in Yorkshire in 1786, and spent some years as a journeyman printer in England. Soon after going to the United States he was induced by Professor Barton to apply himself to the study of the plants of that region; and in pursuance of his investigations he undertook many long and arduous as well as dangerous journeys, usually spending the summers in the field and the winters in working out the materials accumulated during his expeditions. In 1822 he was appointed curator of the botanic gardens of Harvard university, but continued his explorations, and in 1834 crossed the continent to the Pacific Ocean, and visited the Sandwich Islands. Some property having been left him in England on condition of his residing on it during part of each year, he left America in 1842, and did not again revisit it, except for a short time in 1852. He died at St Helen's, Lancashire, 10th September 1859.

Almost the whole of his scientific work was done in the States, and his published works appeared there. The more important of these are, *The Genera of North American Plants, and a Catalogue of the Species for the year* 1817, 2 vols. (1818); *Journal of Travels into the Arkansas Territory during the year* 1819 (1821); *The North American Sylva*, 3 vols. (1842-1849); *Manual of the Ornithology of the United States and of Canada* (1834 and 1840); and numerous papers on similar subjects in the various American scientific periodicals.

NUX VOMICA, a poisonous drug, consisting of the seed of *Strychnos Nux-Vomica*, L., a tree indigenous to most parts of India, and found also in Burmah, Siam, Cochin China, and northern Australia. The tree, which belongs to the natural order *Loganiaceæ*, is of moderate size, with a short, thick, often crooked stem, and ovate entire leaves, marked with 5 or 6 or 7 veins radiating from the base of the leaf. The flowers are small, greenish-white, and tubular, and are arranged in terminal corymbs. The fruit is of the size of a small orange, and has a thin hard shell, enclosing a bitter, gelatinous, white pulp, in which from 1 to 5 seeds are vertically embedded. The seed is disk-shaped, rather less than 1 inch in diameter, and about ¼ inch in thickness, slightly depressed towards the centre, and in some varieties furnished with an acute keel-like ridge at the margin. This is particularly the case with the seeds imported from Bombay and collected in that province. Those imported from Madras and Cochin China have usually a rounded margin (*Pharm. Journ.* [3], xii. p. 1053). The acute margin is considered in commerce indicative of superior quality, seeds so characterized yielding the largest quantity of the active principles. The external surface of the seed is of a greyish-green colour and satiny appearance, due to a coating of appressed silky hairs. The interior of the seed consists chiefly of horny albumen, which is easily divided along its outer edge into two halves by a fissure, in which lies the embryo. The latter is about three-tenths of an inch long, having a pair of heart-shaped membranous cotyledons.


Flowers, Fruit, and Seed of Nux Vomica.

The drug owes its poisonous property chiefly to the alkaloids *strychnia* and *brucia*, the mixed alkaloids found in the seed being in the proportion of about 1 per cent. of the former to 2 per cent. of the latter. These alkaloids occur in the seeds in combination with a probably complex body which has been named strychnic or igasuric acid. Brucia is distinguished from strychnia by giving a red colour when moistened with strong nitric acid, and by being soluble in 150 parts of boiling water, while strychnia requires 2500 parts for its solution. It is remarkable that although the pulp contains strychnia it is not poisonous to birds, being eaten by the hornbill, *Buceros malabaricus*, and other species. Parasitic plants of the natural order *Loranthaceæ*, when growing on *Strychnos Nux-Vomica*, acquire the poisonous properties of the latter.

Nux Vomica seeds are imported into Great Britain from Bombay, Madras, and Cochin China to the average extent of about 200 tons per annum, valued at £1600.

NYANZA. For Albert Nyanza and Victoria Nyanza, see NILE, *supr.* pp. 504, 505.

NYASSA, LAKE. See ZAMBESI.

NYBORG, a town and seaport of Denmark on the east side of the island of Fünen, 28¼ miles by rail east of Odense, and the point from which the steam-packets cross the Great Belt to Korsör in Zealand. The fortress, built by Christian IV. and Frederick III., was dismantled in 1869, and the ruins of the castle are now used as a prison. From 4812 in 1870 the population increased to 5402 by 1880.

As early as the 12th century the town was founded and a castle erected on Knudshoved (Canute's Head) by Knud, nephew of Waldemar the Great; and from the 13th to the 15th century Nyborg was one of the most important places in Denmark, a seat of the royal court, and a frequent meeting-place of the estates. In 1531 the people of Lübeck took the town by storm. In 1658 it surrendered to the Swedes; but Peter Bredal, icebound in the harbour, held them at bay till he was able to make his escape. By the defeat of the Swedes under the walls of the fortress in 1659 the country was freed from their dominion. In 1808 the marquis La Romana, who with a body of Spanish troops garrisoned the fortress for France, revolted from his allegiance and held out till he and a portion of his men got off with the English fleet.

NYIREGYHÁZA, a town of Hungary, in the district of Szabolcs, is situated at the junction of the river Theiss and the railways of the north-east of Hungary, 30 miles to the north of Debreczin. It contains four churches, a gymnasium, and a mineral bath. The inhabitants of the town, who numbered 24,102 in 1880, are engaged in agriculture, wine-growing, and the manufacture of soda, matches, and saltpetre. The annual fairs are largely frequented. A little to the north-west is the famous wine-producing district of Tokay, which yields about 18 million gallons of wine annually, including 3 or 4 million gallons of genuine Tokay.

NYKÖPING, a city of Sweden, the chief town of the province of Nyköping (Södermanland), is situated on both banks of a stream which unites Lakes Yngaren, Tisaren, &c., with By Fjord, and so with the Baltic. Connected by a branch line with the railway from Stockholm to the Norwegian frontier, it lies about 100 miles by rail south-west of Stockholm. The ruins of its once famous castle, the governor's residence, the churches of St Nicholas and All Saints, the town-house (1662), and the hospital are the more noteworthy buildings. The population was 4825 in 1862, 4813 in 188

Nyköping (*i.e.*, New-Market, Latinized as Nicopia) begins to appear as a regular town with churches and monasteries early in the 13th century. Its castle was the seat of the kings of Södermanland, and after those of Stockholm and Calmar was the strongest in Sweden. The death of Waldemar in 1293, the starving to death of Dukes Waldemar and Eric in 1318, the marriage and the deaths both of Charles IX. and his consort Christina of Holstein, the birth of their daughter Princess Catherine, and in 1622 the birth of her son Charles X. are the main incidents of which it was the scene. Burned down in 1665 and again damaged by fire in 1719, it still remained the seat of the provincial authorities till 1760. The town was burned by Albert of Mecklenburg's party in 1389, by an accidental conflagration in 1665, and by the Russians in 1719.

NYLGHAU, or **Nil-gai**, one of the largest of the antelopes, a handsome and graceful animal, with short, straight, erect horns, pointed and turned slightly forwards at the tips, and present in the male only (see Plate II., vol. ii.). It has a short erect mane, and the male has also a tuft of hair upon the throat. When adult the sexes are very different in colour, the male being generally of a dark iron-grey or slate colour, approaching black on the head and legs, while the female and young are of a bright light-brown or fawn colour. In both male and female at all ages the lips, chin, and under-parts as well as two transverse stripes on the inner sides of the ears and rings on the fetlocks are white, and the mane and tip of the tail black. The horns are black, and from 8 to 9 inches long. The male stands about 4 feet 4 inches high at the shoulder, the female is smaller. The tail is 18 to 21 inches in length

The nylghau is one of the few true antelopes occurring in India, and is peculiar to that country, being found from near the foot of the Himalayas to the south of Mysore, though rare to the north of the Ganges and also in the extreme south. It is most abundant in central India, and does not occur in Assam or the countries to the east of the Bay of Bengal. It frequents forests and low jungles, though often found in tolerably open plains, associating in small herds. One, or very often two, young are produced at a birth, and when caught early they are readily tamed. They are often kept in captivity in the menageries of the native princes, and also in Europe, but the temper of the old males is uncertain. When fighting they drop on their knees, and then, advancing in this position until within convenient distance, make a sudden spring, butting with their horns with great force.

The first description of this animal, accompanied by a rude figure, was given by Dr Parsons in a paper entitled "An Account of a Quadruped brought from Bengal, and now to be seen in London," published in the *Philosophical Transactions* for 1745. No name was assigned to it, but the author identified it with an animal called "Biggel," seen in the stables of the viceroy of Goa by John Albert de Mandelsloe in his voyage through the Indies in 1638. In 1767 and the following years several living specimens were sent to England, from which Dr William Hunter drew up an excellent account of the characters of the male, female, and young, and of their habits in captivity, which, with a very spirited figure by Stubbs (often since copied), was published in the *Philosophical Transactions* for 1770. Dr Hunter was apparently unaware of Parsons's paper, and gives the animal the native name of "Nyl-ghau," signifying in Persian "blue bull." On Parsons's description Pallas founded his *Antilope tragocamelus* (*Spicilegia Zoologica*, i. p. 9, 1767), which was therefore its earliest specific name, though others have been used in later times, especially *A. picta*, given by Pallas (*Spicilegia*, xii. p. 14, 1777) to the animal described by Hunter under the supposition that it was a different species. It has also had several generic names, *Boselaphus*, *Damalis*, *Portax*, &c., the first-named being the one to which preference is now usually given.

NYMPH. The belief that the nature which surrounds mankind—the woods, the springs, the hills—is full of a life resembling, yet different from, human life is universal in a primitive stage of thought. At Psophis in Arcadia a row of tall cypress trees was called *αἱ πάρθενοι*, the damsels. In other places the name *κόραι* was used, but the general term for the spirits who dwell in external nature was *νύμφαι*. All three words have the same meaning. There is a close relation between the souls of dead men and the life of nature; the Nymphs often play the part of death and carry away human beings to dwel with them. This idea appears in a slightly different form when heroes and favoured mortals live in communion with them. The connexion of a human being with a Nymph has something unnatural about it, and almost alway brings some disaster on the mortal. Yet another form o the idea appears in the word *νυμφόληπτος*; he whose mind the Nymphs take possession of loses his human wi and becomes mad, but has wisdom more than human The worship of the Nymphs was practised throughout the classical period in places where they seemed to have chosen a home for themselves, in shady groves and beside springs of clear water. It retained its primitive simplicity. No temple, no statue, no priest was needed; the offerings of a rural people were placed on the simple altar. The cultus is therefore not often mentioned in literature; but it appears to have been closely connected with the household life of the people, and to have had a strong hold on them. Among the ceremonies of marriage an acknowledgment of the power of the Nymphs was included. The bride, herself a *νύμφη*, was sprinkled with water from the fresh spring of the Nymphs, or she went to bathe in the spring.

The Nymphs, the ever-youthful spirits of nature, protected and nourished children (*κουροτρόφοι*); they were themselves often, especially in Asia Minor, the mothers of the heroes of the land. In the Troad, Hermes and the Sileni sport with them in the mountain caves. Their life was long, according to Hesiod 9720 times that of man; it was a common belief that they were born and died along with the trees of the forest. It was usual to distinguish Nymphs of the rivers and fountains, Naiads, from those of the forests and mountains, Dryads, Hamadryads, Oreades; but they were all *κοῦραι Διός*, the maidens of heaven, or, in more anthropomorphic language, the daughters of Zeus. The worship of the Nymphs became more fashionable in later time, and shrines of Nymphs (*νυμφαῖα*) were built even in cities.

O

O. The history of the symbol O is parallel to that of E. Each represents several sounds which are distinguished habitually in speech without any difficulty, but for which, owing to the imperfection of the English alphabet, there are no separate symbols. Probably the confusion is worst in English; but French and Italian also have more sounds for each of these symbols than can be properly included under them, and so they distinguish these sometimes by diacritical marks, as *ò* or *ó*, and sometimes they do not distinguish at all.

The different sounds which O is used to denote in English lie, with one exception, on the line between the pure *a*-sound and the pure *u*-sound. We have already seen that *e* denotes several different sounds on the other line—that between pure *a* and pure *i*. The difference between the sounds on these two lines is this. In the *a*—*i* line only the tongue is employed; it is raised more and more for each successive sound. But in the *a*—*u* line the tongue is not the only agent; the cavity of the mouth is also contracted, so that the passage is narrowed, and the lip-aperture is lessened more and more for each sound; in technical phrase the lips are "rounded," so that for *u* the aperture is the smallest possible to allow of the utterance of a true vowel, hence the great ease with which the *u*-sound passes into a *w*, in which there is friction caused by the still greater closing of the lips, and therefore we have a consonant not a vowel sound.

The following different sounds—denoted by O in English—are readily discriminated. Beginning from the *a*-end of the line, we come first to the sounds heard in "not" and in "lord"; for both of these the back of the tongue is much depressed and the lips are only slightly rounded. The difference between the two sounds consists in this—for the first the back of the tongue is more convex than for the second; the passage is therefore somewhat narrowed, and the two corresponding sounds are therefore (here and in all the other similar pairs) known technically as "narrow" and "wide," or as "open" and "close." The narrow sound is written by *o* in English when *r* or *l* follows, and the wide is written *aw* as in "law," or *au* as in "Paul," or even *a* as in "pall." The next pair may be exemplified by "pole" and "pour," narrow and wide respectively; for these the tongue is higher and the rounding greater. Here again several digraphs represent the same sound, as in "foal," "soul," "hoe," "grow." Next the doubled *o* is generally used to represent the last sound in the scale, the close *u*, for which the tongue is highest and the "rounding" greatest, as in "pool"; but in "rule" and others the same symbol is used for this sound as would be used in other European languages. Lastly—the exception mentioned above—*o* is one of the symbols employed to denote the neutral vowel, as in "son," as well as *u* in "sun" and *a* in "final."

The modified German *o*—written *ö* or *oe*—is a sound unknown in English. It is produced by putting the tongue into the position for the sound denoted by *a* in "fate" or *e* in "fête"—a middle sound in the line between *a* and *i*—and then by rounding the lips. It thus combines the specialities of the two scales of vowel-sound—the *i*-scale and the *u*-scale.

In Italian there are an "open" *o* (marked *ò*) and a "close" *o* (marked *ó*). The "open" *o* corresponds to the open or wide sound described above. The "close" *o* is not quite the same as the "narrow" *o* of English, but comes a little nearer to *u*.

In the form of the symbol there is no recorded variation, except that in old Latin it was sometimes square, as ◇. In Greek two symbols were employed—O and Ω—for short and long *o* respectively. But it is not improbable that the second of these denoted at first not merely long *o* but a more open sound, more near to the sound of "law" in English.

OAJACA, or **OAXACA**, the chief town of the province of the same name in Mexico, lies 1600 feet above the sea in a beautiful valley on the left bank of the Atoyac, or Rio Verde, which reaches the Pacific after a course of about 170 miles. The city is surrounded by luxuriant gardens, orchards, and cochineal plantations; its streets are wide and regular, and among its public buildings are the cathedral, the bishop's palace (fashioned after the type of a similar ancient edifice at Mitla), and the Dominican monastery and church. Chocolate, cigars, cotton-cloth, wax candles, &c., are manufactured. The population was 26,228 in 1877. The city, which dates from 1522, was visited by a severe earthquake in 1870.

OAK (Anglo-Saxon, *ác* or *æc*), a word found, variously modified, in all Germanic languages, and applied to plants of the genus *Quercus*, a well-marked section of the natural order *Corylaceæ* (*Cupuliferæ* of De Candolle), including some of the most important timber trees of the north temperate zone. All the species are arborescent or shrubby, varying in size from the most stately of forest trees to the dwarfish bush. Monœcious, and bearing their male flowers in catkins, they are readily distinguished from the rest of the Cupuliferous family by their peculiar fruit, an acorn or nut, enclosed at the base in a woody cup, formed by the consolidation of numerous involucral bracts developed beneath the fertile flower, simultaneously with a cup-like expansion of the thalamus, to which the bracteal scales are more or less adherent. The ovary, three-celled at first, but becoming one-celled and one-seeded by abortion, is closely invested by the perianth, toothed on the margin, and adherent below; the male flowers are in small clusters on the usually slender and pendent stalk, forming an interrupted catkin; the stamens vary from six to twelve. The alternate leaves are more or less deeply sinuated or cut in most of the species, but in some of the deciduous and many of the evergreen kinds are nearly or quite entire on the margin. The oaks are widely distributed over the temperate parts of Europe, Asia, North Africa, and North America. In the western hemisphere they range along the Mexican highlands and the Andes far into the tropics, while in the Old World the genus well

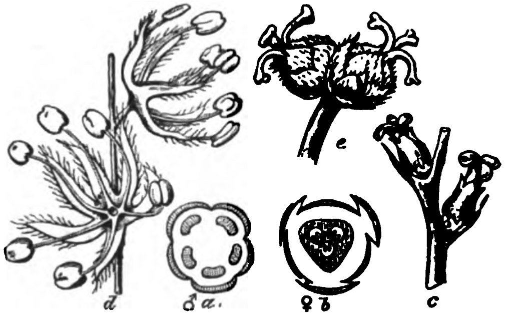


FIG. 1.—Inflorescence of Oak. *a, b, c, Quercus Robur.* (From Behrens, *Allgemeine Botanik*, pp. 209, 210.) *d, e, Q. sessiliflora* (Smith); half natural size. (From Kotschy, *Die Eichen Europa's*, Vienna, 1862, plate xxxii.)

represented in the Himalayas and the hills of China, exists likewise in the peninsula of Malacca, in Java, and in some other islands of the archipelago, several species occurring in the Moluccas and Borneo. On the mountains of Europe and North America they grow only at moderate elevations, and none approach the arctic circle. The multitude of species and the many intermediate forms render their exact limitation difficult, but those presenting sufficiently marked characters to justify specific rank probably approach 300 in number.

The well-known *Q. Robur*, one of the most valued of the genus, and the most celebrated in history and myth, may be taken as a type of the oaks with sinuated leaves. Though known in England, where it is the only indigenous species, as the British oak, it is a native of most of the milder parts of Europe, extending from the shores of the Atlantic to the Ural; its most northern limit is attained in Norway, where it is found wild up to lat. 63°, and near the Lindesnæs forms woods of some extent, the trees occasionally acquiring a considerable size. In western Russia it flourishes in lat. 60°, but on the slope of the Ural the 56th parallel is about its utmost range. Its northern limit nearly coincides with that of successful wheat cultivation. Southwards it extends to Sardinia, Sicily, and the Morea. In Asia it is found on the Caucasus, but does not pass the Ural ridge into Siberia. In Britain and in most of its Continental habitats two varieties exist, regarded by many as distinct species: one, *Q. pedunculata*, has the acorns, generally two or more together, on long stalks, and the leaves nearly sessile; while in the other, *Q. sessiliflora*, the fruit is without or with a very short peduncle, and the leaves are furnished with well-developed petioles. But, though the extreme forms of these varieties are very dissimilar, innumerable modifications are found between them; hence it is more convenient to regard them as at most sub-species of *Q. Robur*. The British oak is one of the largest trees of the genus, though old specimens are often more remarkable for the great size of the trunk and main boughs than for very lofty growth. The spreading branches have a tendency to assume a tortuous form, owing to the central shoots becoming abortive, and the growth thus being continued laterally, causing a zigzag development, more exaggerated in old trees and those standing in exposed situations; to this peculiarity the picturesque aspect of ancient oaks is largely due. When standing in dense woods the trees are rather straight and formal in early growth, especially the sessile-fruited kinds, and the gnarled character traditionally assigned to the oak applies chiefly to its advanced age. The broad deeply-sinuated leaves with blunt rounded lobes are of a peculiar yellowish colour when the buds unfold in May, but assume a more decided green towards midsummer, and eventually become rather dark in tint; they do not change to their brown autumnal hue until late in October, and on brushwood and saplings the withered foliage is often retained until the spring. The catkins appear soon after the young leaves, usually in England towards the end of May; the acorns, oblong in form, are in shallow cups with short, scarcely projecting scales; the fruit is shed the first autumn, often before the foliage changes.

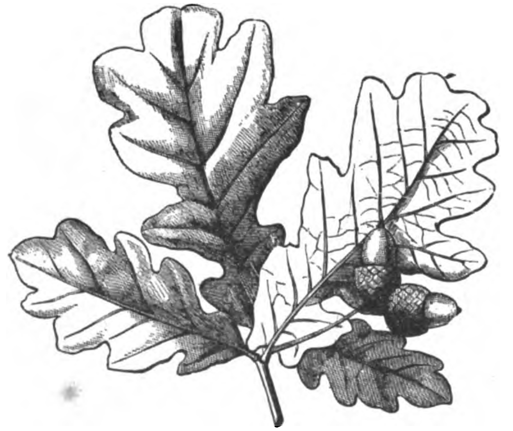


FIG. 2.—*Q. pedunculata*; half natural size. (From Kotschy, *op. cit.*, plate xxvii.)

Vast oak forests still covered the greater part of England and central Europe in the earlier historic period; and, though they have been gradually cleared in the progress of cultivation, oak is yet the prevailing tree in most of the woods of France, Germany, and southern Russia, while in England the coppices and the few fragments of natural forest yet left are mainly composed of this species. The pedunculated variety is most abundant in the southern and midland counties, the sessile-fruited kinds in the northern parts and in Wales, especially in upland districts; the straighter growth and abundant acorns of this subspecies have led to its extensive introduction into plantations. The name of "durmast" oak, originally given to a dark-fruited variety of *Q. sessiliflora* in the New Forest, has been adopted by foresters as a general term for this kind of oak; it seems to be the most prevalent form in Germany and in the south of Europe. A variety of the sessile oak with sweet acorns appears to be the *Q. Esculus* of some writers. Many of the ancient oaks that remain in England may date from Saxon times, and some perhaps from an earlier period; the growth of trees after the trunk has become hollow is extremely slow, and the age of such venerable giants only matter of vague surmise. The celebrated Newland oak in Gloucestershire, known for centuries as "the great oak," was by the latest measurement 47½ feet in girth at 5 feet from the ground. The Cowthorpe oak, standing (a ruin) near Wetherby in Yorkshire, at the same height measures 38½ feet, and seems to have been of no smaller dimensions when described by Evelyn two centuries ago; like most of the giant oaks of Britain, it is of the pedunculate variety. The preservation of these old trees has been in past times largely due to the survival of the reverence in which the oak was held by Celt and Saxon,—a feeling which seems to have been shared by several Aryan races. The great regard paid to the oak probably originated in the value attached to its timber and fruit; the largest and most durable of European trees, its wood was looked upon as the most precious produce of the forest. With both Greek and Roman it was the favourite timber for house, bridge, and ship building; and the furrowed columns with spreading base that upheld their stone-built temples of historic age seem to indicate the oak-trunk as their archaic prototype. The tree was not in less esteem among the Teutonic nations; the long ships of the Northmen were hewn from the same "heart of oak" of which the war-ships of England were until lately constructed. The Anglo-Saxons employed oak timber not only for their dwellings and their fleets but occasionally for more sacred architecture,—the church till recently standing at Greenstead in Essex, and supposed to have been erected in the 10th century, was wholly formed of oak trunks roughly squared. The few ancient timber mansions still existing in England are generally built entirely of oak, which in many cases remains sound after the lapse of several hundred years, sometimes outlasting the brick and stone with which the structures have been repaired. The great oak woods that in early days covered the larger part of Britain had in Tudor times become so reduced that an Act was passed in the reign of Henry VIII. to enforce their preservation, and by the end of the 16th century oak planting became common. At present large quantities of timber are still obtained from hedgerows and copsewoods; but, although some attempts have been made to renew the royal forests, much of the oak timber employed in Britain is imported from abroad. Many of the Continental woods are failing to produce their former supply; the large quantity still obtained from the port of Memel, and formerly drawn from Prussia and nearer Poland, is now brought thither from the distant forests of the Dnieper and the Don.

The wood of the British oak, when grown in perfection, is the most valuable produced in temperate climates. The heart-wood varies in colour from dark brown to pale yellowish-brown; hard, close-grained, and little liable to split accidentally, it is, for a hard wood, easy to work. Under water it excels most woods in durability, and none stand better alternate exposure to drought and moisture, while under cover it is nearly indestructible as long as dry-rot is prevented by free admission of air. Its weight varies from 48 to about 55 ℔ the cubic foot, but in very hard slowly-grown trunks sometimes approaches 60 ℔. The sap-wood is lighter and much more perishable, but is of value for many purposes of rural economy. The relative qualities of the two varieties have been the frequent subject of debate, the balance of practical testimony seeming to establish the superiority of *Q. pedunculata* as far as durability in water is concerned; but when grown under favourable circumstances the sessile oak is certainly equally lasting if kept dry. The wood of the durmast oak is commonly heavier and of a darker colour, hence the other is sometimes called by woodmen the white oak, and in France is known as the "chêne blanc." The oak of Britain is still in great demand for the construction of merchant shipping, though teak has become in some measure its substitute, and foreign oak of various quality and origin largely takes its place. Its great abundance of curved trunks and boughs rendered the oak peculiarly valuable to the shipwright when the process of bending timber artificially was less understood; the curved pieces are still useful for knees. The younger oaks are employed by the carpenter, wheelwright, waggon-builder, and for innumerable purposes by the country artisan. The most durable of fences are those formed of small oaks, split lengthwise by the wedge into thin boards. The finely-grained heart-wood is sought by the cabinetmaker for the manufacture of furniture, and high prices are often given for the gnarled and knotted portions of slowly-grown trees, to be sawn into veneers. Oak was formerly largely used by wood-carvers, and is still in some demand for those artists, being harder and more durable than lime and other woods that yield more readily to the sculptor's tool. Oak was thus applied at a very early date; the shrine of Edward the Confessor, still existing in the abbey at Westminster, sound after the lapse of 800 years, is of dark-coloured oak-wood. The wood, of unknown age, found submerged in peat-bogs, and of a black hue, is largely used in decorative art under the name of "bog-oak."

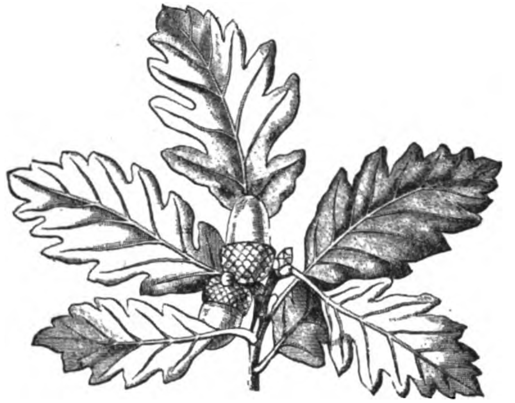


FIG. 3.—*Q. sessiliflora*; half natural size. (From Kotschy, *op. cit.*, plate xxxii.)

The oak grows most luxuriantly on deep strong clays, calcareous marl, or stiff loam, but will flourish in nearly any deep well-drained soil, excepting peat or loose sand; in marshy or moist places the tree may grow well for a time, but the timber is rarely sound; on hard rocky ground and exposed hillsides the growth is extremely slow and the trees small, but the wood is generally very hard and durable. The oak will not bear exposure to the full force of the sea gale, though in ravines and on sheltered slopes oak woods sometimes extend nearly to the shore. The cultivation of this tree in Europe forms one of the most important branches of the forester's art. It is frequently raised at once by sowing the acorns on the ground where the trees are required, the fruit being gathered in the autumn as soon as shed, and perfectly ripe seeds selected; but the risk of destruction by mice and other vermin is so great that transplanting from a nursery-bed is in most cases to be preferred. The acorns should be sown in November on well-prepared ground, and covered to a depth of 1½ or 2 inches; the seeds germinate in the spring, and the seedlings are usually transplanted when one or two years old to nursery-beds, where they are allowed to grow from two to four years, till required for the plantation. Some authorities recommend the tap-roots to be cut in the second year, with the view of increasing the ball of fibre; but, if the trees are removed from the seed-bed sufficiently early, the root is best left to its natural development. The oak requires shelter in the early stages of growth; in England the Scotch pine is thought best for this purpose, though Norway spruce answers as well on suitable ground, and larch and other trees are sometimes substituted. The conifers are allowed to grow to a height of from 3 to 5 feet before the young oaks are planted, and are gradually thinned out as the latter increase in size. The distance between the oaks depends upon the growth intended before thinning the young wood; usually they are placed from 8 to 12 feet apart, and the superabundant trees cut out as they begin to interfere with each other. The lower branches often require removal, to ensure the formation of a tall straight trunk, and this operation should be performed before the superfluous shoots get too large, or the timber will be injured; but, as with all trees, unnecessary pruning should be avoided, as every branch removed lessens the vigour of growth. Where artificial copsewood is the object, hazel, hornbeam, and other bushes may be planted between the oaks; but, when large timber is required, the trees are best without undergrowth.

The oak, after the trunk is felled, throws up shoots from the cut stump more surely and abundantly than most trees; hence it is well adapted for the formation of brushwood, of which great quantities are employed in Britain for the manufacture of crates and hoops, and for many other uses. Where the underwood consists mainly of oak it is generally cut once in twenty years, but in some places fifteen years are thought sufficient, while on poor land thirty years are sometimes allowed to intervene between the cuttings. Oak coppices are generally cut in the spring, because the bark is then more readily separated, and large timber trees are very often felled at the same period; but winter felling is probably best when sound heart-wood is the chief thing in view. The growth of the oak is slow, though it varies greatly in different trees; London states that an oak, raised from the acorn in a garden at Sheffield Place, Sussex, became in seventy years 12 feet in circumference; but the increase of the trunk is usually very much slower, and when grown for large timber oak can rarely be profitably felled till the first century of its growth is completed. The tree will continue to form wood for 150 or 200 years before showing any symptoms of decay. As firewood oak holds a high position, though in Germany it is considered inferior to beech for that purpose. It makes excellent charcoal, especially for metallurgic processes; the Sussex iron, formerly regarded as the best produced in Britain, was smelted with oak charcoal from the great woods of the adjacent Weald, until they became so thinned that the precious fuel was no longer obtainable.

An important product of oak woods is the bark that from a remote period has been the chief tanning material of Europe. The most valuable kind is that obtained from young trees of twenty to thirty years' growth, but the trunks and boughs of timber trees also furnish a large supply; it is separated from the tree most easily when the sap is rising in the spring. It is then carefully dried by the free action of the air, and when dry built into long narrow stacks until needed for use. The value of oak bark depends upon the amount of tannin contained in it, which varies much, depending not only on the growth of the tree but on the care bestowed on the preparation of the bark itself, as it soon ferments and spoils by exposure to wet, while too much sun-heat is injurious. That obtained from the sessile-fruited oak is richer in tannic acid than that yielded by *Q. pedunculata*, and the bark of trees growing in the open is more valuable than the produce of the dense forest or coppice. The bark of young oak branches has been employed in medicine from the days of Dioscorides, and is occasionally used in modern practice, chiefly as an astringent: in decoction it is given as a gargle for throat affections depending on relaxation, and is administered in dysenteric hæmorrhages and some forms of diarrhœa; it was regarded by the practitioners of a former age as useful in consumption, a disease from which tanners are said to be nearly exempt. Poultices made of the crushed or powdered bark have been used with advantage where astringent external applications are indicated; as a tonic it has in modern medicine given place to other remedial agents. The astringent principle is a peculiar kind of tannic acid, called by chemists *querci-tannic*, which, yielding more stable compounds with gelatine than other forms, gives oak bark its high value to the tanner. According to Neubauer, the bark of young oaks contains from 7 to 10 per cent. of this principle; in old trees the proportion is much less.

The acorns of the oak possess a considerable economic importance as food for swine. In the Saxon period the "mast" seems to have been regarded as the most valuable produce of an oak wood; nor was its use always confined to the support of the herds, for in time of dearth acorns were boiled and eaten by the poor as a substitute for bread both in England and France, as the sweeter produce of *Q. Esculus* is still employed in southern Europe. Large herds of swine in all the great oak woods of Germany depend for their autumn maintenance on acorns; and in the remaining royal forests of England the inhabitants of the neighbouring villages yet claim their ancient right of "pannage," turning their hogs into the woods in October and November. Some trees of the sessile-fruited oak bear sweet acorns in Britain, and several varieties were valued by the ancient Italians for their edible fruit. A peculiar kind of sugar called *quercite* exists in all acorns. A bitter principle to which the name of *quercin* has been applied by Gerber, its discoverer, has also been detected in the acorn of the common oak; the nutritive portion seems chiefly a form of starch. A spirit has been distilled from acorns in process of germination, when the saccharine principle is most abundant.

The British oak grows well in the northern and middle States of America; and, from the superiority of the wood to that of *Q. alba* and its more abundant production of acorns, it will probably be much planted as the natural forests are destroyed. The young trees require protection from storms and late frosts even more than in England; the red pine of the north-eastern States, *Pinus resinosa*, answers well as a nurse, but the pitch pine and other species may be employed. In the southern parts of Australia and in New Zealand the tree seems to flourish as well as in its native home.

The oak in Europe is liable to injury from a great variety of insect enemies: the young wood is attacked by the larvæ of the small stag-beetle and several other *Coleoptera*, and those of the wood-leopard moth, goat moth, and other *Lepidoptera* feed upon it occasionally; the foliage is devoured by innumerable larvæ; indeed, it has been stated that half the plant-eating insects of England prey more or less upon the oak, and in some seasons it is difficult to find a leaf perfectly free from their depredations. The young shoots are chosen by many species of *Cynipidæ* and their allies as a receptacle for their eggs, giving rise to a variety of gall-like excrescences, from which few oak trees are quite free.

Of the European timber trees of the genus, the next in importance to the British oak is *Q. Cerris*, the Turkey oak of the nurserymen. This is a fine species, having when young straighter branches than *Q. Robur*, but in old age the boughs generally curve downwards, and the tree acquires a wide spreading head; the bark is dark brown, becoming grey and furrowed in large trees; the foliage varies much, but in the prevailing kinds the leaves are very deeply sinuated, with pointed, often irregular lobes, the footstalks short, and furnished at the base with long linear stipules that do not fall with the leaf, but remain attached to the bud till the following spring, giving a marked feature to the young shoots. The large sessile acorns are longer than those of *Q. Robur*, and are dark-brown when ripe; the hemispherical cups are covered with long, narrow, almost bristly scales, giving them a mossy aspect; the fruit ripens the first autumn. The foliage in some of the numerous varieties is almost evergreen, and in Britain is retained long after the autumnal withering.

This oak abounds all over the Turkish peninsula, and forms a large portion of the vast forests that clothe the slopes of the Taurus ranges and the south shores of the Black Sea; it is likewise common in Italy and Sardinia, and occurs in the south of France and also in Hungary. It was introduced into England by Miller about 1735, and is now common in parks and plantations, where it seems to flourish in nearly all soils. The Turkey oak in southern England grows twice as fast as *Q. Robur*; in the mild climate of Devonshire and Cornwall it has reached a height of 100 feet and a diameter of 4 feet in eighty years, which is about the limit of its profitable growth for timber. The wood is hard, heavy, and of fine grain, quite equal to the best British oak for indoor use, but of very variable durability where exposed to weather. The ships of Greece and Turkey are largely built of it, but it has not always proved satisfactory in English dockyards. The heart-wood is dark in colour, takes a fine polish, and from the prominence of the medullary rays is valuable to the furniture maker; it weighs from 40 to 50 lb the cubic foot. The comparatively rapid growth of the tree is its great recommendation to the planter; it is best raised from acorns sown on the spot, as they are very bitter and little liable to the attacks of vermin; the tree sends down a long tap-root, which should be curtailed by cutting or early transplanting, if the young trees are to be removed. It seems peculiarly adapted for the mild moist climate of Ireland. It succeeds in many parts of the United States, but is less hardy than the native species. It would appear well fitted for New Zealand planting. Acorns are produced on the Turkey oak in great abundance in some seasons, but in cold wet years do not always ripen in Britain; notwithstanding their bitterness they are greedily eaten by swine. Some southern varieties of this tree bear acorns comparatively sweet, and they are sometimes eaten after being roasted, in which process the tannic acid is partly destroyed. Dalechamps says that some of the esculent acorns of southern Europe occasionally prove unwholesome, causing effects resembling those of poisoning by *Lolium temulentum*.

In North America, where the species of oak are very numerous, the most important member of the group is *Q. alba*, the white oak, abounding all over the eastern districts of the continent from Lake Winnipeg and the St Lawrence countries to the shores of the Mexican Gulf. In aspect it more nearly resembles *Q. Robur* than any other species, forming a thick trunk with spreading base and, when growing in glades or other open places, huge spreading boughs, less twisted and gnarled than those of the English oak and covered with a whitish bark that gives a marked character to the tree. The leaves are large, often irregular in form, usually with a few deep lobes dilated at the end; they are of a bright light green on the upper surface, but whitish beneath; they turn to a violet tint in autumn. The egg-shaped acorns are placed singly or two together on short stalks; they are in most years sparingly produced, but are occasionally borne in some abundance. On rich loams and the alluvial soils of river-valleys, when well drained, the tree attains a large size, often rivalling the giant oaks of Europe; trunks of 3 or 4 feet in diameter are frequently found, and sometimes these dimensions are greatly exceeded. The wood is variable in quality and, though hard in texture, is less durable than the best oak of British growth; the heart-wood is of a light reddish brown varying to an olive tint; a Canadian specimen weighs 52½ lb the cubic foot. In the States it is largely used in shipbuilding, for house timber, and many other purposes; wheels and the frames of waggons and sleighs as well as casks are often made of it; large quantities are exported to England from Canada. The young wood is very strong, flexible, and elastic; it is split into thin strips, to be made into baskets. The large roots, often presenting a very fine grain and taking a good polish, are sought for by the cabinetmaker. The bark is inferior to that of many oaks. The acorns are sweet, and were formerly eaten by the Red Men, but are too scantily produced in most seasons to be of much economic importance. White oaks have often been planted in England, but the trees do not grow as fast as in their native land, while the wood is inferior. According to some American authorities, the timber of *Q. alba* is of better quality in the southern and middle States than in Canada and New England.

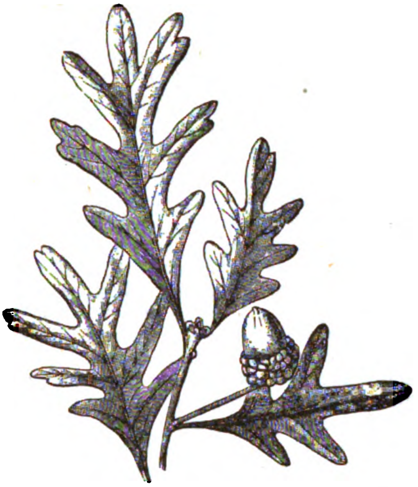


Fig. 4.—*Q. alba pinnatifida*; one-third natural size. (From Michaux, *Histoire des chênes de l'Amérique*.)

Q. obtusiloba, the post oak of the backwoodsman, a smaller tree with rough leaves and notched upper lobes, produces an abundance of acorns and good timber, said to be more durable than that of the white oak.

The pin oak, sometimes called the "over-cup" oak, *Q. macrocarpa*, is remarkable for its large acorns, the cups bordered on the edge by a fringe of long narrow scales; the leaves are very large, sometimes from 10 inches to a foot in length, with very deep lobes at the lower part, but dilated widely at the apex, and there notched. The tree is not of large growth, but its tough wood is useful for bolts and trenails; it is sometimes called the "burr-oak."

The true over-cup oak, *Q. lyrata*, is a large tree, chiefly found on swampy land in the southern States; the lyrate leaves are dilated at the end; the globose acorns are nearly covered by the tuberculated cups.

In the woods of Oregon, from the Columbia river southwards, an oak is found bearing some resemblance to the British oak in foliage and in its thick trunk and widely-spreading boughs, but the bark is white as in *Q. alba*; it is *Q. Garryana*, the western oak of Nuttall. This tree acquires large dimensions, the trunk being often from 4 to 6 feet in diameter; the wood appears to be good, but experience has scarcely tested its durability; the acorns are produced in great quantity, and are used by the Indians as food.

The red oak, *Q. rubra*, has thin large leaves on long petioles, the lobes very long and acute, the points almost bristly; they are pink when they first expand in spring, but become of a bright glossy green when full-grown; in autumn they change to the deep purple-red which gives the tree its name. Common throughout the northern and middle States and Canada, the red oak attains a large size only on good soils; the wood is of little value, being coarse and porous, but it is largely used for cask-staves; the bark is a valuable tanning material.

A species nearly allied is the scarlet oak, *Q. coccinea*, often confounded with the red oak, but with larger leaves, with long lobes ending in several acute points; they change to a brilliant scarlet with the first October frosts, giving one of the most striking of the various glowing tints that render the American forests so beautiful in autumn. The trunk, though often of considerable size, yields but an indifferent wood, employed for similar purposes to that of *Q. rubra*; the bark is one of the best tanning materials of the country. Both these oaks grow well in British plantations, where their bright autumn foliage, though seldom so decided in tint as in their native woods, gives them a certain picturesque value.

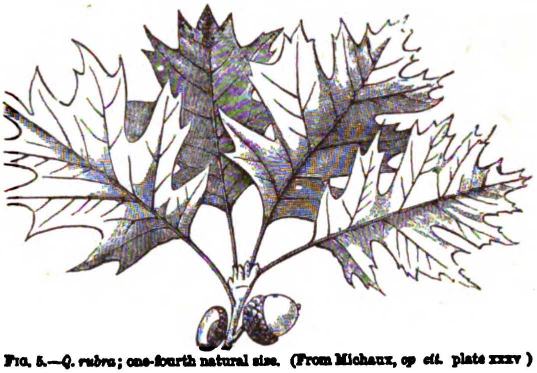


Fig. 5.—*Q. rubra*; one-fourth natural size. (From Michaux, *op. cit.* plate xxxv.)

Nearly akin to these are several other forms of little but botanical interest; not far removed is the black or dyer's oak, *Q. tinctoria*, a large and handsome species, with a trunk sometimes 4 feet in diameter, not uncommon in most forests east of the Mississippi, especially in somewhat upland districts. The leaves are frequently irregular in outline, the lobes rather short and blunt, widening towards the end, but with setaceous points; the acorns are nearly globular. The wood is coarsely grained, as in all the red-oak group, but harder and more durable than that of *Q. rubra*, and is often employed for building and for flour-barrels and cask-staves. The bark, very dark externally, is an excellent tanning substance; the inner layers form the *quercitron* of commerce, used by dyers for communicating to fabrics various tints of yellow, and, with iron salts, yielding a series of brown and drab hues; the colouring property depends on a crystalline principle called *quercitrin*, of which it should contain about 8 per cent. The cut-leaved oaks are represented in eastern Asia by several species, of which *Q. mongolica* is widely spread over Dahouria, north China, and the adjacent countries; one of the Chinese silkworms is said to feed on the leaves.

The chestnut oaks of America represent a section distinguished by the merely serrated leaves, with parallel veins running to the end of the serratures. *Q. Prinus*, a beautiful tree of large growth, and its subspecies *Q. castanea* and *Q. montana*, yield timber little inferior to white oak. *Q. Chinquapin* or *prinoides*, a dwarf variety, often only a foot in height, forms dense miniature thickets on the barren uplands of Kansas and Missouri, and affords abundant sweet acorns; the tree is called by the hunters of the plains the "shin-oak."

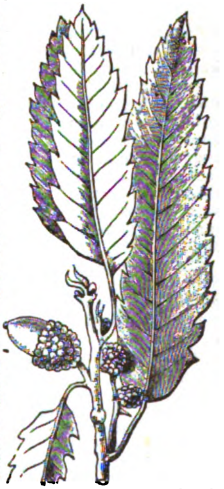


Fig. 6.—*Q. castaneæfolia* (Meyer); one-third natural size. (From Kotschy, *op. cit.*, plate xl.)

Evergreen oaks with entire leaves are represented in North America by *Q. virens*, the live oak of the southern States; more or less abundant on the Atlantic coasts of Carolina and Florida, its true home is the country around the Mexican Gulf, where it rarely grows more than 50 or 60 miles inland. The oval leaves are dark-green above, and whitish with stellate hairs beneath, the margin entire and slightly recurved. The live oak is one of the most valuable timber trees of the genus, the wood being extremely durable, both exposed to air and under water; heavy and close-grained, it is perhaps the best of the American oaks for shipbuilding, and is invaluable for water-wheels and mill-work. Live oaks grow but slowly, and few large trees are left in the settled districts; but when standing in open places the trunk sometimes attains a great size, and an old tree, with its far-spreading boughs, often clothed with the beard-like "Spanish moss," has a peculiarly venerable aspect. One growing at Grove Creek, near Charleston, is said to have attained a girth of 45 feet at the ground; trees of 12 feet in circumference were formerly not unfrequent. The stalked oblong acorns in elongated cups are pleasant in taste, and were eaten by the Indians of Texas. The tree in England is scarcely hardy, though it will grow freely in some sheltered places. Many varieties of *Q. virens* are found in the Mexican isthmus.

The evergreen oak of southern Europe is *Q. Ilex*, usually a smaller tree, frequently of rather shrub-like appearance, with abundant glossy dark-green leaves, generally ovate in shape and more or less prickly at the margin, but sometimes with the edges entire; the under surface is hoary; the acorns are oblong on short stalks. The ilex, sometimes called by gardeners the "holm oak" from its resemblance to the holly, abounds in all the Mediterranean countries, showing a partiality for the sea air. The stem sometimes grows 80 or 90 feet in height, and old specimens are occasionally of large diameter; but it does not often reach a great size. In its native lands it attains a vast age; Pliny attributes to several trees then growing in Rome a greater antiquity than the city itself. The wood is very heavy and hard, weighing 70 ℔ the cubic foot; the colour is dark brown; it is used in Spain and Italy for furniture, and in the former country for firewood and charcoal. In Britain the evergreen oak is quite hardy in ordinary winters, and is useful to the ornamental planter from its capacity for resisting the sea gales; but it generally remains of small size. *Q. Ballota*, an allied form, abundant in Morocco, bears large edible acorns, which form an article of trade with Spain; an oil, resembling that of the olive, is obtained from them by expression. *Q. Gramuntia*, another allied species, also furnishes a fruit which, after acquiring sweetness by keeping, is eaten by the Spaniards.

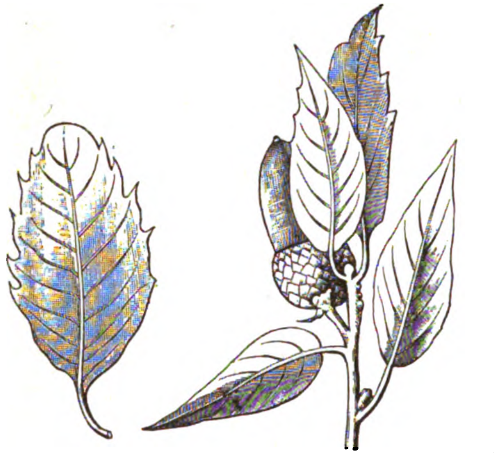


Fig. 7.—*Q. Ilex* (L.); half natural size. (From Kotschy, *op. cit.* plate xxxviii.)

In America several oaks exist with narrow lanceolate leaves, from which characteristic they are known as "willow oaks." *Q. Phellos*, a rather large tree found on swampy land in the southern States, is the most important of this group; its timber is of indifferent quality.

The cork oak, *Q. Suber*, has been described in a preceding article (Cork). In Spain the wood is of some value, being hard and close-grained, and the inner bark is used for tanning. From its rugged silvery bark and dark-green foliage, it is a handsome tree, quite hardy in Cornwall and Devonshire, where it has grown to a large size.

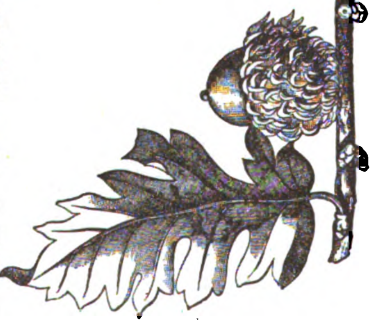


Fig. 8.—*Q. Vallonea*; half natural size. (From Kotschy, *op. cit.*, plate vii.)

The valonia of commerce, one of the richest of tanning materials, is the acorn of *Q. Ægilops*, a fine species indigenous to Greece and the coasts of the Levant, and sometimes called the "Oak of Bashan." The very large acorns are remarkable for their thick cups with long reflexed scales; the leaves are large, oblong, with deep serratures terminating in a bristle-like point. The cups are the most valuable portion of the valonia, abounding in tannic acid; immature acorns are sometimes exported under the name of "camatina." The allied *Q. Vallonea* likewise yields valonia.

Some oaks are of indirect importance from products formed by their insect enemies. Of these the Aleppo gall (see Galls) is yielded by *Q. infectoria*. *Q. coccifera*, a small bush growing in Spain and many countries around the Mediterranean, furnishes the kermes dye (Kermes). *Q. persica*, or according to some *Q. mannifera*, attacked by a kind of *Coccus*, yields a sweet exudation which the Kurds collect and use as manna, or as a substitute for honey or sugar in various confections (see Manna). (C. P. J.)

OAKAPPLE, or Oakgall. See Galls, vol. x. p. 45.

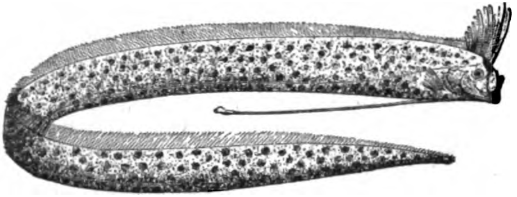
OAKLAND, a city of the United States, in Alameda county, California, lies opposite San Francisco, of which it is practically a residential suburb, on the eastern shore of San Francisco Bay, at the terminus of the Central Pacific Railroad. Its beautiful situation, its shady streets, and the excellent quality of its buildings make it a distinctly attractive place. A branch of the bay, dividing the city into East and West Oakland, forms a good harbour, but is obstructed by a bar. The railway pier, 2 miles long, contains a number of warehouses and is traversed by a broad carriage road. Among the local industrial establishments are flour-mills, planing-mills, potteries, tanneries, and a jute-factory turning out 5,000,000 sacks per annum. Oakland, deriving its name from a grove of oaks in the midst of which it was built, was incorporated as a city in 1854. Its population was 1549 in 1860, 10,500 in 1870, and 34,555 in 1880.

OAKUM is a preparation of tarred fibre used in shipbuilding, for caulking or packing joints of timbers in wood vessels and the deck planking of iron and steel ships. Oakum is made by preference from old tarry ropes and cordage of vessels, its teasing and preparation being a common penal occupation in prisons.

OAMARU, a municipal borough on the coast of Otago, New Zealand (South Island), 73 miles by rail north from Dunedin, and in 45° 5′ S. lat. and 171° 2′ E. long., is a thriving seaport. It is the outlet of the largest agricultural district in New Zealand, and comprises land of exceptional fertility. It is on the main railway between Christchurch and Dunedin, and is connected by branch lines with fertile inland districts. A breakwater and mole, constructed of blocks of concrete like those used at Port Said in Egypt, enclose a large and commodious basin in what was an open roadstead; and the harbour, when completed, will be one of the safest in the colony, and capable of accommodating very large ships. Steamers run three or four times a week between Oamaru and Dunedin. The town is well supplied with gas and water, and is built of white Oamaru limestone, an excellent building-stone abundant in the district. The population in 1881 was 5791; and the capital value of the rateable property in 1883 was £810,428. Coal is obtained at the entrance of Shag Valley, 40 miles to the south. The district is famed for its stock, and the fine quality of its grain, which is often equal to that of South Australia; also for the character of the English grasses laid down there, which flourish in a rich black loam on a limestone formation. The local industries comprise flour-mills, an elevator in connexion with storing grain, a woollen factory, the Oamaru stone company, a boot and shoe factory, a meat-preserving factory, breweries, and a bacon-curing factory. There are several public buildings, including a grammar school, a hospital, an athenæum, and a public hall.

OAR-FISH, a fish of the family of ribbon-fishes (*Trachypteridæ*), to which great interest is attached no less on account of the extraordinary shape of its body than of its internal organization, which is unmistakably that of a deep-sea fish. As in the other members of this family, the body is much elongated and compressed, sword-shaped;

but in the oar-fish this character is excessive, the length of the body being about fifteen times its depth. The head likewise is compressed, short, resembling in its form that of a herring; the eye is large; the mouth is small, and provided with very feeble teeth. A long many-rayed dorsal fin, of which the very long anterior rays form a kind of high crest, extends from the top of the head to the end of the tail; the anal and perhaps the caudal fins are absent; but the ventrals (and by this the oar-fish is distinguished from the other ribbon-fishes) are developed into a pair of long filaments, which terminate in a paddle-shaped extremity, but are too flexible to assist in locomotion. The whole body is covered with a layer of silvery epidermoid substance, which easily comes off and adheres to other objects.


Oar-fish.

Oar-fishes are the largest deep-sea fishes known, the majority of the specimens observed measuring 12 feet in length; but some are recorded to have exceeded 20 feet. Their range in the great depths of the ocean seems to extend over all seas, from the North Sea to the South Atlantic, from Mauritius and Japan to the coasts of New Zealand. But, however numerous they may be in the depths which are their home, it is only by rare accident that specimens reach the surface; and of these a very small proportion only have come under the observation of naturalists, and been actually recorded. Thus from the coasts of Great Britain only about twenty captures are known in the long space of a century and a half, and not more than thirteen from those of Norway. Oar-fishes have been considered by naturalists to have given rise to some of the tales of "sea-serpents," but their size as well as the facility with which they are secured when observed render this solution of the question of the existence of such a creature improbable. When they rise to the surface of the water they are either dead or in a helpless and dying condition. The ligaments and tissues by which the bones and muscles were held together whilst the fish lived under the immense pressure of great depths have then become loosened and torn by the expansion of the internal gases; and it is only with difficulty that the specimens can be taken entire out of the water, and preserved afterwards. Every specimen found has been more or less mutilated; and especially the terminal portion of the tail, which seems to end in a delicate tapering filament, has never been perfect;—it is perhaps usually lost as a useless appendage at a much earlier period of the life of the fish.

OASES. Throughout the great belt of desert extending from the west coast of Africa to central Asia, various fertile tracts occur, clothed with vegetation and watered by springs, to which the name oases has been applied. Those which are best known are met with in the central and eastern portions of the Great Sahara and in the Libyan Desert. In that region they consist generally of deep depressions or valleys, locally termed "wádis," where the water comes to the surface in natural springs, or where it may be procured by sinking wells. Under the influence of these beneficent springs vegetation bursts forth and covers a more or less extensive area, which becomes a halting-place for travellers in the desert, and frequently supports a considerable population. Many of the oases are situated in the mountainous regions, where the ground is sufficiently elevated to precipitate the moisture in the atmosphere. The rain which falls, however, is rapidly absorbed by the rocks or sandy soil, and much of it collects in depressions at no great depth from the surface. The Arabs have long been in the habit of tapping these subterranean waters by sinking wells, a copious supply being usually obtained at depths varying down to 200 fathoms. Indeed, so rapidly does the water ascend when the aqueous strata are pierced in certain localities that the well-sinkers are sometimes suffocated ere they reach the surface. In the Algerian Sahara a large number of artesian wells have been sunk by the French, resulting in the formation of oases, which have to some extent affected the habits of the native tribes by inducing them to become cultivators of these fertile tracts. It is evident, therefore, that, notwithstanding the arid climate which prevails generally throughout the African deserts, a tolerably plentiful supply of water can be obtained by artificial means at various points. The springs, being essential to the very existence of the oases, are naturally guarded with care so as to prevent the sands encroaching on them. Should they cease to flow, the decay of the vegetation rapidly ensues and the oases disappear. Another characteristic feature of these fertile tracts is the palm-tree forests, which are admirably adapted to such unfavourable conditions. The date and the dúm palm are the commonest species met with in the forests; they are highly prized by reason of the produce which they yield to the cultivators of the soil and the shelter which they afford from the scorching sun. Indeed, so serviceable are they that in some cases the Arabs artificially create an oasis with the aid of a few palm trees by digging holes deep enough to allow the roots to pierce the aqueous strata.

From the accounts given by various travellers it would appear that, while the larger oases cover extensive tracts, the smaller ones are liable to be effaced by drifting sand. As an example of one of the largest, Air or Asben may be mentioned, which measures 180 miles from north to south. Such extensive fertile tracts are dotted over with villages, whose inhabitants carry on the cultivation of the soil and export various articles of produce. By means of irrigation different cereals are successfully cultivated, such as barley, rice, and millet

In the western Sahara the chief oases are:—(1) Tuát, about 1000 miles to the south-west of Tripoli; the principal town being Insálah ('Ain Sálah); (2) Taudeni, south-west of Tuát; (3) 'Arawán, south of Taudeni and north of Timbuktu; and (4) Wálata, south-west of 'Arawán. In the eastern portion of the Great Desert the important oases are:—(1) Fezzán, the capital of which is Morzúk, lying to the south-south-east of Tripoli; (2) Ghadámes, north-west of Fezzán; (3) Tibesti, south of Fezzán; (4) Bilma, west-south-west of Tibesti; and (5) Air or Asben, west from Bilma and north-west from Lake Tchad. The last is perhaps one of the most remarkable oases in the African desert, forming a tableland whose average elevation is 2000 feet, with peaks rising to a height of 5000 feet. Heavy tropical rains are precipitated by this lofty plateau, and hence the valleys are clothed with vegetation. This oasis is richly cultivated, producing barley, maize, and millet. The capital is Agades, a town with 7000 inhabitants, which is situated on the caravan route between Morzúk and Sokoto, and constitutes one of the important centres of trade in central Africa.

In the Libyan Desert the chief oases are:—(1) Khargeh or Khárija (the outer oases), sometimes termed the *oasis magna*, about 120 miles to the west of Thebes; (2) Dakhel or Dákhila (the inner oases), situated to the west of Khargeh; (3) Farafreh (Faráfira), north-west of Dakhel; (4) Bahríya (northern), to the north of Farafreh; (5) Síwa (the famous oasis of Jupiter Ammon), at the northern limits of the Libyan Desert; and (6) the Kufra group, south-west of Síwa. Perhaps the most fertile of these tracts is Dakhel, which was first made known to Europeans in 1819 by Sir A. Edmonstone. The chief produce consists of dates, rice, olives, and apricots, but durra, barley, lemons, citrons, and figs also grow on the rich soil of this oasis. It contains eleven villages, the total population being estimated at 6000.

Similar fertile tracts, though of smaller extent, occur in Arabia and in that part of Persia lying to the west of the Salt Desert. In central Asia the great desert of Gobi, ranging from Turkestan to Manchuria, is interspersed with a few oases, the chief one being Kami, which is characterized by a rich growth of vegetation.

OAT, *Avena sativa*, L., one of about forty species mostly dispersed through the temperate regions of the Old World. It belongs to the tribe *Aveneæ* of the order *Gramineæ* or Grasses. The spikelets form a loose panicle, familiar in the cultivated oat, the flowering glume having its dorsal rib prolonged into an awn, which is in some species twisted and bent near the base.

The origin of the cultivated oat is generally believed to be *A. fatua*, L., or "wild oat." Prof. J. Buckman succeeded in raising "the potato-oat type" and "the white Tartarian oat" from grain of this species.[1] Mr A. Stephen Wilson, however, thinks that as yet there is no real proof of this relationship, because his own cultivation of the wild oat made no difference upon it;[2] but there appears to be a great tendency in the oat to degenerate on stiff clay soils into "weed oats," a fact which may perhaps account for this divergence of opinion. Lindley had previously suggested that the cultivated oat was a domesticated variety of some wild species, and that it might not improbably be referred to *A. strigosa*, Schreb., "the bristle-pointed oat," which is the origin of the Scotch oat, according to Buckman. The white and black varieties of this species, Mr Wilson observes, were cultivated in England and Scotland from remote times, and "are frequently mentioned in Rogers' *History of Agriculture and Prices* . . . and they are still grown as a crop in Orkney and Shetland."[3] Both these species are found in Europe, North Africa, Siberia, and north-west India.[4] The "naked oat," *A. nuda*, L., is probably only a race of *A. sativa*;[5] it was found by Bunge in waste ground about Pekin. "According to Lindley," writes Mr Wilson,[6] "the naked oat is the pilcorn of the old agriculture, and we see from Rogers[7] that it was in cultivation in England in the 13th century." Both this and the "common otes," *A. vesca*, are described by Gerard.[8] Parkinson tells us that in his time [early in the 17th century] the naked oat was sown in sundry places, but "nothing so frequent" as the common sort. The chief differences between *A. fatua* and *A. f.*, var. *sativa*, according to Buckman,[9] are, that in the former the chaff-scales which adhere to the grain are thick and hairy, and in the latter they are not so coarse and are hairless. The wild oat, moreover, has a long stiff awn, usually twisted near the base. In the cultivated oat it may be wanting, and if present it is not so stiff and is seldom bent. The grain is very small and worthless in the one, but larger and full in the other. Mr Wilson adds that in the point of attachment "in the wild oat the hanger terminates in a little oval spatula, . . . forming a kind of ball-and-socket connexion. . . . In the cultivated oat the continuity of the vascular tissue in the hanger is not broken off by any point of the kind."[10] There are now many varieties of the cultivated oat.[11] With regard to the antiquity of the oat, De Candolle observes that it was not cultivated by the Hebrews, the Egyptians, the ancient Greeks, and the Romans.[12] Central Europe appears to be the locality where it was cultivated earliest, at least in Europe, for grains have been found among the remains of the Swiss lake-dwellings perhaps not earlier than the bronze age,[13] while Pliny alludes to bread made of it by the ancient Germans.[14] Pickering also records Galen's observations (*De Alim. Fac.*, i. 14), that it was abundant in Asia Minor, especially Mysia, where it was made into bread as well as given to horses; he also states that ten varieties were introduced by Mohammed Ali into Egypt for fodder, and that it was seen by Bruce wild in Abyssinia, sometimes tall enough to conceal horse and rider (Grev.). And he adds that eastward from Syria it is called "sulu" by the Tatars, and was observed by Kaempfer and others in Japan; that it was brought over by colonists, and is now cultivated in north-east America; and that it has now become naturalized in parts of South America.[15]

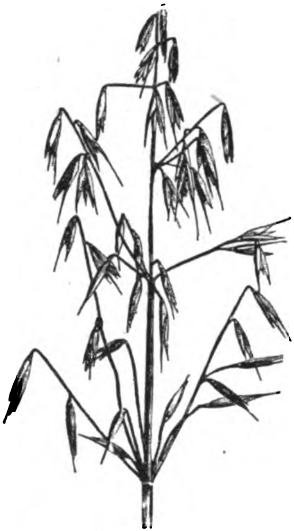


Fig. 1.—Panicle of *A. fatua*, var. *sativa*. (After Le Maout.)

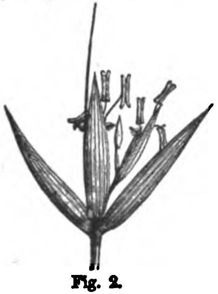


Fig. 2.

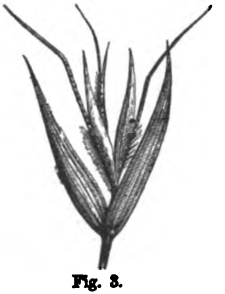


Fig. 3.

Fig. 2.—Spikelet of *A. fatua*, var. *sativa*; with two fertile florets, and one terminal, rudimentary. (After Nees.)
Fig. 3.—Spikelet of Wild Oat, *A. fatua*; glumes hairy and long-pointed; awn twisted at base. (After Buckman.)

Besides the use of the straw when cut up and mixed with other food for fodder, the oat grain constitutes an important food for both man and beast. Being cultivated best in comparatively low temperatures, it has long formed the staple food for Scotland, north England, and Derbyshire, as well as for Germany, wherever wheat does not flourish. It is extensively grown in all the northern States of the American Union, and in New England its production largely exceeds that of wheat. The oat grain (excepting the naked oat), like that of barley, is closely invested by the husk. "This latter is used both in Scotland and Wales for the preparation of a kind of porridge . . . called sowans and sucan."[16] Oatmeal is made from the kiln-dried grain from which the husks have been removed; and the form of the food is the well-known "porridge." In Ireland it is mixed with Indian-corn meal and is called "stirabout." Groats or grits are the whole kernel from which the husk is removed. Their use is for gruel, which used to be consumed as an ordinary drink in the 17th century at the coffee-houses in London. The meal can be baked into "cake" or biscuit, as the Passover-cake of the Jews; but it cannot be made into loaves in consequence of the great difficulty in rupturing the starch grains, unless the temperature be raised to a considerable height. With regard to the nutritive value of oatmeal, as compared with that of wheat flour, it contains a higher percentage of albuminoids than any other grain, viz., 12·6—that of wheat being 10·8—and less of starch, 58·4, as against 66·3 in wheat. It has rather more sugar, viz., 5·4—wheat having 4·2—and a good deal more fat, viz., 5·6, as against 2·0 in flour. Lastly, salts amount to 3·0 per cent. in oat, but are only 1·7 in wheat. Its nutritive value, therefore, is higher than that of ordinary seconds flour.[17] (G. H.)

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[1] *Science and Practice of Farm Cultivation*, p. 172 (1865).

[2] *A Bushel of Corn*, p. 145.

[3] *Op. cit.*, p. 145.

[4] Hooker's *Students' Flora*, p. 466 (1870).

[5] De Candolle, *Géographie Botanique*, ii. p. 941.

[6] *Op. cit.*, p. 146.

[7] *Rarer Kinds of Grain*, vol. ii. p. 173.

[8] *Herball*, p. 68 (1597).

[9] *Op. cit.*, p. 169.

[10] *Op. cit.*, p. 143.

[11] See Wilson, *op. cit.*, p. 141; AGRICULTURE, vol. i. pp. 359, 360; and Morton's *Cyclopædia of Agriculture*, s.v.

[12] *Op. cit.*, ii. p. 938, with reff.

[13] Pickering, *Chron. Hist. of Pl.*, p. 451.

[14] *H.N.*, xviii. 17.

[15] *Op. cit.*, p. 341.

[16] E. Smith, *Foods*, p. 167.

[17] Letheby, *Lectures on Food*, pp. 6, 7 (1870).

OATES, Titus (*c.* 1650 to 1705), was, according to one account, the son of an Anabaptist preacher, chaplain to Pride, and, according to another, of Samuel, the rector of All Saints' Church, Hastings. He was admitted on 11th June 1665 to Merchant Taylors', having, according to one authority, been previously at Oakham. There he remained a year, more or less, "and seems afterwards to have gone to Sedlescombe school in Sussex, from whence he passed to Caius College, Cambridge, on 29th June 1667, and was admitted a sizar of St John's, 2d February 1668/9, aged 18." Upon very doubtful authority he is stated to have been also at Westminster School before going to the university. On leaving the university he apparently took Anglican orders, and officiated in several parishes, Hastings among them. Having brought malicious charges in which his evidence was rejected, he narrowly escaped prosecution for perjury. He next obtained a chaplaincy in the navy, from which he appears to have been speedily dismissed for bad conduct and with the reputation of worse. He now, it is said, applied for help to Dr Tonge, rector of St Michael's in Wood Street, an honest half-crazy man, who even then was exciting people's minds by giving out quarterly "treatises in print to alarm and awake his majesty's subjects." Oates offered his help, and it was arranged that he should pretend to be a Roman Catholic so as the better to unearth the Jesuit plots which possessed Tonge's brain (Lingard). Accordingly he was received into the church by one Berry, himself an apostate, and entered the Jesuit College of Valladolid as Brother Ambrose. Hence he was soon expelled. In October 1677 he made a second application, and was admitted to St Omer on 10th December. So scandalous, however, was his conduct that he was finally dismissed in 1678. Returning in June 1678 to Tonge, he set himself to forge a plot by piecing together things true and false, or true facts falsely interpreted, and by inventing treasonable letters and accounts of preparations for military action. The whole story was written by Oates in Greek characters, copied into English by Tonge, and finally told to one of Charles II.'s confidential servants named Kirkby (Lingard). Kirkby having given the king his information, Oates was sent for (13th August), and in a private interview gave details, in forty-three articles, of the plot and the persons who had engaged to assassinate Charles. The general improbability of the story was so manifest, and the discrepancies were so glaring, that neither then nor at any subsequent time did Charles express anything but amused incredulity. To bolster up the case a fresh packet of five forged letters was concocted (31st August); but the forgery was transparent, and even Sir William Jones, the attorney-general, though a violent upholder of the plot, dared not produce them as evidence.

Oates now (6th September) made an affidavit before Sir Edmondbury Godfrey to an improved edition of his story, in eighty-one articles. Among the persons named was Coleman, secretary to the duchess of York, whom Godfrey knew, and to whom he sent word of the charges. Coleman in turn informed the duke, and he, since the immediate exposure of the plot was of the utmost consequence to him, induced Charles to compel Oates to appear (28th September) before the privy council. Here Oates delivered himself of a story the falsehood of which was so obvious that the king was able to expose him by a few simple questions. At this moment an accident most fortunate for Oates took place. Amongst the papers seized at his request were Coleman's, and in them were found copies of letters written by the latter to Père la Chaise, suggesting that Louis should furnish him with money, which he would use in the French and Catholic interest among members of parliament. Among them, too, were these passages: "Success will give the greatest blow to the Protestant religion that it has received since its birth"; "we have here a mighty work upon our hands, no less than the conversion of three kingdoms, and by that perhaps the utter subduing of a pestilent heresy, which has so long domineered over great part of the northern world." The credit of Oates was thus, in the eyes of the people, re-established, and Coleman and others named were imprisoned. Charles was anxious for his brother's sake to bring the matter to a conclusion, but he dared not appear to stifle the plot; so, when starting for Newmarket, he left orders with Danby that he should finish the investigation at once. But Danby purposely delayed; an impeachment was hanging over his head, and anything which took men's minds off that was welcome. Possibly, too, he was sincerely desirous of frustrating Charles's Catholic sympathies and secret dealings with France. Shaftesbury, with very different views, was eager in his patronage of the plot and its founder.

On 12th October occurred the murder of Godfrey, and the excitement was at its highest pitch. That Oates could ever have induced any one to believe in his tales is incredible to one who does not recollect the victories of Catholic France, the relaxing of the penal laws, the activity of the Jesuits, the fear of a standing army and of James, the agitation of the opposition led by Shaftesbury, and the ignorance and apprehension of the designs of the court. On 21st October parliament met, and, though Charles in his speech had barely alluded to the plot, all other business was put aside and Oates was called before the House. Here he gave details of a pretended apportioning by Oliva, the general of the Jesuit order, of all the chief posts to leading Roman Catholics in the country. The proceedings which followed are best read in the parliamentary history. A new witness was wanted to support Oates's story, and in November Bedloe came forward. At first he remembered little; by degrees he remembered everything that was wanted. Not even so, however, did their witness agree together, so, as a bold stroke, Oates, with great circumstantiality, accused the queen before Charles of high treason. Charles both disbelieved and exposed him, whereupon Oates carried his tale before the House of Commons. The Commons voted for the queen's removal from court, but, the Lords refusing to concur, the matter dropped. It was not, however, until 18th July 1679 that the slaughter of Jesuits and other Roman Catholics upon Oates's testimony and that of his accomplices was to some extent checked. Sir George Wakeman, the queen's physician, was accused of purposing to poison the king, and the queen was named as being concerned in the plot. The refusals of Charles to credit or to countenance the attacks on his wife are the most creditable episodes in his life. Scroggs had intimation that he was to be lenient. Sir Philip Lloyd proved Oates to have perjured himself in open court, and Wakeman was acquitted. On 26th June 1680, upon Oates's testimony, the duke of York was presented as a recusant at Westminster, and in November the informer gave evidence in the trial of Strafford. But the panic had now worn itself out, and the importance of Oates rapidly declined; so much so that after the dissolution in 1682 he was no more heard of during Charles's reign, but enjoyed his pension of £600 or £900, it is uncertain which, in quiet. Shortly before the death of Charles, James brought, and won, a civil action against Oates, with damages of £100,000; in default of payment Oates was taken to prison; while there he was indicted for perjury, and was tried in May 1685, soon after the accession of James II. He was convicted, and received an awful sentence, the execution of which was expected to kill him, and which was rigorously carried out; but to the astonishment of all he survived.

Oates was in prison for three and a half years. Upon the flight of James, and during the excitement against the Catholics, he partially gained his liberty, and brought an appeal against his sentence before the Lords, who, while admitting the sentence to be unjust, confirmed it by a majority of thirty-five to twenty-three. The Commons, however, passed a bill annulling the sentence; and a conference was held in which the Lords, while again acknowledging that legally they were wrong, adhered to their former determination. The matter was finally settled by Oates receiving a royal pardon, with a salary of £300 a year. In November 1689 he was again seen in Westminster Hall, when Peterborough, Salisbury, and others were impeached. In 1690, finding that there was no hope of preferment in the English Church, he became a Baptist, but in less than a year was ejected from their body. In 1691 he became acquainted with William Fuller, whom he induced to forge another plot, though not with the success he had himself attained. He appears to have lived after this chiefly in retirement, though we read in Evelyn that in 1696 he dedicated to William a book against James. He died 13th July 1705.

Authorities.—Oates's, Dangerfield's, and Bedloe's *Narratives*; *State Trials*; *Journals of Houses of Parliament*; North's *Examen*; the various memoirs and diaries of the period; Fuller's *Narrative*; Dryden's *Absalom and Achitophel*; Burnet's *History*; Narcissus Luttrell's *Relation*. Lingard gives an exhaustive and trustworthy account of the Popish terror and its victims; and the chief incidents in Oates's career are graphically described by Macaulay. On the question of the place of his education see *Notes and Queries*, 22d December 1883. (O. A.)

OATH, Anglo-Saxon *ádh*, a word found throughout the Teutonic languages (Gothic *aiths*, modern German *eid*), but without ascertainable etymology. The verb to *swear* is also Old Teutonic (Gothic *svaran*, modern German *schwören*); this word, too, is not clear in original meaning, but is in some way connected with the notion of answering,—indeed it still forms part of the word *answer*, Anglo-Saxon *and-swarian*; it has been suggested that the swearer answered by word or gesture to a solemn formula or act. Among other terms in this connexion, the Latin *jurare*, whence English law has such derivatives as *jury*, seems grounded on the metaphorical idea of binding (root *ju*, as in *jungo*); the similar idea of a bond or restraint may perhaps be traced in the Greek ὅρκος. It may be worth notice that the Latin *sacramentum* (whence modern French *serment*) does not really imply the sacredness of an oath, but had its origin in the money paid into court in a Roman lawsuit, the loser forfeiting his pledge, which went to pay for the public rites (*sacra*); thence the word passed to signify other solemn pledges, such as military and judicial oaths.

The subject of oaths and swearing, difficult in itself, has been made more obscure by the unsatisfactory methods employed by most writers on it. This is not due to want of ability in the writers themselves, among whom are included such men as Calvin and Paley, but to their not having followed their subject on the lines of historical development; on the contrary, the usual plan has been to accommodate to modern views, and discuss with modern arguments, an institution which originated in an early stage of knowledge, and has been confused by the changes it has undergone while being carried on into the midst of new ideas. The student who finds, by consulting modern theological and legal authorities, how indefinite are their views of the binding operation of an oath and the consequences of breaking it (apart from prosecution for perjury) will understand that its meaning must be sought, not among those who now administer and take it, but in the history of older states of culture in which it arose. The very formula, "so help you God," by which legal oaths are administered in England, has not for ages had any precise signification.

An oath may be defined as an asseveration or promise made under non-human penalty or sanction. Writers, viewing the subject among civilized nations only, have sometimes defined the oath as an appeal to a deity. It will be seen, however, by some following examples, that the harm or penalty consequent on perjury may be considered to result directly, without any spirit or deity being mentioned; indeed it is not unlikely that these mere direct curses invoked on himself by the swearer may be more primitive than the invocation of divinities to punish. Oaths scarcely belong to the lowest or savage level of life, unless when rude tribes may have learned them from more civilized neighbours. Their original appearance may rather have been in a somewhat higher barbaric stage of society, where legal forms had already come into use, and oaths were needed as a means of strengthening testimony or promise. Examples of the simplest kind of curse-oath may be seen among the Nagas of Assam, where two men will lay hold of a dog or a fowl by head and feet, which is then chopped in two with a single blow of the dao, this being emblematic of the fate expected to befall the perjurer. Or a man will stand within a circle of rope, with the implication that if he breaks his vow he may rot as a rope does, or he will take hold of the barrel of a gun, a spear-head, or a tiger's tooth, and solemnly declare, "If I do not faithfully perform this my promise, may I fall by this!" (Butler in *Journ. Asiatic Soc. Bengal*, 1875, p. 316). Another stage in the history of oaths is that in which the swearer calls on some fierce beast to punish him if he lies, believing that it has the intelligence to know what he says and the power to interfere in his affairs. In Siberia, in lawsuits between Russians and the wild Ostyaks, it is described as customary to bring into court the head of a bear, the Ostyak making the gesture of eating, and calling on the bear to devour him in like manner if he does not tell the truth (Erman, *Travels in Siberia*, vol. i. p. 492, London, 1848). Similar oaths are still sworn on the head or skin of a tiger by the Santals and other indigenous tribes of India. To modern views, a bear or a tiger seems at any rate a more rational being to appeal to than a river or the sun, but in the earlier stage of nature-religion these and other great objects of nature are regarded as animate and personal. The prevalence of river-worship is seen in the extent to which in the old and modern world oaths by rivers are most sacred. In earlier ages men swore inviolably by Styx or Tiber, and to this day an oath on water of the Ganges is to the Hindu the most binding of pledges, for the goddess will take awful vengeance on the children of the perjurer In New Guinea certain tribes are reported to swear by the sun, or a mountain, or a weapon, that the sun may burn them, or the mountain crush them, or the weapon wound them if they forswear themselves. The Tunguz brandishes a knife before the sun, saying, "If I lie may the sun plunge sickness into my entrails like this knife." The natural transition from swearing by these great objects of nature to invoking gods conceived in human form is well shown in the treaty-oath between the Macedonians and the Carthaginians recorded by Polybius (vii. 9); here the sun and moon and earth, the rivers and meadows and waters, are invoked side by side with Zeus and Hera and Apollo, and the gods of the Carthaginians. The heaven-god, able to smite the perjurer with his lightning, was invoked by the Romans, when a hog was slain with the sacred flint representing the thunderbolt, with the invocation to Jove so to smite the Roman people if they broke the oath (Liv., i. 24; Polyb., iii. 25). Another form of this Aryan rite was preserved by the old Slavonic nation of Prussia, where a man would lay his right hand on his own neck and his left on the holy oak, saying, "May Perkun (the thunder-god) destroy me!" The oaths of the lower culture show a remarkable difference from those of later stages. In the apparently primitive forms the curse on the perjurer is to take effect in this world, as when an African negro swears by his head or limbs, which will wither if he lies; this kind of oath by the swearer's body is still found in both the Eastern and the Western worlds, and generally with the same implication of evil to fall on the part sworn by. But as nations became more observant, experience must have shown that bears and tigers were as apt to kill truth-tellers as perjurers, and that even the lightning-flash falls without moral discrimination. In the *Clouds* of Aristophanes, indeed, men have come openly to ridicule such beliefs, the Socrates of the play pointing out that notorious perjurers go unharmed, while Zeus hurls his bolts at his own temple, and the tall oaks, as if an oak-tree could perjure itself. The doctrine of miraculous earthly retribution on the perjurer lasted on in legend, as where Eusebius relates how three villains conspired to bring a false accusation against Narcissus, bishop of Jerusalem, which accusation they confirmed by solemn oath before the church, one wishing that if he swore falsely he might perish by fire, one that he might die of the pestilence, one that he might lose his eyes; a spark no man knew from whence burned to ashes the first perjurer's house and all within, the second was consumed by the plague from head to foot, whereupon the third confessed the crime with tears so copious that he lost his sight (Euseb., *Hist. Eccl.*, vi. 9). As a general rule, however, the supernatural retribution on perjury has been transferred from the present world to the regions beyond the grave, as is evident from any collection of customary oaths. A single instance will show at once the combination of retributions in and after the present life, and the tendency to heap up remote penalties in the vain hope of securing present honesty. The Siamese Buddhist in his oath, not content to call down on himself various kinds of death if he breaks it, desires that he may afterwards be cast into hell to go through innumerable tortures, among them to carry water over the flames in a wicker basket to assuage the thirst of the infernal judge, then that he may migrate into the body of a slave for as many years as there are grains of sand in four seas, and after this that he may be born a beast through five hundred generations and an hermaphrodite five hundred more.

The forms of oath belonging to all nations and ages, various as they are in detail, come under a few general heads. It may be first observed that gestures such as grasping hands, or putting one hand between the hands of another in token of homage, are sometimes treated as of the nature of oaths, but wrongly so, they being rather of the nature of ceremonies of compact. The Hebrew practice of putting the hand under another's thigh is usually reckoned among oath-rites, but it may have been merely a ceremony of covenant (Gen. xxiv. 2, xlvii. 29; see Joseph., *Ant.*, i. 16). Even the covenant among many ancient and modern nations by the parties mixing their blood or drinking one another's is in itself only a solemn rite of union, not an oath proper, unless some such ceremony is introduced as dipping weapons into the blood, as in the form among the ancient Scythians (Herod., iv. 70); this, by bringing in the idea of death befalling the covenant-breaker, converts the proceeding into an oath of the strongest kind. The custom of swearing by weapons, though frequent in the world, is far from consistent in meaning. It may signify, in cases such as those just mentioned, that the swearer if forsworn is to die by such a weapon; or the warrior may appeal to his weapon as a powerful or divine object, as Parthenopæus swears by his spear that he will level to the ground the walls of Thebes (*Æschyl.*, *Sept. contra Theb.*, 530; see the custom of the Quadi in Ammian. Marcellin., xvii.); or the weapon may be a divine emblem, as when the Scythians swore by the wind and the sword as denoting life and death (Lucian, *Toxaris*, 38). Oaths by weapons lasted into the Christian period; for instance, the Lombards swore lesser oaths by consecrated weapons and greater on the Gospels (see Ducange, *s.v.* "Juramenta super arma"; Grimm, *Deutsche Rechtsalterth.*, p. 896). Stretching forth the hand towards the object or deity sworn by is a natural gesture, well shown in the oath of Agamemnon, who with uplifted hands (*Διὶ χεῖρας ἀνασχών*) takes Heaven to witness with Sun and Earth and the Erinnyes who below the earth wreak vengeance on the perjurer (Homer, *Il.*, xix. 254; see also Pindar, *Olymp.*, vii. 120). The gesture of lifting the hand towards heaven was also an Israelite form of oath: Abraham says, "I have lifted up my hand to Jehovah," while Jehovah Himself is represented as so swearing, "For I lift up My hand to heaven, and say, I live for ever" (Gen. xiv. 22; Deut. xxxii. 40; see Dan. xii. 7; Rev. x. 5). This gesture established itself in Christendom, and has continued to modern times. In England, for example, in the parliament at Shrewsbury in 1398, when the Lords took an oath on the cross of Canterbury never to suffer the transactions of that parliament to be changed, the members of the Commons held up their hands to signify their taking upon themselves the same oath (J. E. Tyler, *Oaths*, p. 99). In France a juror takes oath by raising his hand, saying, "Je jure!" The Scottish judicial oath is taken by the witness holding up his right hand uncovered, and repeating after the usher, "I swear by Almighty God, and as I shall answer to God at the great day of judgment, that I will," &c. In the ancient world sacrifice often formed part of the ceremony of the oath; typical examples may be found in the Homeric poems, as in Agamemnon's oath already mentioned, or the compact between the Greeks and Trojans (*Il.*, iii. 276), where wine is poured out in libation, with prayer to Zeus and the immortal gods that the perjurer's brains shall, like the wine, be poured on the ground; the rite thus passes into a symbolic curse-oath of the ordinary barbaric type. Connected with such sacrificial oaths is the practice of laying the hand on the victim or the altar, or touching the image of the god. A classic instance is in a comedy of Plautus (*Rudens*, v. 2, 45), where Gripus says, "Tange aram hanc Veneris," and Labrax answers "Tango" (Greek instance, Thucyd., v. 47; see Justin, xxiv. 2). Thus Livy (xxi. 1) introduces the phrase "touching the sacred objects" (*tactis sacris*) into the picturesque story of Hannibal's oath. Details of the old Scandinavian oath have been preserved in Iceland in the Landnámabók (*Islendinga Sögur*, Copenhagen, 1843): a bracelet (baugr) of two rings or more was to be kept on the altar in every head court, which the godi or priest should wear at all law-things held by him, and should redden in the blood of the bullock sacrificed, the witness pronouncing the remarkable formula: "Name I to witness that I take oath by the ring, law-oath, so help me Frey, and Niörd, and almighty Thor" (hialpi mer svâ Freyr, ok Niördr, ok hinn almâttki Âss), &c. This was doubtless the great oath on the holy ring or bracelet which the Danes swore to King Alfred to quit his kingdom ("on tham halgan beage," *Anglo-Sax. Chron.*; "in eorum armilla sacra," Ethelwerd, *Chron.*, iv.). An oath, though not necessarily expressed in words, is usually so. In the Homeric instances the prayer which constitutes the oath has a somewhat conventional form, and in the classical ages we find well-marked formulas. These are often references to deities, as "by Zeus!" "I call Zeus to witness" (*ναὶ μὰ Δία*; *ἴστω Ζεύς*); "by the immortal gods!" "I call to witness the ashes of my ancestors" (per deos immortales; testor majorum cineres). Sometimes a curse is invoked on himself by the swearer, that he may perish if he fail to keep his oath, as "the gods destroy me," "let me perish if," &c. (dii me perdant; dispeream si). An important class of Roman oaths invokes the deity to favour or preserve the swearer in so far as he shall fulfil his promise—"as the gods may preserve me," "as I wish the gods to be propitious to me" (me ita di servent; ita deos mihi velim propitios). The best Roman collection is to be found in the old work of Brissonius, *De Formulis et Solemnibus Populi Romani Verbis*, Paris, 1583. Biblical examples of these classes of oaths are "as the Lord liveth" (1 Sam. xiv. 39, and elsewhere), "so do God to me, and more also" (2 Sam. iii. 35, and elsewhere).

The history of oaths in the early Christian ages opens a controversy which to this day has not been closed. Under Christ's injunction, "Swear not at all" (Matt. v. 34; also James v. 12), many Christians seem at first to have shrunk from taking oaths, and, though after a time the usual customs of judicial and even colloquial oaths came to prevail among them, the writings of the Fathers show efforts to resist the practice. Chrysostom perhaps goes furthest in inveighing against this "snare of Satan": "Do as you choose; I lay it down as a law that there be no swearing at all. If any bid you swear, tell him, Christ has spoken, and I do not swear" (Homil. ix. in *Act. Apostol.*; see a collection of patristic passages in Sixt. Senens., *Bibliothec. Sanct.*, vi. adnot. 26). The line mostly taken by influential teachers, however, was that swearing should indeed be avoided as much as possible from its leading to perjury, but that the passages forbidding it only applied to superfluous or trifling oaths, or those sworn by created objects, such as heaven or earth or one's own head. On the other hand, they argued that judicial and other serious swearing could not have been forbidden, seeing that Paul in his epistles repeatedly introduces oaths (2 Cor. i. 23; Phil. i. 8; Gal. i. 20). Thus Athanasius writes: "I stretch out my hand, and as I have learned of the apostle, I call God to witness on my soul" (*Apol. ad Imp. Const.*; see Augustine, *De Mend.*, 28; *Epist.*, cl., iii. 9; cl., iv. 250; *Enarr. in Psalm.* lxxxviii. (4); *Serm.*, 307, 319). This argument is the more forcible from Paul's expressions being actually oaths in accepted forms, and it has also been fairly adduced that Christ, by answering to the adjuration of the high priest, took the judicial oath in solemn form (Matt. xxvi. 63). The passages here referred to will give an idea of the theological grounds on which in more modern times Anabaptists, Mennonites, and Quakers have refused to take even judicial oaths, while, on the other hand, the laws of Christendom from early ages have been only directed against such swearing as was considered profane or otherwise improper, and against perjury. Thus from the 3d or 4th century we find oaths taking much the same place in Christian as in non-Christian society. In the 4th century the Christian military oath by God, Christ, the Holy Spirit, and the majesty of the emperor is recorded by Vegetius (*Rei Milit. Inst.*, ii. 5). Constantine's laws required every witness in a cause to take oath; this is confirmed in Justinian's code, which even in some cases requires also the parties and advocates to be sworn (*Cod. Theod.*, xi. 39; *Justin. Cod.*, iv. 20, 59). Bishops and clergy were called upon to take oath in ordination, monastic vows, and other ecclesiastical matters (see details in Bingham, *Antiq. of Chr. Church*, xvi. 7). By the Middle Ages oaths had increased and multiplied in Christendom far beyond the practice of any other age or religion. The Reformation made no change in principle, as is seen, for instance, in Art. xxxix. of the church of England: "As we confess that vain and rash swearing is forbidden Christian men by our Lord Jesus Christ, and James His apostle, so we judge, that Christian Religion doth not prohibit, but that a man may swear when the Magistrate requireth, in a cause of faith and charity, so it be done according to the Prophet's teaching, in justice, judgement, and truth." But about this time began a legal reformation, which has for reasons of public policy continually reduced the number of oaths required to be taken and apparently tends toward their total abolition.

The history of swearing in early Christendom would lead us to expect that the forms used would be adopted with more or less modification from Hebrew or Roman sources, as indeed proves to be the case. The oath introduced in the body of one of Constantine's laws—"As the Most High Divinity may ever be propitious to me" (Ita mihi summa Divinitas semper propitia sit)—follows an old Roman form. The Roman oath by the genius of the emperor being objected to by Christians as recognizing a demon, they swore by his safety (Tertull., *Apol.*, 32). The gesture of holding up the hand in swearing has been already spoken of. The Christian oath on a copy of the Gospels seems derived from the late Jewish oath taken holding in the hand the scroll of the law (or the phylacteries), a ceremony itself possibly adapted from Roman custom (see treatise "Shebuoth" in *Gemara*). Among the various mentions of the oath on the Gospels in early Christian writers is that characteristic passage of Chrysostom in a sermon to the people of Antioch: "But do thou, if nothing else, at least reverence the very book thou holdest forth to be sworn by, open the Gospel thou takest in thy hands to administer the oath, and, hearing what Christ therein saith of oaths, tremble and desist" (*Serm. ad Pop. Antioch.*, Homil. xv.). The usual mode was to lay the hand on the Gospel, as is often stated in the records, and was kept up to a modern date in the oath in the university of Oxford, "tactis sacrosanctis Evangeliis"; the practice of kissing the book, which has now almost superseded it in England, appears in the Middle Ages (J. E. Tyler, *Oaths*, pp. 119, 151). The book was often laid on the altar, or (after the manner of ancient Rome) the swearer laid his hand on the altar itself, or looked towards it; above all, it became customary to touch relics of saints on the altar, a ceremony of which the typical instance is seen in the representation of Harold's oath in the Bayeux tapestry. Other objects, as the cross, the bishop's crosier, &c., were sworn by (see Ducange, *s.v.* "Jurare"). An oath ratified by contact or inspection of a sacred object was called a "corporal" or bodily oath, as distinguished from a merely spoken or written oath; this is well seen in an old English coronation oath, "so helpe me God, and these holy euangelists by me bodily touched vppon this hooly awter." The English word signifying the "sacred object" on which oath is taken is *halidome* (Anglo-Saxon, *háligdóm*; German, *heiligthum*); the halidome on which oaths are now sworn in England is a copy of the New Testament. Jews are sworn on the Old Testament; the sacred books of other religions are used in like manner, a Mohammedan swearing on the Koran, a Hindu on the Vedas.

Among the oath-formulas used in Christendom, that taken by provincial governors under Justinian is typical of one class: "I swear by God Almighty, and His only begotten Son our Lord Jesus Christ, and the Holy Ghost, and the Most Holy Glorious Mother of God and ever Virgin Mary, and by the Four Gospels which I hold in my hand, and by the Holy Archangels Michael and Gabriel," &c. The famous oath of the kings Louis and Charles at Strasburg in 842 (A.D.) runs: "By God's love and the Christian people and our common salvation, as God shall give me knowledge and power," &c. Earlier than this, as in the oath of fealty in the capitularies of Charlemagne in 802, is found the familiar form "Sic me adjuvet

Deus," closely corresponding to above-mentioned formulas of pre-Christian Rome. This became widely spread in Europe, appearing in Old French "Si m'ait Dex," German "So mir Gott helfe," English "So help me God." A remarkable point in its history is its occurrence in the "So help me Frey," &c., of the old Scandinavian ring-oath already described. Among the curiosities of the subject are quaint oaths of kings and other great personages: William Rufus swore "by that and that" (per hoc et per hoc), William the Conqueror "by the splendour of God," John "by God's teeth"; other phrases are given in Ducange (*l.c.*), as "per omnes gentes," "per coronam," "par la sainte figure de Dieu," "par la mort Dieu," &c.

Profane swearing, the trifling or colloquial use of sacred oaths, is not without historical interest, formulas used being apt to keep up traces of old manners and extinct religions. Thus the early Christians were reproved for continuing to say "*mehercle!*" some of them not knowing that they were swearing by Hercules (Tertull., *De Idol.*, 20). Oaths by deities of pre-Christian Europe lasted into the modern world, as when a few generations ago Swedish peasants might be heard to swear, "Odin take me if it is not true!" (Hylten-Cavallius, *Wärend och Wirdarne*, vol. i. p. 228). The thunder-god holds his place still in vulgar German exclamations, such as "Donner!" (Grimm, *Deutsche Mythologie*, pp. 10, 166). The affected revival of classical deities in Italy in the Middle Ages still lingers in such forms as "per Bacco!" "cospetto di Bacco!" (by Bacchus! face of Bacchus!). In France the concluding oath of the last paragraph has dwindled into "mordieu!" or "morbleu!" much as in England the old oaths by God's body and wounds became converted into "oddsbodikins!" and "zounds!"

The oaths now administered among civilized nations are chiefly intended for maintaining governments and securing the performance of public business. They fall under the headings of political, ecclesiastical, and legal. In England the coronation oath is to be administered by one of the archbishops or bishops in the presence of all the people, who, on their parts, reciprocally take the oath of allegiance to the crown.

The archbishop or bishop shall say: "Will you solemnly promise and swear to govern the people of this kingdom of England and the dominions thereto belonging according to the statutes in parliament agreed on, and the laws and customs of the same?" *The king or queen shall say*: "I solemnly promise so to do." *Archbp. or bp.* "Will you to your power cause law and justice, in mercy, to be executed in all your judgements?" *K. or Q.* "I will." *Archbp. or bp.* "Will you, to the utmost of your power, maintain the laws of God, the true profession of the Gospel, and the Protestant reformed religion established by the law? And will you promise unto the bishops and clergy of this nation, and to the churches committed to their charge, all such rights and privileges as by law do or shall appertain unto them, or any of them?" *K. or Q.* "All this I promise to do." *After this the king or queen, laying his or her hand upon the holy Gospels, shall say*: "The things which I have here before promised I will perform and keep; so help me God," *and then shall kiss the book.*

The chief officers of state take an "official" oath well and truly to serve his (or her) majesty. Special oaths are taken by privy councillors, archbishops and bishops, peers, baronets and knights, recruits, and others. The old oath of allegiance, as administered (says Blackstone) upwards of 600 years, contained a promise "to be true and faithful to the king and his heirs, and truth and faith to bear of life and limb and terrene honour, and not to know or hear of any ill or damage intended him without defending him therefrom" (Blackstone, *Commentaries*, book i. chap. x.). In the reign of William III. it was replaced by a shorter form, and in the present reign stands: "I — — do swear that I will be faithful and bear true allegiance to Her Majesty Queen Victoria, her heirs and successors, according to law." Statutes of Charles II. and George I. enacted that no member should vote or sit in either house of parliament without having taken the several oaths of allegiance, supremacy, and abjuration. The oath of supremacy in the reign of William III. was: "I A B doe swear that I doe from my heart abhorr detest and abjure as impious and hereticall this damnable doctrine and position that princes excommunicated or deprived by the Pope or any authority of the see of Rome may be deposed or murdered by their subjects or any other whatsoever. And I doe declare that no forreigne prince person prelate state or potentate hath or ought to have any jurisdiction power superiority preeminence or authoritie ecclesiasticall or spirituall within this realme. Soe," &c. The oath of abjuration introduced in the time of William III. recognizes the king's rights, engages the juror to support him and disclose all traitorous conspiracies against him, promises to maintain the Hanoverian Protestant succession, and expressly renounces any claim of the descendants of the late Pretender. This oath was not only taken by persons in office, but might be tendered by two justices to any person suspected of disaffection. In modern times a single parliamentary oath was substituted for the three, and this was altered to enable Roman Catholics to take it, and Jews were enabled to sit in parliament by being allowed to omit the words "on the true faith of a Christian." In its present form the parliamentary oath consists of an oath of allegiance and a promise to maintain the succession to the crown as limited and settled in the reign of William III. The "judicial" oath taken by judges of the Court of Appeal or of the High Court of Justice, and by justices of the peace, is "to do right to all manner of people after the laws and usages of this realm, without fear or favour, affection or ill-will." Jurors are sworn, whence indeed their name (*juratores*); in felonies the oath administered is: "You shall well and truly try and true deliverance make between our sovereign lady the Queen and the prisoner at the bar whom you shall have in charge, and a true verdict give according to the evidence." In misdemeanours the form is: "Well and truly try the issue joined between our sovereign lady the Queen and the defendant, and a true verdict," &c. The oath of the jurors in the Scottish criminal courts is: "You [the jury collectively] swear in the name of Almighty God and as you shall answer to God at the great day of judgment that you will truth say and no truth conceal in so far as you are to pass upon this assize." The oldest trace of this form of oath in Scotland is in *Reg. maj.*, i. cap. 11, copied from Glenville, which points to an origin in the Norman inquest or "recognition." In the ancient custom of compurgation, once prevalent in Europe, the accused's oath was supported by the oaths of a number of helpers or compurgators who swore to their belief in its validity. A remnant of it lasted on till the 17th century in the "ex officio" oath of a clergyman cited before the ecclesiastical court for misconduct, who might be required to call his neighbours as compurgators to swear to their belief in his innocence. The *jusjurandum* or decisory oath of Roman law, which was of greater authority than *res judicata* (*Digest* xii. 2, 2), is still represented in modern law by the *serment décisoire* of the Code Civil, and the "reference to the oath of the party" of Scotch law (see the case of Longworth *v.* Yelverton, in *Law Reports*, 1 Scotch Appeals, 218). Such an oath is final and conclusive. It has something in common with the old "wager of law" in England, abolished by 3 and 4 William IV. c. 42, s. 13, in so far as it makes an oath the *finis litium*. The decisory oath was formerly used in the ecclesiastical courts (Burn, *Eccl. Law*, *s.v.* "Oaths"). It seems to be still used in admiralty cases in Massachusetts (Dunlop, *Adm. Pr.*, 290). Witnesses are sworn: "The evidence you shall give . . . shall be the truth, the whole truth, and nothing but the truth. So," &c. Where a witness is sworn on the *voir dire*, the oath is: "You shall true answer make to all such questions as the court shall demand of you. So help you God." As to witnesses of religions other than Christian, an oath is to be administered to them in such form and with such ceremonies as they may declare to be binding. The great number of oaths formerly required have been much reduced by modern legislation, in many cases a voluntary declaration before a justice, notary, &c., being substituted. Many alterations of the English law as to oaths have been made of late years in relief of those conscientiously objecting. Quakers, Moravians, and Separatists are allowed to make affirmation, whether as witnesses or on other occasions, where an oath was formerly required. Thus a Quaker in the witness-box affirms by answering "Yea!" and when taking his seat in parliament substitutes for "swear" the words "solemnly, sincerely, and truly declare and affirm," and omits "So help me God." The Evidence Further Amendment Act, 1869 (32 and 33 Vict. c. 68, s. 4), allowing affirmations in place of oaths in certain cases in judicial proceedings, is by the Evidence Amendment Act, 1870 (33 and 34 Vict. c. 49), extended to proceedings before all persons having authority to administer oaths. It was specially intended to meet the case of an arbitrator. But the right to affirm in lieu of taking the parliamentary oath has been held not to apply to the case of avowed atheists, as appears from the case of Mr Charles Bradlaugh, elected member for Northampton, but not permitted to take the affirmation and sit (1883; see Clarke *v.* Bradlaugh, 7 Q. B. D. 38). False witness given under affirmation is punishable as perjury. Profane swearing and cursing is punishable by law, any labourer, sailor, or soldier being liable to forfeit 1s., every other person under the degree of a gentleman 2s., and every gentleman or person of superior rank 5s., to the poor of the parish.

The administering or taking of certain oaths is criminal in English and Scotch law. It is a felony punishable by penal servitude for life (*a*) to administer or cause to be administered or aid or assist at the administering of any oath or engagement purporting or intending to bind the person taking the same to commit treason or murder or any felony which on the 12th of July 1812 was punishable with death; (*b*) to take any such oath or engagement, not being compelled thereto (52 George III. c. 104, s. 1). It is a felony punishable with penal servitude for seven years (*a*) to administer or cause to be administered or aid or assist at or be present and consenting to the administering or taking of any oath or engagement purporting or intending to bind the person taking the same to engage in any mutinous or seditious purpose; to disturb the public peace; to be of any association, society, or confederacy formed for any such purpose; to obey the orders or commands of any committee or body of men not lawfully constituted, or of any leader or commander, or other person not having authority by law for that purpose; not to inform or give evidence against any associate, confederate, or other person; not to reveal or discover any unlawful combination or confederacy or any illegal act done or to be done, or any illegal oath or engagement which may have been administered or tendered to or taken by any person, or the import of any such oath or engagement; (*b*) to take any such oath or engagement, not being compelled thereto (37 George III. c. 123, s. 1). Compulsion is no defence unless the person taking the oath or engagement within fourteen days (in the case of oaths falling under 52 George III. c. 104) or within four days if not prevented by actual force or sickness, and then within four days after the cessation of the hindrance produced by such force or sickness (in the case of oaths falling under 37 George III. c. 123), declares the circumstances of the administration of the oath by information on oath before a justice of the peace or a secretary of state or the privy council, or, if on active service, to his commanding officer. The Draft Criminal Code proposes to incorporate these provisions with little alteration. The Irish Act (50 George III. c. 102) is more stringent than 37 George III. c. 123, as the person administering the oath is punishable with penal servitude for life, the person taking the oath is punishable as in England and Scotland. A club or society in which members are required or permitted to take an unlawful oath is unlawful, and the members may be proceeded against either summarily or by indictment (39 George III. c. 79, 57 George III. c. 19). The latter statute, as appears from the preamble, was specially aimed at the corresponding societies which existed in Great Britain at the time of the French Revolution.

Politicians and moralists have placed much reliance on oaths as a practical security. It has been held, as Lycurgus the orator said to the Athenians, that "an oath is the bond that keeps the state together" (Lycurg., *Leocr.*, 80; see Montesquieu, *Spirit of Laws*). Thus modern law-books quote from the leading case of Omychund *v.* Barker: "No country can subsist a twelvemonth where an oath is thought not binding; for the want of it must necessarily dissolve society." On the other hand, wherever the belief in supernatural interference becomes weakened, and oaths are taken with solemn form but secret contempt or open ridicule, they become a serious moral scandal, as had already begun to happen in classical times. The yet more disastrous effect of the practice of swearing is the public inference that, if a man has to swear in order to be believed, he need not speak the truth when not under oath. The early Christian fathers were alive to this depreciation of ordinary truthfulness by the practice of swearing, and opposed, though unavailingly, the system of oaths which more and more pervaded public business. How in the course of the Middle Ages oaths were multiplied is best seen by examining a collection of formulas such as the *Book of Oaths* (London, 1649), which range from the coronation oath to the oaths sworn by such as valuers of cloths and the city scavengers.[1] Oaths of allegiance and other official oaths are still taken throughout Europe, but experience shows that in times of revolution they are violated with little scruple, and in the case of the United Kingdom it is doubtful whether they have any more practical value than, if so much as, simple declarations. The question of legal oaths is more difficult. On the one hand, it is admitted that they do induce witnesses, especially the ignorant and superstitious, to give evidence more truthfully than they would do on even solemn declaration. On the other hand, all who practise in courts of justice declare that a large proportion of the evidence given under oath is knowingly false, and that such perjury is perceptibly detrimental to public morals. The lowering of truth in ordinary intercourse, which follows from the requirement of swearing as a confirmation in public matters, remains much as it was in ancient times. One noteworthy point is that an effect is now produced by oaths foreign to their proper purpose, which is to use the sanction of religion for the enforcement of obligations; now, however, the oath has passed into a sanction of the religion, so that an oath taken in legal form is construed as a confession of faith in Christianity, or at least in the existence of God. (E. B. T.)

OBADIAH (עֹבַדְיָה, Οβδειου, Αβδιου, Abdias) is a name pretty frequent in the Old Testament, meaning "servant" or worshipper "of Jehovah." It is synonymous with Abdi and Abdeel, and of a type common in Semitic proper names; compare the Arabic ʽAbdalláh, Taimallát, ʽAbd Manát, &c., the Hebrew Obed Edom, and many Phœnician forms. The name of Obadiah is prefixed to the fourth and shortest book of the minor prophets, and as no date or other historical note is added it is not surprising that an early Hebrew tradition recorded by Jerome (*Comm. in Ob.*) identified the prophet with the best-known Obadiah of the historical books, the protector of the prophets in the reign of Ahab (1 Kings xviii.). His tomb was shown in Samaria with those of Elisha and John the Baptist, and the *Epitaphium Paulæ* describes the wild performances, analogous to those of modern dervishes, that took place before these shrines.

It is now agreed on all hands that it is vain to connect Obadiah the prophet with any other Obadiah of the Old Testament, and that our only clue to the date and composition of the book lies in internal evidence. The prophecy is directed against Edom. Jehovah has sent a messenger forth among the nations to stir them up to battle against the proud inhabitants of Mount Seir, to bring them down from the rocky fastnesses which they deem impregnable. Edom shall be not only plundered but utterly undone and expelled from his borders, and this he shall suffer (through his own folly) at the hand of trusted allies (vers. 1-9). The cause of this judgment is his cruelty to his brother Jacob. In the day of Jerusalem's overthrow the Edomites rejoiced over the calamity, grasped at a share of the spoil, lay in wait to cut off the fugitives (vers. 10-14). But now the day of Jehovah is near upon all nations, Esau and all the heathen shall drink full retribution for their banquet of carnage and plunder on Jehovah's holy mountain. A rescued Israel shall dwell in Mount Zion in restored holiness; the house of Jacob shall regain their old possessions; Edom shall be burned up before them as chaff before the flame; they shall spread over all Canaan, over the mountain of Esau and the south of Judah as well as over Gilead and the Philistine and Phœnician coast. The victorious Israelites shall come up on Mount Zion to rule the mountain of Esau, and the kingdom shall be Jehovah's (vers. 15-21).

In vers. 10-14 the expositor finds sure foothold. The calamity of Jerusalem can only be the sack of the city by Nebuchadnezzar; the malevolence and cruelty of Edom on this occasion are characterized in similar terms by several writers of the exile, but by none with the same circumstance and vividness of detail as here (Ezek. xxv. 8, 12 *sq.*, xxxv.; Lam. iv. 21; Psalm cxxxvii.). It is impossible to doubt that these verses were written under the lively and recent impression of the events to which they refer; to regard them as predictive (Caspari, Pusey, &c.) is to misunderstand the whole character of prophetic foresight, and to ascribe them with Hitzig to the Persian or Greek period is equally unreasonable. The opening verses of the prophecy, on the other hand, present a real difficulty. Obad. 1-6, 8 agree so closely and in part verbally with Jer. xlix. 14-16, 9, 10, 7 that the two passages cannot be independent; nor does it seem possible that Obadiah quotes from Jeremiah, for Obad. 1-8 is a well-connected whole, while the parallel verses in Jeremiah appear in different order, interspersed with other matter, and in a much less lucid connexion. In Jeremiah the picture is vague, and Edom's unwisdom (ver. 7) stands without proof. In Obadiah the conception is quite definite. Edom is attacked by his own allies, and his folly appears in that he exposes himself to such treachery. Again, the probability that the passage in Jeremiah incorporates disjointed fragments of an older oracle is greatly increased by the fact that the prophecy against Moab in the preceding chapter uses, in the same way, Isa. xv., xvi., and the prophecy of Balaam. In spite of the objections of Blau (*Z. D. M. G.*, xx. 173 *sq.*) there is no good reason to doubt that the prophecy against Edom ascribed to Jeremiah is really from his pen; it is earlier than the fall of Jerusalem,[1] and is one of a circle of prophecies in which Nebuchadnezzar (the lion ascending from Jordan, ver. 19) appears as the instrument of divine judgment on the nations. This being so, it seems necessary to conclude, with Ewald (*Propheten*, i. 489 *sq.*), Graf (*Jeremia*, p. 558 *sq.*), and others, that Jeremiah and our book of Obadiah alike quote from an older oracle. Ewald supposes that the treacherous allies of Edom are the Aramæans and the time that of Ahaz (2 Kings xvi. 6); but the tone of the prophecy seems rather to refer it to a later date, when Edom had been for some time independent and powerful; and it is not improbable that in Obad. 1-8 we have the first mention of that advance of the Arabs upon the lands east of Palestine which is referred to also in Ezek. xxv. (comp. MOAB, vol. xvi. p. 535). That the book of Obadiah, short as it is, is a complex document might have been suspected, apart from Jer. xlix., from an apparent change of view between vers. 1-9 and vers. 15 *sq.* In the former verses Esau is destroyed by his allies, and they occupy his territory, but in the latter he perishes with the other heathen in the day of universal retribution, he disappears before the victorious advance of Israel, and the southern Judæans occupy his land.

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[1] As to reform of the excessive multiplication of oaths see Paley, *Moral Philosophy*, book iii. part i. chap. 16; and J. E. Tyler, *Oaths*.

The eschatology of Obadiah contains little that is peculiar. The conceptions of the "rescued ones" (פליטה), of the sanctity of Zion, of the kingship of Jehovah, are the common property of the prophets from the time of Isaiah. The restoration of the old borders of Israel and the conquest of Edom and the Philistines are ideas as old as Amos ix., Isa. xi. 14; but the older prophets more often represent this conquest as a suzerainty of Israel over its neighbours, as in the days of David, while in Obadiah, as in other later books, the intensified antithesis—religious as well as political—between Judah and the surrounding heathen finds its expression in the idea of a consuming judgment on the latter,—the great "day of Jehovah." This view is not, however, original in Obadiah; it is already expressed in Zephaniah. Between Joel and Obadiah there are points of material and verbal agreement, so close as to imply that Joel used the earlier book (Joel iii. 19,—Ob. 10, 14; Joel iii. 3,—Ob. 11; Joel ii. 32, iii. 17,—Ob. 17). Another characteristic common to Obadiah with the latest prophets is that, while he uses the words house of Jacob and house of Joseph, the northern tribes have become to him a mere name; the restoration he thinks of is a restoration of the kingdom of Jerusalem, and even Gilead is to be occupied not by Joseph but by Benjamin.

An indication of the place where Obadiah wrote seems to lie in ver. 20, where he speaks of "the exiles in this חל." The word as pointed has been variously explained to mean "bulwark" or "army"; it may also be read as "sand" or "sea-coast" (Ewald), but, as the text of the verse is not sound and cannot be translated without some correction, it is unsafe to build on this obscure allusion. The prominence given to Edom, and the fact that Chaldæa is not mentioned at all, make it probable that the book was not written in Babylonia. The same verse speaks of exiles in Sepharad. Sepharad is probably Sardis, the Çparda of Darius in the Behistun inscription. Many of the Jews were doubtless sold as slaves by Nebuchadnezzar. Lydia was a great slave-market, and Asia Minor was a chief seat of the Diaspora at an early date (comp. Gutschmidt, *Neue Beiträge*, p. 77), so that this identification does not supply ground for Hitzig's argument that Obadiah was written in the Greek period, when we read of many Jews being transplanted to Asia Minor (Jos., *Ant.*, xii. 3). Schrader, however (*K. G. F.*, 116 *sq.*; *K. A. T.*, 446), thinks of a Shaparda mentioned by Sargon, and lying in south-west Media.

Literature.—The commentaries on the minor prophets (see HOSEA); Jäger, *Ueber das Zeitalter Obadia's*, Tübingen, 1837; Caspari, *Der Pr. Obadia*, 1842; Delitzsch in *Z. f. Luth. Th.*, 1851. A fuller list is given by Reuss, *Gesch. des A.T.* (1881), p. 449. (W. R. S.)

OBAN, a seaport town and parliamentary burgh of the Western Highlands of Scotland, is situated in Argyllshire, 70¾ miles north-west of Callander by rail, and 96 from Glasgow. It lies along a deep and sheltered bay in the Firth of Lorn opposite the island of Kerrera, and its villas are scattered over the hill-slopes behind. The public buildings comprise six churches, a court-house, four banks, a high school, and a large number of hotels. There are no manufactures except the distilling of whisky; but eleven fairs for cattle, sheep, horses, &c., are annually held in the town. A considerable trade is carried on in connexion with the fisheries, particularly in herrings. Oban is an important centre of the Highland tourist traffic. The rental of the burgh increased from £1719 in 1847 to £7160 in 1864, and upwards of £20,000 in 1882; and the population, which was only 1480 in 1831 and 2413 in 1871, reached 3991 in 1881, or, within the extended area, 4330.

A Renfrew trading company erected what was practically the first house in Oban in 1713; a custom-house was built in 1763; in 1786 the hamlet was made a Government fishing-station; in 1791 a plan was drawn up for laying out a large village; and in 1796 the Stevensons started a shipbuilding-yard, which remained in operation for about thirty years. Made a burgh of barony in 1811, Oban became a parliamentary burgh in 1832, and adopted the Lindsay Act in 1862.

OBELISK. See ALEXANDRIA, vol. i. p. 495; ARCHITECTURE, vol. ii. p. 390; and EGYPT, vol. vii. pp. 768, 778. The obelisk known as "Cleopatra's Needle," referred to in vol. i. p. 495 as having been offered to the English Government by Mehemet Ali, but declined, has since been brought to London, and placed on the Thames Embankment in 1878. The other was conveyed to the United States and erected in Central Park, New York, in 1880.

OBERAMMERGAU, a small village in the mountain valley of the Ammer, in Upper Bavaria, lies 2760 feet above the sea, and about 45 miles to the south-west of Munich. In 1880 it contained 1349 inhabitants, who were mainly engaged in making toys and in carving crucifixes, images of saints, and rosaries. Many of the houses are adorned with quaint frescos of Biblical subjects. The interest of Oberammergau to the outer world is derived from the Passion Plays which are performed here by the villagers at intervals of ten years (the last in 1880), and are now attended by many thousands of European and American visitors.

The Oberammergau Passion Play, or dramatic representation of the sufferings of Christ, is not a survival of a mediæval mystery or miracle-play, but took its rise from a vow made by the inhabitants in 1633, with the hope of staying a plague then raging. The original text and arrangements were probably made by the monks of Ettal, a monastery a little higher up the valley; but they were carefully remodelled by the parish priest at the beginning of the present century, when the Oberammergau play obtained exemption from the general suppression of such performances by the Bavarian Government. The music was composed by Rochus Dedler, schoolmaster of the parish in 1814. The performances take place on the Sundays of summer, in a large open-air theatre holding 6000 persons, and each lasts about nine hours, with a short intermission at noon. Each scene from the history of Christ is prefaced by a tableau of typical import from the Old Testament. About 700 actors are required, all belonging to the village. The proceeds of the performances are devoted to the good of the community, after defrayal of the costs and payment of a small remuneration to the actors. The villagers regard the Passion Play as a solemn act of religious worship, and the performances are characterized by the greatest reverence. The principal parts are usually hereditary in certain families, and are assigned with regard to moral character as well as dramatic ability. It is considered a disgrace not to be allowed to take part in the play, and the part of Christ is looked upon as one of the greatest of earthly honours. In the years intervening between the representations the villagers are carefully drilled in dramatic performances by their pastor, and most witnesses agree in rating very highly the results produced by the combined religious fervour and artistic instinct of these Alpine peasants. It is to be feared, however, that the concourse of fashionable visitors who now flock to the performance will gradually have the effect of impairing its genuineness and simplicity.

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[1] In ver. 12 "have assuredly drunken" should be "shall assuredly drink."

Edward Devrient (in 1850) was among the first to direct general attention to Oberammergau; and numerous German monographs have since appeared on the same subject. A short notice of the play is also given by Hase, *Das Geistliche Schauspiel* (Engl. tr. by A. W. Jackson, 1880). English accounts of the performances have been given by Blackburn (new ed., 1880), MacColl (reprinted from the *Times*, 1880), Molloy (1880), Oxenham (1880), and others. An English version of the text of the Passion Play has been published by E. Childe (1880). Articles on the subject have also appeared in the following magazines:—*Century*, 1888; *Blackwood's*, vol. cvii.; *Contemporary*, vol. xviii.; *Macmillan's*, vol. ii.; *Harper's*, vols. xlii. and xliii.; *Once a Week*, vol. xxiii.

OBERHAUSEN, a Prussian town of recent origin, in the province of the Rhine, is situated 5 miles from the east bank of that river and 20 miles to the north of Düsseldorf. Its importance is due to the fact of its being one of the busiest railway junctions in Germany, and to the extensive coal-pits in the vicinity. The town also possesses iron-works, rolling-mills, zinc smelting-works, railway workshops, and manufactures of wire-rope, glass, porcelain, and soap. The annual export of coals is estimated at about 700,000 tons. The first houses of Oberhausen were built in 1845, and it received its municipal charter in 1875. In 1880 it contained 16,680 inhabitants, of whom 12,079 were Roman Catholics.

OBERLIN, a village of the United States, in Russia township, Lorain county, Ohio, 35 miles west-south-west of Cleveland by the Lake Shore and Michigan Railway, has a population of 3242 (1880), and is well known as the seat of Oberlin College. This institution for liberal education, open to all irrespective of sex or colour, was founded in 1833 by the Rev. John J. Shipherd and Philo P. Stewart, and named in honour of J. F. Oberlin; by the year 1835 it comprised a theological seminary, a college proper, a ladies' department, and a preparatory school; and since then a conservatory of music has been added. In 1883 nine distinct buildings were occupied by the various sections; the total number of teachers was 73, and of pupils 1474 (698 male, 776 female, 78 coloured), and the library contained 20,000 volumes.

OBERLIN, Jean-Frédéric (1740-1826), pastor and philanthropist, was the son of a teacher, and was born 31st August 1740 at Strasburg, where he studied theology. In 1766 he became Protestant pastor of Waldbach, a remote and poverty-stricken region in the Steinthal (Ban de la Roche) in Alsace. At once he set himself to better the material equally with the spiritual condition of the inhabitants. He began by constructing roads through the valley and erecting bridges, inciting the peasantry to the enterprise by himself taking a mattock and commencing operations. His example proved equally effectual in introducing an improved system of agriculture, with the result that the sterile Waldbach soon "began to blossom as the rose." Substantial cottages were erected, various industrial arts were introduced, and activity and comfort began to prevail in homes formerly tenanted by listless and ignoble poverty. Regarding the intellectual needs of his parishioners Oberlin was also keenly solicitous. He founded an itinerant library, originated infant schools—the first that have existed—and established an ordinary school at each of the five villages in the parish. In the work of education he received great assistance from Louise Scheppler, who lived in his house in the capacity of servant and housekeeper. By his unselfish devotion to their interests Oberlin won so entirely the confidence of his parishioners that he was consulted in the most minute domestic affairs, and his word became the recognized unwritten law of the district. He died 1st June 1826, and was interred with great manifestations of honour and affection at the village of Fouday. Since his death the Steinthal has suffered no interruption to its prosperity. When he began his labours its inhabitants did not number more than 500; in the beginning of the century they had increased to about 3000; and now they are supposed to number about 6000.

Among the numerous narratives of the labours of Oberlin mention may be made of Sims, *Brief Memorials of Oberlin*, London, 1830; *Memoirs of Oberlin, with a short notice of Louisa Scheppler*, London, 1838, 2d ed. 1852; H. Ware, *Biography of Oberlin*, Boston, 1845; Spach, *Oberlin le pasteur*, Strasburg, 1865, 2d ed. 1868; Riff, *Drei Bilder aus dem Leben von Papa Oberlin*, Strasburg, 1880; and Butler, *Life of J. F. Oberlin*, 1882. The collected writings of Oberlin were published by Burkhardt at Stuttgart in 1843, in 4 vols.

OBERLIN, Jérémie Jaques (1735-1806), archæologist, brother of Jean Frédéric Oberlin noticed above, was born at Strasburg 8th August 1735. While studying theology at the university he devoted special attention to Biblical archæology. In 1755 he was chosen professor at the gymnasium of his native town, in 1763 librarian to the university, in 1770 professor of rhetoric, and in 1782 of logic and metaphysics. Oberlin published several manuals on archæology and ancient geography, and made frequent excursions into different provinces of France to investigate antiquarian remains and study provincial dialects, the result appearing in *Essai sur le patois Lorrain*, 1775; *Dissertations sur les Minnesingers*, 1782-89; and *Observations concernant le patois et les mœurs des gens de la campagne*, 1791. He also published several editions of Latin authors. He died 10th October 1806.

OBERON (Auberon, Alberon), king of the fairies, husband of Titania, first appears in literature as protector of the hero in *Huon de Bordeaux*, a chanson de geste, dating from about the 12th century (see France, vol. ix. p. 638). The name corresponds to the German Alberich or Elferich (elf-king). The fairy element in the legend of Huon has been treated in modern times by Wieland in the poem, and by Weber in the opera, of *Oberon*; and the story of the elf-king's quarrel with Titania, as every one knows, supplies an important *motif* in Shakespeare's *Midsummer Night's Dream*.

OBESITY. See Corpulence, vol. vi. p. 435.

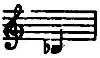
OBI. See Siberia.

OBLIGATION, in law, is a term derived from the Roman law, in which *obligatio* signified a tie of law (*vinculum juris*) whereby one person is bound to perform or forbear some act for another. The *obligatio* of Roman law arose either from voluntary acts or from circumstances to which legal consequences were annexed. In the former case it was said to arise *ex contractu*, from contract, in the latter *quasi ex contractu*, *ex delicto*, or *quasi ex delicto*,—that is to say, from tort, or from acts or omissions to which the law practically attached the same results as it did to contract or tort. *Obligatio* was used to denote either end of the legal chain that bound the parties, the right of the party who could compel fulfilment of the *obligatio*, the *creditor*, or the duty of the party who could be compelled to fulfilment, the *debitor*. In English law obligation has only the latter sense. Creditor and debtor have also lost their Roman law signification; they have been narrowed to mean the parties where the obligation is the payment of a sum of money. In English law obligation is used in at least four senses—(1) any duty imposed by law; (2) the special duty created by a *vinculum juris*; (3) not the duty, but the evidence of the duty,—that is to say, an instrument under seal, otherwise called a bond; (4) the operative part of a bond. The third use of the word is chiefly confined to the older writers. *Simplex* and *duplex obligatio* were the old names for what are now more commonly called a single and a double or conditional bond. The party bound is still called the obligor, the party in whose favour the bond is made the obligee. The fourth like the third, is a use scarcely found except in the older writers. The word "bond" is of course a mere translation of *obligatio*. Obligations may be either perfect or imperfect. A perfect obligation is one which is directly enforceable by legal proceedings; an imperfect or moral obligation (the *naturalis obligatio* of Roman law) is one in which the *vinculum juris* is in some respects incomplete, so that it cannot be directly enforced, though it is not entirely destitute of legal effect. A perfect obligation may become imperfect by lapse of time or other means, and, conversely, an imperfect obligation may under certain circumstances become perfect. Thus a debt may be barred by the Statute of Limitations and so cease to be enforceable. The obligation, however, remains, though imperfect, for if there be a subsequent acknowledgment by the debtor, the debt revives, and the imperfect obligation becomes again perfect. At one period there was some doubt among English lawyers whether a moral obligation could be regarded as sufficient consideration for a contract; it has now, however, been long decided that it cannot be so regarded.

The Scotch law as to obligations closely follows the Roman. As in English law, the term obligation is used to express the instrument itself by which the obligation is imposed. The bond or unilateral obligation of Scotch law is a simple contract to pay the sum borrowed, &c., with interest. The English bond is generally a contract to pay double the sum of the debt, with a condition that the bond is to be void if the debt be paid by a certain day. In Scotch law gratuitous obligations rank in competition with the claims of creditors; in English law a voluntary bond, though effectual against the grantor, cannot be set up against creditors. Bonds in Scotland which are heritable securities still rank as immovables for certain purposes, though they have been made movables as regards the succession of the creditor, unless executors are expressly excluded (31 and 32 Vict. c. 101, s. 117).

American law is in general agreement with English, except in the case of Louisiana, where the terms obligor and obligee are used in as wide a sense as the *debitor* and *creditor* of Roman law. By art. 3522 of the Louisiana civil code obligor or debtor means the person who has engaged to perform some obligation, obligee or creditor the person in favour of whom some obligation is contracted, whether such obligation be to pay money or to do or not to do something. The term obligation is important in America from its use in art. i. s. 10 of the constitution of the United States, "No State shall pass any law . . . impairing the obligation of contracts." This does not affect the power of Congress to pass such a law. Contracts between private individuals are of course within the provision. So are private conveyances, charters of private corporations, and statutory and other grants by a State. On the other hand, marriage and divorce, and arrangements which are political in their nature, such as charters of municipal corporations, licences to carry on particular trades, or regulations of police, are not within the provision. In order to fall within it, the law must act upon the terms of the agreement, and not merely upon the mode of procedure. If it act not upon the terms but upon the remedy, it impairs the obligation if it purport to be retrospective, but it is valid so far as it applies to subsequent contracts.

OBOE, or HAUTBOY. The oboe is an instrument containing a conical column of air, which is set in vibration by means of a double-tongued reed. A series of holes pierced in the side of the pipe permits the instrumentalist to progressively shorten the column by the successive opening of the lateral holes, and thus produce a series of fundamental sounds, the scale of which, in the primitive instruments without keys, does not exceed the extent of an octave. All wind instruments with a conical column of air, whatever may be the mode by which that is set in motion, are subject to the laws of vibration of open pipes, according to which, by a stronger pressure in blowing, the oboe reproduces each of its fundamental sounds in the octave higher, and thus acquires a scale of two octaves, which, partially chromatic in the old instruments, has become completely chromatic by the adoption of keys. This extension of compass is further augmented in modern instruments, in the grave sounds by keys permitting lengthenings of the primitive column of air, and in the acute by the employment of other partial sounds than the first of the harmonic series. In the present day the mean chromatic extent of the oboe is comprised between the notes



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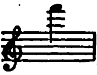

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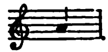
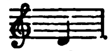
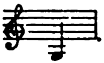
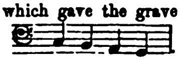
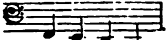
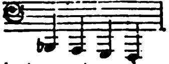
The double reed is the most simple, as it is probably the oldest, of all reed contrivances. It is sufficient to flatten the end of a wheat straw to constitute an apparatus capable of setting in vibration by the breath the column of air contained in the rudimentary tube; the invention of this reed is certainly due to chance. An apparatus for sonorous disturbance thus found, it was easy to improve it: for the wheat stalk a reed stalk was substituted, and in the extremity of its pipe another reed stalk much shorter in length was inserted, pared and flattened at the end; and then came the lateral holes, probably another discovery of the great inventor chance. For the reed tube a wooden one was substituted, still preserving the reed tongue, and it is in this form, after having played an important part amongst the sonorous contrivances of antiquity, that we find the ancestor of the oboe playing a part no less important in the 16th century, in which it formed the interesting families of the cormornes, the corthols, and the cervelas. All these families have disappeared in the instrumental combinations of Europe, but they are still to be found in Eastern wind instruments, such as the Caucasian *salamouri*, the Chinese *kwantze*, and the *hitshiriki* of Japan. It is important to remark that the column of air in a cylindrical pipe, disturbed by any reed, submits to the laws of vibration of stopped pipes; accordingly, to produce a sound of a given pitch, the pipe must be theoretically half as short as an open pipe would be to obtain a note of the same pitch. Moreover, open pipes under an increasing pressure of blowing, produce, in subdividing the air column, the harmonics according to the arithmetical progression 2, 3, 4, 5, &c., while the stopped pipes can only produce the odd harmonics in the series. In other words, the conical pipe reproduces its fundamental sounds in the interval of the octave, the cylindrical in that of the twelfth. A double reed associated with a cylindrical pipe can only be used for columns of air of small diameter. Practice has demonstrated that the reed stalk of which the tongue reed is made should not be of narrower internal diameter than the pipe containing the column of air it is to act upon. By the flattening necessary to form the tongues of a double reed, it must be tolerably large, from which it happens that its proper sound is relatively grave, and will only agree with instruments not above the region of the male voice. It must be remembered that the reproduction of fundamental sounds in the twelfth is only possible by an artifice of modern invention. But it is evident that chance has again intervened to show that a very small double reed can set in vibration columns of air of considerable diameter, provided that the column becomes gradually narrower towards its superior extremity where it receives the reed, so as to terminate in a diameter equivalent to that of the reed itself. It is impossible to say when it was that man first employed the phenomena of double reeds and conical pipes, but the knowledge of them must at least have been later than that of the cylindrical pipe, which we may regard as directly furnished by nature. That antiquity made use of them, however, has been proved by M. Gevaert in his admirable *Histoire de la musique dans l'antiquité*; but this learned author shows that the double-reed pipes held but an insignificant place in the instrumental music of ancient Greece and Rome.

The instrument we call oboe appears for the first time in Sebastian Virdung's *Musica getutscht und ausgezogen* (1511). It there bears the name of *schalmey*, and is already combined with an instrument of similar construction called *bombardt*. This beginning of the oboe family suggests the possibility of Virdung's schalmey having existed in the Middle Ages. Where, when, and how it was introduced into western Europe is at present unknown, but the *zamr-al-kebir* still used in Moslem countries is practically identical with it, a circumstance which suggests the possibility of its having been brought into Europe by the crusaders.

The manufacture of musical instruments could not remain unaffected by the great artistic movement known as the Renaissance; accordingly, we find them not only improved and purified in form in the 16th century, but also ranged in complete families from the soprano to the bass. Praetorius, in his *Syntagma Musicum* (1615-20), gives us the full nomenclature of the family with which we are concerned, composed of the following individuals.

(1) The little schalmey, he says, rarely employed: it measured about 17 inches in length, and had six lateral holes. Its deepest note was . (2) The discant schalmey (fig. 1), the primitive type of the modern oboe; its length was about 26 inches, and its deepest note . (3) The alto pommer (fig. 2), 30½ inches long, with its deepest note . (4) The tenor pommer (fig. 3), measuring about 4 feet 4 inches; besides the six lateral holes of the preceding numbers there were four keys which gave the grave notes . (5) The bass pommer, having a length of nearly 6 feet, and six lateral holes and four keys which gave . (6) The great double quint pommer, measuring about 9 feet 8 inches in length; the four keys permitted the production of the notes . These instruments, and especially numbers (2), (3), (4), and (5), occupied an important place on the Continent in the instrumental combinations of the last three centuries. The following illustration (fig. 4), borrowed from a picture,[1] painted in 1610 by Van Alsloot, represents six musicians playing the following instruments indicated in the order of their position in the picture: a bass oboe, bent over and become the bassoon, an alto pommer, a cornet (German "zinke"), a discant schalmey, a second alto pommer, and a trombone.[2]

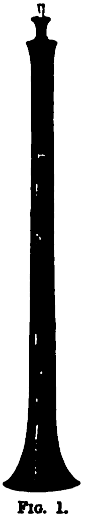


FIG. 1. The discant Schalmey.

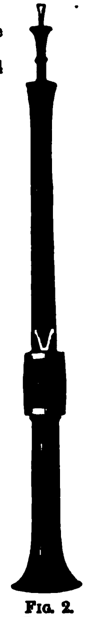


FIG. 2. The alto Pommer.

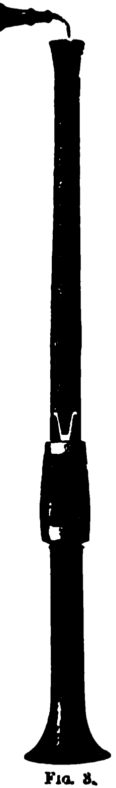


FIG. 3. The tenor Pommer.

The 17th century brought no great changes in the construction of the four smaller instruments of the family. Of much extended use in France, they were there called "haulx bois," or "haultbois," to distinguish them from the two larger instruments which were designated by the words "gros bois." Haultbois became hautbois in French, and oboe in English, German, and Italian; and this word is now used to distinguish the present smaller instrument of the family.

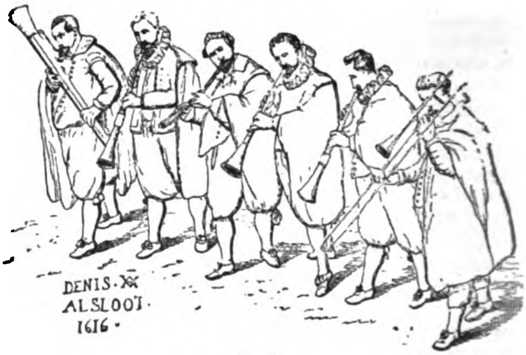
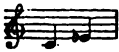
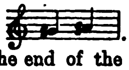
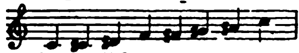


FIG. 4.

The little schalmey and tenor pommer seem to have disappeared in the 17th century; it is the discant schalmey and the alto pommer which by improvement have become two important elements in modern instrumentation. The oboe, as such, was employed for the first time in 1671, in the orchestra of the Paris opera in *Pomone* by Cambert. The first two keys, , date from the end of the 17th century. In 1727 Gerhard Hoffmann of Rastenberg added the keys . A Parisian maker, Delusse, furnished, at the end of the 18th century, much appreciated improvements in the boring of the instrument. The *Méthode* of Sellner, published at Vienna in 1825, allows nine keys, , and one which, when opened, established a loop or ventral segment of vibration in the column of air, facilitating the production of sounds in the octave higher. Triebert of Paris owes his great reputation to the numerous improvements he introduced in the construction of the oboe.

The alto pommer became but slowly transformed: it was called in French "hautbois de chasse," in Italian "oboe di caccia." In the 18th century we find it more elegant in form, but with all the defects of the primitive instrument. The idea of bending the instrument into a half circular form to facilitate the handling is attributed to an oboist of Bergamo, one Jean Perlendis, who was established at Strasburg about 1760. The fact of the instrument's resembling a kind of hunting-horn used at that time in England probably gained for it the name of "corno inglese," which it still retains ("cor anglais" in French). The first employment of it in the orchestra is referred to Gluck, who had two "cors anglais" in his *Alceste*, as played at Vienna in 1767. But it was not until 1808 that the cor anglais was first heard in the Paris opera; it was played by the oboist Vogt in *Alexandre chez Apelle* by Catel. The improvements in manufacture of this instrument closely followed those introduced in the oboe. The 18th century produced an intermediate oboe between (2) and (3), which was called "hautbois d'amour," and was frequently employed by J. S. Bach. It was a third lower than the ordinary oboe, and fell into disuse after the death of the great German composer. It has been resuscitated by the firm of C.

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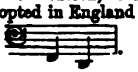
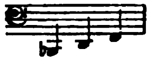
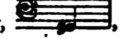
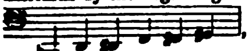
[1] This picture, belonging to the National Museum of Madrid, represents a procession of all the religious orders in the city of Antwerp on the festival of the Virgin of the Rosary.

[2] For further details see Mahillon's catalogue of the *Musée du Conservatoire royal de musique de Bruxelles.*

Mahillon of Brussels, and reconstructed with the improvements of modern manufacture.

After the 16th century we find the instruments which were designated by the name of "gros bois," the (5) and (6) of Prætorius, transformed into shorter instruments, the fagott and contrafagott; so called because the column of air, the same as in the pommer, was formed of two conical tubes which communicated with the lower part of the instrument, and were pierced in a single piece of wood. It is probably owing to the aspect of this double pipe that the satirical name of fagot was given, preserved in Italian as fagotto, and in German as fagott. A canon of Ferrara named Afranio has been cited as the author of the transformation, about 1539, of the bass pommer, but Count Valdrighi, the curator of the Estense library,[1] and Wasielewski,[2] who has reproduced the drawing of Afranio's invention, deprive him of the merit of the innovation. The fagottino is transformed in the same fashion.

Sigismund Scheitzer of Nuremberg acquired a great reputation in the 16th century for making the "basson," a French word substituted for the old fagot, and adopted in England as bassoon. His instrument had only two keys, . We cannot tell when the bassoon gained its present form, but it was probably at the end of the 17th century. It was made in exactly the same style as the fagottino represented in fig. 5. It appeared for the first time in the orchestra with the oboe in *Pomone* (1671). It had three keys then,  The B♭ key rendering a lengthening of the instrument necessary, we may suppose it took its modern form at that epoch. The fourth key, , dates from 1751. The bassoon appears with four keys in the *Encyclopédie* of Diderot and D'Alembert (Paris, 1751-65). The number of keys increased by the beginning of the present century to eight, viz., , and two keys to facilitate the production of acute harmonics. It has since been improved by Almenräder in Germany, Savari, and more recently Triebert and Goumas, Paris, and C. Mahillon, Brussels.

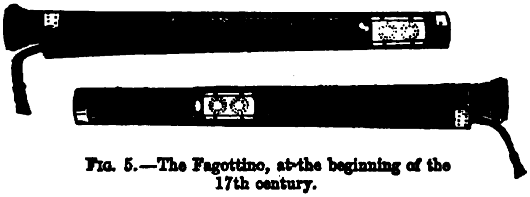
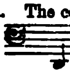
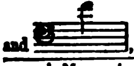


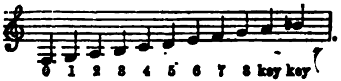
FIG. 5.—The Fagottino, at the beginning of the 17th century.

The reform in the construction of the flute due to Theobald Boehm of Munich about 1840, a reform which principally consisted in the rational division of the tube by the position of the lateral holes, prompted Triebert to try to adapt the innovation to the oboes and bassoons; but he failed, because the application of it denaturalized the timbre of the instruments, which it was necessary, before all things, to preserve. But his efforts did not remain sterile. In 1856 a French bandmaster, M. Sarrus, thought out the construction of a family of brass instruments with conical tubes pierced at regular distances, which, diminishing the length of the air column, has rendered a series of fundamental sounds easy,—more equal and free in timbre than that of the oboe family. Gautrot of Paris realized the inventor's idea, and, under the name of "sarrusophones," has created a complete family, from the sopranino in E♭ to the contrabass in B♭, of which his firm preserves the monopoly.

In 1868 the firm of C. Mahillon, Brussels, produced a reed contrabass of metal, destined to replace the old contrabassoon of wood, since much used in orchestras and military bands. The first idea of this instrument goes back to 1839, and is attributed to Schöllnast and Son of Pressburg. It is a conical brass tube of very large proportions, with lateral holes placed as theory demands, in geometrical relation, with a diameter almost equal to the section of the tube at the point where the hole is cut. From this it results that for each sound one key only is required, and the seventeen keys give the player almost the facility of a keyboard. The compass written for this contrabass is comprised between  and , but sounds an octave lower.

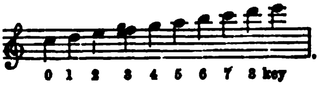
We now turn to another kind of reed and its association with two kinds of cylindrical and conical pipes,—the beating reed, which is formed of a single tongue, and engenders vibrations in the column of air to which it is applied by the contact of the tongue with the frame of a groove to which it is adapted. The beating reed, though not having the extreme antiquity of the double reed, was used at a very early period, for we find it applied to the chalumeaus of ancient Egypt, still in use under the name of *arghoul*, to the Greek *auloi*, and the Roman *tibiæ*.[3] The beating reed is a piece of reed growth, closed at the upper end by the natural knot, beneath which a tongue is partly detached by a longitudinal slit. We do not see the probable operation of chance so clearly here as in the double reed. It may have been the inconvenience resulting from the employment of double-tongued reeds of large dimensions to make cylindrical pipes of a certain diameter speak that urged the invention of a more commodious substitute. With double *auloi* it would have been almost impossible to blow two double reeds at one time, while, on the contrary, it is easy to sound two pipes furnished with beating reeds introduced simultaneously into the player's mouth. Such as these are the actual Egyptian *arghoul* and *summárah*. It is in the beating reed and cylindrical tube, a combination bequeathed to us by remote antiquity, that we find the principle of one of the leading instruments of the modern orchestra, the clarinet or clarionet.

The European chalumeau of the Middle Ages, in English "shawm," differed but little from the ancient Egyptian chalumeau: its tube was of wood, and the upper part of the tube communicated with the bore by an opening made laterally and longitudinally, on the edges of which the reed-tongue was bound by repeated turns of string. Neither in the Middle Ages nor in the 16th century do we find the chalumeau much employed. Prætorius, who in his *Theatrum instrumentorum* has given exact drawings of the instruments he knew, does not cite the chalumeau. But there exists in the fine collection of the Liceo Musicale at Bologna a double chalumeau of wood covered with leather, the make of which takes it back to the 16th century. Drawings of this instrument occur in the *Encyclopédie* of Diderot and D'Alembert, and in the *Muzykaal Kunstwoordenboek* of J. Verschure-Reynvaan (Amsterdam, 1795). The chalumeau was pierced with eight holes and with two keys, and produced the following series of fundamental sounds—



The present writer has had the good fortune to find quite recently two examples in the National Museum at Munich, and has been kindly authorized by Herr von Hefner-Alteneck, director of the museum, to reproduce them for the museum of the conservatoire at Brussels. For one of these see fig. 6. It is from this reproduction that he has been enabled to determine the exact nature of the improvement of the chalumeau, about 1690, by Christopher Denner of Nuremberg, an improvement which has gained for him the reputation of having invented the clarinet. Every clarinet player knows that it is sufficient for one of the upper keys not to quite close the hole for it to produce, instead of the fundamental sound, the interval of the twelfth above it,—in other words, the second partial. This phenomenon is easily explained: the communication between the external air and the upper part of the air-column in the instrument forms a ventral segment or loop of vibration and forces the column to divide, and, as a cylindrical pipe affected by a reed sounds harmonically after the manner of stopped pipes, the possible partial after the fundamental is naturally the second. This phenomenon must have struck Denner, and have suggested to him the idea of obtaining the same result according to a regular manner and at the will of the executant. He arrived at it by raising a little the key governed by the thumb of the left hand, which when opened conjointly with the A key produced the B♭ of the chalumeau. This change of position of the key did not hinder the production of the B♭, but doubled at one stroke the extent of compass of the instrument in giving it the following notes—

FIG. 6.—The Chalumeau.



This was Denner's invention; he did not invent the clarinet, but he was the first to make use of the artifice already referred to which permits instruments of cylindrical bore to produce fundamental sounds and their twelfths.

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[1] Musurgiana, *Il phagotus d'Afranio.*

[2] *Geschichte der Instrumentalmusik im 16en Jahrhundert.*

[3] F. A. Gevaert, *Histoire de la musique dans l'antiquité.*

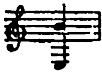
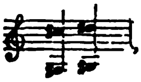
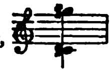
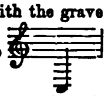
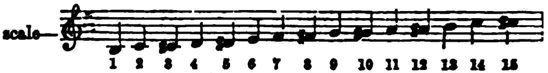
About the middle of last century the clarinet was lengthened and a key was added, , which filled the vacant space between the two registers. Two new keys were also added, , it is said, by Barthold Fritz of Brunswick (*ob.* 1766). The sixth key, , is attributed to the clarinetist Lefebvre, Paris, about 1791. In 1810 Ivan Müller carried the number of keys up to thirteen, in which state the instrument has come to us, and is the system most employed. It has been improved by the Belgian makers, Bachmann, the elder Sax, C. Mahillon, and Albert, who have collectively established the reputation of Belgian clarinets. In Paris, Lefebvre, Buffet-Crampon, and his successor Goumas—in London, Rudall, Rose, and Carte, justly own a high position among famous clarinet-makers. The firm of C. Mahillon, Brussels, have invented the mechanism with double effect known by the name of C♯ key. Invented in 1862, it is now universally adopted. In 1842 the Parisian maker Buffet, advised by a professor named Klosé, adopted from Boehm's flute the invention of movable rings. His clarinet has consequently been ranked as of Boehm's system, although the lateral division of the tube does not follow that which that clever maker applied to his flute. The clarinet was first employed in a theatre in 1751, in the pastoral by Rameau entitled *Acante et Céphise*. The imperfections of the instrument at that time obliged them to be made in nearly every key. To avoid the burden of this the 18th-century players varied the key of their instruments by added joints. About the middle of the 18th century the clarinet was introduced in military music and by degrees supplanted the oboe. The instruments used at first were in C and F. About 1815 they were replaced by the B♭ and E♭ clarinets.

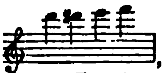
FIG. 7.—The Clarinet.

Besides the high clarinets, the basset horn (Italian, corno di bassetto) was soon known in Germany; a clarinet in F with the grave fifth of the one in C, it was made to descend easily to  with the help of supplementary keys, and to diminish the length of the tube it was bent back upon itself in the part nearest to the bell,—the curve being enclosed in a kind of box which concealed the artifice. The invention of the basset horn is attributed to a Bavarian maker at Passau, who was living about 1770, but whose name is now unknown. Obtaining the improvements given to it by Theodore Lotz of Pressburg in 1782, and Ivan Muller in 1812, and those of contemporary makers, the basset horn has become the beautiful alto clarinet which is generally used in the key of E♭.

It would appear that the first idea of the bass clarinet emanated from Henri Greuser of Dresden, who made the first one in 1793. It was not used in the orchestra until 1836, when Meyerbeer made magnificent employment of it in the *Huguenots*.

The almost forgotten clarinet d'amour was made in G and F, the fourth and fifth below the clarinet in C. It differed from other clarinets in the bell, which, retracted in the lower part, affected the pear-shaped contour that distinguishes the modern cor anglais.

A few words remain to be said about the combination of the beating reed with a conical tube, which goes no farther back than the beginning of this century. A fagottino in F, called "dolcino," was at that time used, the air-column of which was more decidedly conical than that of the fagottino properly so called. The double reed was replaced in it by a beating reed attached to a mouthpiece like that of the clarinet but smaller. This instrument seems not to have had success. But the most important combination of beating reed and conical tube was accomplished in 1846 by Adolphe Sax, a Belgian established in Paris, who invented the family of saxophones. This instrument is a brass tube pierced to produce the following scale—

In virtue of the principle previously explained, the saxophone "octaves," and, setting out from the fourth fundamental, each note can be reproduced in the next upper octave by the help of two keys successively employed, which, by opening, form a loop. Four more keys disposed at the upper end permit the production of , which completes the compass of the saxophone. Four instruments of the saxophone family are now used, viz., the soprano in B♭, a major second below the note written; the alto in E♭, a fifth below the soprano; the tenor in B♭, an octave below the soprano; and the baritone in E♭, an octave below the alto. These instruments fill an important place in the military music of France and Belgium. The brilliant success which Ambroise Thomas has achieved by using the beautiful tone of the alto saxophone in the ghost scene in *Hamlet* is well known. (V. M.)

O'BRIEN, WILLIAM SMITH (1803-1864), the head of the "Young Ireland" party, was born on 17th October 1803, and received his education at Harrow and at Cambridge. He entered parliament in 1826 as member for Ennis, and from 1835 to 1848 represented the county of Limerick. Although he spoke in 1828 in favour of Catholic emancipation, he for many years continued to differ on other points from the general policy of O'Connell. He, however, opposed the Irish Arms Act of 1843, and in January 1844 became an active member of the Repeal Association. Though he was destitute of oratorical gifts, his chivalrous devotion to the welfare of his country secured him enthusiastic attachment as a popular leader. In July 1846 he with the "Young Ireland" party left the Repeal Association, and in the beginning of 1847 he established the Irish Confederation. The French Revolution of 1848 stimulated his hopes of success, and incited him to more extreme efforts against the English rule. In May 1848 he was tried at Dublin for sedition, but the jury disagreed. In the following July he established a war directory, and attempted to make a rising among the peasantry of Ballingarry, but although he was at first joined by a large following the movement wanted cohesion, and the vacillating crowd dispersed as soon as news reached them of the approach of the dragoons. O'Brien was arrested at Thurles, tried, and sentenced to death. The sentence was commuted to transportation for life. In July 1854 he received his liberty on condition of never revisiting the United Kingdom; and in May 1856 he obtained a full pardon. Henceforth he kept aloof from all political movements. In 1856 he published *Principles of Government, or Meditations in Exile*. He died at Bangor, North Wales, 18th June 1864.

OBSERVATORY

Up to a comparatively recent date an "observatory" was a place exclusively devoted to the taking of astronomical observations, although frequently a rough account of the weather was kept. When the progress of terrestrial magnetism and meteorology began to make regular observations necessary, the duty of taking these was often thrown on astronomical observatories, although in some cases separate institutions were created for the purpose. Of late years, as the work to be done in astronomical observatories is increasing, there seems to be a general tendency to have the magnetical and meteorological observations taken in separate establishments; but, as the exclusively magnetical or meteorological observatories now existing are generally very small institutions and of recent creation, the astronomical observatories will be chiefly considered in this article.

Up to about 300 B.C. it can scarcely be said that an observatory existed anywhere, as the crude observations of the heavens then taken were only made by individuals and at intervals, employing the simplest possible apparatuses. But, when philosophical speculation had exhausted its resources, and an accumulation of facts was found to be necessary before the knowledge of the construction of the universe could advance farther, the first observatory was founded at Alexandria, and continued in activity for about four hundred years, or until the middle or end of the 2d century of the Christian era. It was here that Hipparchus, the founder of modern astronomy, by repeating observations made by his predecessors, discovered the precession of the equinoxes, and investigated with considerable success the motions of the sun, moon, and planets. His work was continued by more or less distinguished astronomers, until Ptolemy (in the 2d century A.D.) gave the astronomy of Alexandria its final development. When science again began to be cultivated after the dark ages which followed, we find several observatories founded by Arabian princes; first one at Baghdad (and possibly one at Damascus), built by the caliph Al-Mamún early in the 9th century, then one on the Moḳattam near Cairo, built for Ibn Yúnis by the caliph Ḥákim (about 1000 A.D.), where the Hákimite tables of the sun, moon, and planets were constructed. The Mongol khans followed the example; thus arose the splendid observatory at Merágha in the north-west of Persia, founded about 1260 A.D. by Hulagu Khan, where Náṣir al-dín Ṭúsí constructed the Ilohkhanic tables; and in the 15th century the observatory at Samarkand was founded by Ulug Begh, and served not only in the construction of new planetary tables but also in the formation of a new catalogue of stars.

With the commencement of scientific studies in Europe in the 15th century the necessity of astronomical observations became at once felt, as they afforded the only hope of improving the theory of the motions of the celestial bodies. Although astronomy was taught in all universities, the taking of observations was for two hundred years left to private individuals. The first observatory in Europe was erected at Nuremberg in 1472 by a wealthy citizen, Bernhard Walther, who for some years enjoyed the co-operation of the celebrated astronomer Regiomontanus. At this observatory, where the work was continued till the founder's death in 1504, many new methods of observing were invented, so that the revival of practical astronomy may be dated from its foundation. The two celebrated observatories of the 16th century, Tycho Brahe's on the Danish island of Hven (in activity from 1576 to 1597) and that of Landgrave William IV. at Cassel (1561-97), made a complete revolution in the art of observing. While the credit of having vastly improved the astronomical instruments perhaps should be divided equally between Tycho Brahe and the landgrave's astronomer Bürgi, the former may claim the honour of having been the first to see the necessity of carrying on for a number of years an extensive and carefully-planned series of observations with various instruments, worked by himself and a staff of assistants. In this respect his observatory (Uraniburgum) resembles our modern larger institutions more closely than do many observatories of much more recent date. The mighty impulse which Tycho Brahe gave to practical astronomy at last installed this science at the universities, among which those of Leyden and Copenhagen were the first to found observatories. We still find a large private observatory in the middle of the 17th century, that of Johannes Hevelius at Dantzic, but the foundation of the royal observatories at Paris and Greenwich and of numerous university observatories shows how rapidly the importance of observations had become recognized by governments and public bodies, and it is not until within the last hundred years that the development of various new branches of astronomy has enabled private observers to compete with public institutions.

The instruments employed in observatories have of course changed considerably during the last two hundred years. When the first royal observatories were founded, the principal instruments were the mural quadrant for measuring meridian zenith distances of stars, and the sextant for measuring distances of stars *inter se*, with a view of determining their difference of right ascension by a simple calculation. These instruments were introduced by Tycho Brahe, but were subsequently much improved by the addition of telescopes and micrometers. When the law of gravitation was discovered it became necessary to test the correctness of the theoretical conclusions drawn from it as to the motions within the solar system, and this necessarily added to the importance of observations. By degrees, as theory progressed, it made greater demands for the accuracy of observations, and accordingly the instruments had to be improved. The transit instrument superseded the sextant and offered the advantage of furnishing the difference of right ascension directly; the clocks and chronometers were greatly improved; and lastly astronomers began early in the 19th century to treat their instruments, not as faultless apparatuses but as imperfect ones, whose errors of construction had to be detected, studied, and taken into account before the results of observations could be used to test the theory. This century has also witnessed the combination of the transit instrument and the mural quadrant or circle in one instrument,—the transit or meridian circle.

While the necessity of following the sun, moon, and planets as regularly as possible increased the daily work of observatories, other branches of astronomy were opened and demanded other observations. Hitherto observations of the "fixed stars" had been supposed to be of little importance beyond fixing points of comparison for observations of the movable bodies. But when many of the fixed stars were found to be endowed with "proper motion," it became necessary to include them among the objects of constant attention, and in their turn the hitherto totally neglected telescopic stars had to be observed with precision, when they were required as comparison stars for comets or minor planets. Thus the field of work for meridian instruments became very considerably enlarged.

In addition to this, the increase of optical power of telescopes revealed hitherto unknown objects—double stars and nebulæ—and brought the study of the physical constitution of the heavenly bodies within the range of observatory work. Researches connected with these matters were, however, for a number of years chiefly left to amateur observers, and it is only within the last fifty years that many public observatories have taken up this kind of work. The application of spectrum analysis, photography, photometry, &c., in astronomy has still more increased the number and variety of observations to be made, so that it has now become necessary for most observatories to devote themselves to one or two special fields of work.

It would be difficult to arrange the existing observatories into classes either according to the work pursued in them or their organization, as the work in many cases at different times has been directed to different objects, while the organization depends mostly on national and local circumstances. As already alluded to above, one of the principal characteristics of the larger observatories of the present day is the distribution of the work among a number of assistants under the general superintendence of a director. This applies principally to the great observatories, where the sun, moon, planets, and a limited number of fixed stars are without interruption being observed, but even among these institutions hardly two are conducted on the same principles. Thus in Greenwich the instruments and observations are all treated according to strict rules laid down by the astronomer-royal, while in Washington or Pulkowa each astronomer has to a certain extent his choice as to the treatment of the instrument and arrangement of the observations. The same is the case with the smaller institutions, in most of which these arrangements vary very much with change of personnel.

The way in which the results of observations are published depends principally on the size of the institutions. The larger observatories issue their "Annals" or "Observations" as separate periodically-published volumes, while the smaller ones chiefly depend on scientific journals to lay their results before the public, naturally less fully as to details. Among these journals the principal are:—*Berliner Astronomisches Jahrbuch* (for the years 1776 to 1829), *Monatliche Correspondenz* (edited by Von Zach, 28 vols., 1800-13), *Astronomische Nachrichten* (founded 1821; 107 vols. in 4to, still appearing with two vols. per annum), *Memoirs of the Royal Astronomical Society* (47 vols. 4to, from 1822), and *Monthly Notices of the Royal Astronomical Society* (44 vols. 8vo, from 1827).

Subjoined is a catalogue of public and private observatories now in activity or which have existed within the last hundred years.

GREAT BRITAIN AND IRELAND.

A. Public Observatories.

Greenwich, royal observatory, lat. + 51° 28′ 38″·4. Founded in 1675 for the promotion of astronomy and navigation. The observations have therefore from the first been principally intended to determine the positions of standard stars, the sun and planets, and above all to follow the motion of the moon with as little interruption as possible, both on and outside the meridian. Since 1873 spectroscopic observations and a daily photographic record of sun-spots have been taken. The observatory is under the direction of the astronomer-royal; and from the time of its first astronomer, Flamsteed, the institution has always maintained its place in the foremost rank of observatories. Thus the observations of Bradley (*ob.* 1762) form the foundation of modern stellar astronomy; but it was especially during the directorship of Airy (1835-81) that the observatory rose to its present high state of efficiency. There are now a chief assistant, eight assistants, and a staff of computers employed. The principal instruments now in use are:—A meridian circle by Simms (and Ransomes and May as engineers), erected in 1850, having a circle of 6-feet diameter and a telescope of 8-inches aperture; a large chronograph (1854); an altazimuth by Simms and Ransomes and May, for observations of the moon, erected in 1847, with 3-feet circles and 4-inch telescope; an equatorial refractor by the same makers (O.G. 12·8 inches, by Merz), mounted in the "English" manner with long polar axis, chiefly used for spectroscopic work; photoheliograph by Dallmeyer of 4-inches aperture, smaller equatorials, clocks, &c. The standard "motor clock" is the centre of a system of electrically-controlled clocks scattered over many provincial towns in the three kingdoms. The magnetical and meteorological department was founded in 1838; it contains a complete set of instruments giving continuous photographic records of magnetic declination, horizontal and vertical force, barometric pressure, dry and wet bulb thermometers, &c. The *Observations* are published with all details from 1750, beginning with 1836 in annual bulky 4to volumes; special results—*e.g.*, five *Star Catalogues*, *Reductions of Lunar and Planetary Observations*—are published in separate volumes.

Oxford, Radcliffe Observatory, lat. + 51° 45′ 36″·0, long. 0^h 5^m 2^s·6 W. Founded in 1771 by the Radcliffe trustees at the instance of Professor Hornsby. Observations were regularly made, but none were published until Manuel J. Johnson was appointed Radcliffe observer in 1839, when systematic observations were commenced with an 8-feet transit instrument by Bird (1778) and a 6-feet mural circle by Jones (1836). Johnson was succeeded in 1830 by Rev. R. Main, who died in 1878, and was followed in 1879 by E. J. Stone. Heliometer (7½ inch) by Repsold (1849); meridian circle by Troughton and Simms, mounted in 1861, formerly belonging to Mr Carrington; self-recording meteorological instruments. The staff now consists of three assistants. Besides the annual 8vo volumes of *Observations* (from 1840), two catalogues of respectively 6317 and 2386 stars, chiefly circumpolar (1860 and 1870) have been published.

Oxford, university observatory, lat. + 51° 45′ 34″·2, long. 0^h 5^m 0^s·4 W. Finished in 1875; is under the Savilian professor of astronomy; there are two assistants. 12¼-inch equatorial refractor by Grubb, and a 13-inch reflector made and presented by Mr De La Rue. The former is used for micrometer work (chiefly on clusters of stars) and photometric observations; the latter for taking lunar photographs, by means of which the director, Professor Pritchard, has investigated the libration of the moon. No. 1 of *Astronomical Observations* (8vo) was published in 1878.

Cambridge, lat. + 52° 12′ 51″·6, long. 0^h 0^m 22^s·8 E. Founded by the university senate in 1820. Directors: G. B. Airy, 1828 to 1835; J. Challis, to 1861; J. C. Adams. Chiefly devoted to meridian work,—up to 1870 with a 5-inch transit by Dollond and a mural circle by Jones; a new meridian circle by Simms, of 8-inches aperture and 3-feet circles, was then erected, and is being used for determining the places of all the stars down to 9·0 mag. between + 25° and + 30° decl. The "Northumberland equatorial" was mounted in the "English" fashion in 1838; the object-glass by Cauchoix is of 11½-inches aperture and 19-feet focal length. The *Observations* from 1828 to 1865 are published in 21 4to volumes.

Durham, lat. + 54° 46′ 6″·2, long. 0^h 6^m 19^s·8 W. Founded in 1841, principally by private subscription; is under the direction of the professor of mathematics and astronomy in the university. There is a small meridian circle by Simms, and an equatorial refractor by Fraunhofer of 6½-inches aperture, with which minor planets, comets, and double stars have been observed. The results from the years 1846-52 have been published in 2 8vo volumes.

Liverpool (Bidston near Birkenhead), lat. + 53° 24′ 4″, long. 0^h 12^m 17^s·2 W. Founded in 1838 by the municipal council; transferred in 1856 to the Docks and Harbour Board; moved to Birkenhead in 1867. Specially intended for testing the rates of chronometers under different temperatures. Transit instrument by Troughton and Simms, and an 8-inch equatorial by Merz.

Kew (Richmond), lat. + 51° 28′ 6″, long. 0^h 1^m 15^s·1 W. The central meteorological observatory of the United Kingdom, with self-registering meteorological and magnetical instruments. Established in 1842 under the auspices of the British Association, afterwards transferred to the Royal Society. A photoheliograph was employed at Mr De La Rue's expense to take daily sun-pictures from 1863 to 1872.

Edinburgh, royal observatory, lat. + 55° 57′ 23″·2, long. 0^h 12^m 43^s·0 W. Founded in 1811 by subscription; the building on the Calton Hill erected in 1818. In 1834 the founders handed over the administration to the Government, and in 1846 the ownership was similarly transferred. Since 1834 the observatory has been under the direction of the astronomer-royal for Scotland, who is also professor of practical astronomy in the university; there are two assistants. Professor T. Henderson (1833 to 1845) commenced extensive meridian observations of fixed stars, since continued by his successor, C. Piazzi Smyth. The mural circle of 6-feet diameter and 8-feet transit are now out of date. A reflector of 2-feet aperture by Grubb (silver on glass) was erected in 1872, but has never been quite finished nor come into use. Observations with deep-soil thermometers have been carried on since 1837, and delicate spectroscopic investigations made by the present astronomer, partly abroad. Observations and results have been published in 14 4to volumes.

Glasgow, lat. + 55° 52′ 42″·8, long. 0^h 17^m 10^s·6 W. Organized in 1840 by subscription, aided by subsidies from the university and the state; is under the professor of astronomy. Meridian circle by Ertel with 42-inch circles, and telescope of 6-inches aperture; equatorial of 9-inches aperture. A catalogue of 6415 stars from meridian observations made since 1860 was published in 1883 by the present director, R. Grant. The observatory was (1868-83) one of the seven first-class meteorological stations.

Dublin, situated about 4 miles north-west of Dublin at Dunsink, lat. + 53° 23′ 13″·0, long. 0^h 25^m 21^s W. Belongs to the university; erected in 1785; is under the direction of the "Andrews professor of astronomy and royal astronomer of Ireland." There is one assistant. In 1808 a reversible meridian circle by Ramsden and Berge of 8-feet diameter was put up, with which Brinkley observed assiduously till 1827, though of his results those relating to stellar parallax were affected by certain instrumental errors which rendered them of no value. Sir W. R. Hamilton (1827-65) devoted himself exclusively to mathematics. In 1868 was erected an equatorial refractor, object-glass of 11¾-inches aperture by Cauchoix (formerly belonging to and given by Sir J. South), which has been used by Brünnow and his successor R. S. Ball (since 1874) for researches on stellar parallax. A meridian circle by Pistor and Martins of 6·4-inches aperture was mounted in 1873 and a large chronograph in 1882; they are used for observing stars possessing special interest (red stars, stars with proper motion, &c.). *Astronomical Observations and Researches made at Dunsink*, parts 1-5, 4to, 1870-84.

Armagh, lat. + 54° 21′ 12″·7, long. 0^h 26^m 35^s·5 W. Founded and endowed by Archbishop Robinson in 1791. Possessed very few instruments until the observatory was enlarged by Archbishop Lord John Beresford in 1827, when a mural circle and a transit by Jones were provided, with which T. R. Robinson (director from 1823 to 1882) observed the stars contained in the catalogue of 5345 stars published in 1859. With the mural circle, to which had been added a 7-inch telescope by T. Grubb (in 1862), about 3000 stars have been observed since 1864, and these are now (1884) ready for press. There is also a 15-inch reflector. Armagh was (1868-83) one of the seven first-class meteorological observatories.

Cork, observatory of Queen's College, lat. + 51° 53′ 30″, long. $0^h 33^m 58^s$ W. Erected in 1878 at the expense of Mr Crawford of Cork; 8-inch refractor, 4-inch siderostat and transit circle, by Grubb. Managed by the professor of natural philosophy.

B. Private Observatories now existing.

Mr J. G. Barclay's observatory, Leyton, Essex, lat. + 51° 34′ 34″, long. $0^h 0^m 0^s{\cdot}9$ W. In activity since 1862; 10-inch refractor by Cooke; chiefly devoted to double stars; small transit circle. Four parts of *Observations* have been published (4to, 1863-77).

Mr A. A. Common's observatory, Ealing, London, W. Silvered-glass reflector of 36-inches aperture (mirror by Calver, mounting by the owner), erected in 1879; chiefly used for celestial photography. Also 18-inch silvered-glass reflector erected in 1876.

Colonel Cooper's observatory, Markree Castle, Sligo, Ireland, lat. 54° 10′ 31″·8, long. $0^h 33^m 48^s{\cdot}4$ W. Founded by the late E. J. Cooper, who in 1834 erected an equatorial refractor of 13·3-inches aperture (glass by Cauchoix). In addition to numerous other observations this instrument was from 1848 to 1856 used for determining the approximate places of 60,000 stars near the ecliptic (*Markree Catalogue*, 4 vols. 8vo, 1852-56). The observatory was restored in 1874, and the refractor has since been used for double-star observations. There is also a transit circle by Ertel.

Earl of Crawford's observatory, Dun Echt, Aberdeenshire, lat. + 57° 9′ 36″, long. $0^h 9^m 40^s$ W. Founded in 1872; is one of the best-equipped observatories existing; has 15-inch equatorial refractor by Grubb, large chronograph (driven by same clock as the refractor), 12-inch silvered reflector by Browning, two 6-inch and several smaller refractors, meridian circle by Simms similar to the one at Cambridge, numerous spectroscopes and minor instruments, also a large library, and a collection of physical instruments. Cometary and spectroscopic observations and reduction of the observations made by the Venus expedition to Mauritius in 1874 have hitherto principally occupied the staff. Three 4to volumes of *Publications* and very frequent *Dun Echt Circulars*, distributing news of discoveries (chiefly relating to comets), have been issued.

Mr E. Crossley's observatory, Bermerside, Halifax, Yorkshire. Equatorial refractor by Cooke of 9·3-inches aperture, erected in 1871, chiefly used for observations of double stars.

Dr W. Huggins's observatory, Upper Tulse Hill, London, lat. + 51° 26′ 47″, long. $0^h 0^m 27^s{\cdot}7$ W. Founded in 1856; furnished with an 8-inch refractor (glass by Clark, mounting by Cooke). In 1870 was erected an equatorial mounting which could carry either a 15-inch refractor or a Cassegrain reflector of 18-inches aperture, both made by Grubb for the Royal Society; mounting improved in 1882 to carry both instruments simultaneously. With these Dr Huggins has made his well-known spectroscopic observations and photographs of stellar spectra, the solar corona, &c., the results being published from time to time in the *Philosophical Transactions*.

Mr G. Knott's observatory, Cuckfield, Sussex (from 1860 to 1873 at Woodcroft, lat. + 51° 0′ 41″, long. $0^h 0^m 34^s$ W., since then at Knowles Lodge, Cuckfield). 7·3-inch refractor by Clark, used for observing double stars and variable stars.

Mr R. S. Newall's observatory, Gateshead, Newcastle-on-Tyne. A refractor of 25-inches aperture by Cooke was mounted in 1870, but appears to have been little used.

Earl of Rosse's observatory, Birr Castle, King's county, Ireland, lat. + 53° 5′ 47″, long. $0^h 31^m 40^s{\cdot}9$ W. In 1839 the late earl made and mounted a reflector of 3-feet aperture (remounted as equatorial in 1876), and in 1845 he completed the celebrated reflector of 6-feet aperture and 54-feet focal length. These instruments, particularly the latter, were used from 1848 to 1878 for observations of nebulæ, and revealed many new features in these bodies; results published in the *Phil. Trans.* for 1844, 1850, 1861, 1868, and collected systematically in the *Trans. Roy. Dubl. Soc.*, 1879-80. Experiments were made by the present earl to determine the amount of heat radiated from the moon (*Phil. Trans.*, 1873).

Rugby School (Temple Observatory). Founded in 1872 in memory of the bishop of Exeter; with 8¼-inch equatorial refractor by Clark, used for observations of double stars and of stellar spectra.

Stonyhurst College observatory, Lancashire, lat. + 53° 50′ 40″, long. $0^h 9^m 52^s{\cdot}7$ W. An 8-inch equatorial refractor by Troughton and Simms, mounted in 1867, used for spectroscopic and micrometric observations; a complete set of self-recording magnetic instruments. From 1868 to 1883 the observatory was one of the seven first-class meteorological stations.

Colonel Tomline's observatory, at Orwell Park, Ipswich, lat. + 52° 0′ 33″, long. $0^h 4^m 55^s{\cdot}8$ E. Founded in 1874; has a 10-inch refractor by Merz, used for observations of comets.

Owing to the limited space at our disposal we are obliged to pass over several smaller private observatories.

C. Private Observatories now discontinued.

Mr Bishop's observatory, South Villa, Regent's Park, London, lat. + 51° 31′ 29″·9, long. $0^h 0^m 37^s{\cdot}1$ W. In activity from 1836 to 1861, then removed to Twickenham, and discontinued in 1874; has a 7-inch refractor by Dollond, with which Mr Hind discovered ten minor planets and several comets, and constructed maps of stars near the ecliptic.

Mr R. C. Carrington's observatory, Redhill, lat. + 51° 14′ 25″·3, long. $0^h 0^m 41^s{\cdot}3$ W. Established in 1854; has a 4½-inch refractor, and transit circle of 5-inch aperture (now at Radcliffe Observatory). With the latter a catalogue of the positions of 3735 stars within 9° of the pole, with the former regular observations of sun-spots, were made from 1853 to 1861.

Rev. W. R. Dawes's observatory, first at Ormskirk (1830-39), lat. + 53° 34′ 18″, long. $0^h 11^m 36^s$ W.; afterwards at Cranbrook, Kent (1844-50), lat. + 51° 6′ 31″, long. $0^h 2^m 10^s{\cdot}8$ E.; then at Wateringbury, near Maidstone, lat. + 51° 15′ 12″, long. $0^h 1^m 39^s{\cdot}8$ E., till 1857; and finally at Hopefield, Haddenham, lat. + 51° 45′ 54″, long. $0^h 3^m 43^s{\cdot}4$ W., till Mr Dawes's death in 1868. Possessed at first only small instruments, then successively a 6-inch refractor by Merz, a 7⅓-inch and an 8¼-inch refractor by Clark, and an 8-inch refractor by Cooke, with all of which a great many measures of double stars were made, which were published in the *Memoirs* of the Royal Astronomical Society.

Mr De La Rue's observatory, Cranford, Middlesex, lat. + 51° 28′ 57″·8, long. $0^h 1^m 37^s{\cdot}5$ W. Established in 1857; with 13-inch reflector, devoted to solar and lunar photography. The Kew photoheliograph was employed here from 1858 to 1863 to take daily photographs of the sun. The reflector was presented to the Oxford observatory in 1874.

Mr Isaac Fletcher's observatory, Tarnbank, Cumberland, lat. + 54° 39′ 13″·7, long. $0^h 13^m 44^s{\cdot}5$ W. Established in 1847; in 1859 a 9½-inch refractor by Cooke was mounted and used for observing double stars.

Mr Groombridge's observatory, Blackheath, lat. + 51° 28′ 2″·7, long. $0^h 0^m 0^s{\cdot}6$ E. In 1806 Mr Groombridge obtained a new transit circle of 4-feet diameter by Troughton, with which he up to 1816 observed stars within 50° of the pole. The resulting catalogue of 4243 stars was published in 1838.

Sir William and Sir John Herschel's observatory at Slough near Windsor, lat. + 51° 30′ 20″, long. $0^h 2^m 24^s$ W. William Herschel settled at Datchet in 1782, and at Slough in 1786, and erected several 20-feet reflectors (of 18-inches aperture), and in 1789 his 40-feet reflector of 4-feet aperture. The latter was comparatively little used (two satellites of Saturn were discovered with it), while the former served to discover about 2500 nebulæ and clusters, 800 double stars, and two satellites of Uranus, as also to make the innumerable other observations which have made the name of Herschel so celebrated. Sir J. Herschel used a 20-feet reflector at Slough from 1825 to 1833, and from 1834 to 1838 at the Cape of Good Hope, to examine the nebulæ and double stars of the whole of the visible heavens, discovering 2100 new nebulæ and 5500 new double stars.

Rev. T. J. Hussey's observatory, Hayes, Kent, lat. + 51° 22′ 38″, long. $0^h 0^m 3^s{\cdot}6$ E. In activity from about 1825 for about twelve years; 6½-inch refractor by Fraunhofer, used for making one of the star maps published by the Berlin Academy, also small transit circle by Simms.

Mr Lassell's observatory, from about 1820 to 1861 at Starfield near Liverpool, lat. + 53° 25′ 28″, long. $0^h 11^m$ 38″·7 W.; contained reflectors of 9 and 24 inches aperture; employed for observations of the satellites of Saturn, Uranus, and Neptune, and of nebulæ. The 2-feet reflector was used at Malta in 1852-53, and a 4-feet reflector was mounted in 1861, also at Malta, and used till 1864 for observations of satellites and nebulæ. The eighth satellite of Saturn, the two inner satellites of Uranus, and the satellite of Neptune were discovered at Starfield by Mr Lassell.

Dr Lee's observatory Hartwell, Bucks, lat. + 51° 48′ 36″, long. $0^h 3^m 24^s{\cdot}3$ W. In 1836 Dr Lee came into possession of Captain Smyth's 6-inch refractor, and mounted it at Hartwell House, where it continued to be occasionally employed for double-star observations and other work up to about 1864.

Captain Smyth's observatory, Bedford, lat. + 52° 8′ 27″·6, long. $0^h 1^m 52^s{\cdot}0$ W. In 1830 Captain (afterwards Admiral) Smyth erected a 6-inch refractor by Tulley, and observed the double stars and nebulæ contained in his "Bedford Catalogue" (1844), forming vol. ii. of his *Cycle of Celestial Objects*.

Sir James South's observatory, from 1816 to 1824 at Blackman Street, Southwark, long. $0^h 0^m 21^s{\cdot}8$ W. Here South took transit observations of the sun, and he and J. Herschel measured double stars, in 1821-23. In 1826 South erected an observatory at Campden Hill, Kensington, lat. + 51° 30′ 12″, long. $0^h 0^m 46^s{\cdot}8$ W., and procured a 12-inch object-glass from Cauchoix. As Troughton, however, failed to make a satisfactory mounting, the glass was never used until after it had been presented to Dublin university in 1862.

Lord Wrottesley's observatory, from 1829 to 1841 at Blackheath, lat. + 51° 28′ 2″, long. 0^{h} 0^{m} 2^{s}·7 E., where a catalogue of the right ascensions of 1318 stars was formed from observations with a transit instrument by Jones. In 1842 a new observatory was built at Wrottesley Hall, lat. + 52° 37′ 2″·3, long. 0^{h} 8^{m} 53^{s}·6 W., where the transit and a 7¼-inch refractor by Dollond were mounted. Observations were here made of double stars, and for testing J. Herschel's method of finding the annual parallax of stars.

FRANCE.

Paris, national observatory, lat. + 48° 50′ 11″·8, long. 0^{h} 9^{m} 20^{s}·9 E. Founded in 1667, when the construction of a large and monumental building was commenced by the architect Perrault. J. D. Cassini's observations made the institution for some time the most celebrated observatory existing, but later the activity declined, although several eminent men, as Bouvard and Arago, have held the post of director. Since 1854, when Leverrier assumed the directorship, the observations have been conducted with more regularity, and, together with a number of most important theoretical works, published in the *Annals* (35 volumes of *Observations*, 16 of *Memoirs*). The observations are now chiefly taken in order to redetermine the positions of Lalande's 50,000 stars. The principal instruments now in use are:—a meridian circle by Secretan and Eichens, with an object-glass of 9·5-inches aperture and 12-feet focal length, another by Eichens (given by M. Bischoffsheim) of 7·5-inches aperture and 7-feet focal length, a 15-inch equatorial refractor by Lerebours and Brünner, a 12-inch equatorial refractor by Secretan and Eichens, two refractors of 9·5-inches aperture, &c. A refractor of 29-inches aperture by Martin is being mounted. A silvered glass reflector of 4-feet aperture was mounted in 1875, but has never been used. The meteorological bureau was after Leverrier's death (1877) separated from the observatory.

In addition to this national observatory there were during the latter half of last century several minor observatories in Paris, which only lasted for some years. Among these were the observatory at *Collége Mazarin*, lat. + 48° 51′ 29″, where Lacaille observed from 1746 to 1750, and from 1754 to 1762, and the observatory at the *École Militaire*, lat. + 48° 51′ 5″, built in 1768 and furnished with an 8-feet mural quadrant by Bird, with which D'Agelet observed telescopic stars (1782-85), and which was afterwards (1789-1801), under Lalande's direction, employed for observing more than 50,000 stars, published in the *Histoire Céleste* (1801).

Meudon, close to Paris. Founded in 1875; devoted to physical astronomy, and especially to celestial photography, under the direction of J. Janssen.

Montsouris, situated in the Montsouris Park, south of Paris, lat. + 48° 49′ 18″, long. 0^{h} 9^{m} 20^{s}·7 E. Founded in 1875 for the training of naval officers.

Lyons, old observatory in lat. 45° 45′ 46″, long. 0^{h} 19^{m} 18^{s} E., at the Jesuit college. A new observatory was erected in 1877 at St Génis-Laval, at some distance from the city. Transit circle by Eichens (2-feet circles, 6-inch O.G.), 6-inch refractor by Brünner.

Marseilles, lat. 43° 18′ 19″·1, long. 0^{h} 21^{m} 34^{s}·8 E. Originally belonging to the Jesuits, taken over by the ministry of the navy in 1749. It was here that Pons made his numerous discoveries of comets. A new building was erected in 1869; 9½-inch equatorial refractor, reflector of 32-inches aperture and 16-feet focal length. The present director, Stephan, has discovered and micrometrically measured several hundred very faint nebulæ.

Toulouse, lat. 43° 36′ 47″·0, long. 0^{h} 5^{m} 51^{s}·0 E. Erected in 1840 (Darquier had observed at the Lyceum towards the end of last century); restored a few years ago, when an equatorial refractor by Brünner was procured.

Nice, founded and endowed by M. Bischoffsheim for the Bureau de Longitude (1880), situated at Mont Gros, north-east of Nice. Is being furnished with first-class instruments, among which are a refractor of 30-inches aperture by Henry Brothers (mounting by Eichens), a meridian circle by Brunner of 8-inches aperture, and large spectroscopes, &c.

GERMANY.

Altona, lat. + 53° 32′ 45″·3, long. 0^{h} 39^{m} 46^{s}·1 E. Founded in 1823 by the Danish Government to assist in the geodetic operations in Holstein. A meridian circle by Reichenbach (of 4-inches aperture and 3-feet circle) and several theodolites were procured, to which, in 1858, was added a 4½-inch equatorial by Repsold. The observatory is best known by the fact that the *Astronomische Nachrichten*, the principal astronomical journal, was published here from 1821 (by Schumacher up to 1850, by Peters from 1854). The observatory was moved to Kiel in 1872.

Berlin, royal observatory, lat. + 52° 30′ 16″·7, long. 0^{h} 53^{m} 34^{s}·9 E. Was erected in 1705 as part of the building of the Academy of Sciences (lat. + 52° 31′ 12″·5, long. 0^{h} 53^{m} 35^{s} E.), a very unsuitable locality. After the death of Bode in 1826, who had founded the *Astronomisches Jahrbuch* (from 1776), a new observatory was built in the southern part of the city under the direction of Encke, finished in 1835. With the observatory is now connected a computing office, where the *Jahrbuch* is edited. The instruments now in use are:—an equatorial refractor by Utzschneider and Fraunhofer, of 9-inches aperture and 14-feet focal length (with which Neptune was found in 1846 in the place indicated by Leverrier; used at present for observations of minor planets), a meridian circle by Pistor and Martins of 4-inches aperture (lately used by Auwers to observe stars between + 15° and + 25° decl.), another by the same makers of 7-inches aperture, now used to observe stars between + 25° and + 30° decl.

Bonn, university observatory, lat. + 50° 43′ 45″·0, long. 0^{h} 28^{m} 23^{s}·3 E. Finished in 1845 (a temporary observatory had been used by Argelander from 1841 to observe stars from + 45° to + 80° decl.); meridian circle by Pistor of 4½-inches aperture, heliometer by Merz of 6-inches aperture. The former was used by Argelander for observing stars between – 15° and – 31° decl., and afterwards for determining 33,000 places of stars in the northern heavens. The observatory is chiefly known by the zone observations, made from 1852 to 1859 with a small comet-seeker, on which Argelander's great atlas of 324,198 stars between the North Pole and – 2° decl. is founded; many other investigations on proper motions, variable stars, &c., were also made by Argelander. The zone work is now being continued with a 6-inch refractor from – 2° to – 31° decl. by the present director, Schönfeld, who had already, with Krüger, assisted Argelander in the northern zones. With the meridian circle stars between + 40° and + 50° decl. are now being observed. A new meridian circle of 6-inches aperture by Repsold has recently been mounted. Seven 4to volumes of *Observations* have been published.

Bothkamp, Herr von Bülow's observatory, lat. 54° 12′ 9″·6, long. 0^{h} 40^{m} 30^{s}·8 E. Situated a few miles from Kiel, founded in 1870, the principal instrument being an equatorial refractor of 11-inches aperture by Schröder, with spectroscopic and photographic appliances, with which Dr Vogel obtained valuable results from 1871-74, published in three 4to parts of *Beobachtungen*. The observations have only quite recently been recommenced.

Bremen. In the third story of his house in Sandstrasse, Olbers (died 1840) had his observatory, lat. 53° 4′ 38″, long. 0^{h} 35^{m} 10^{s} E.; though the principal instrument was only a 3¾-inch refractor by Dollond, many comets and the planets Pallas and Vesta were discovered and observed here.

Breslau, lat. + 51° 6′ 56″·1, long. 1^{h} 8^{m} 9^{s}·1 E. In a small and unsuitable locality, where a few small instruments are placed.

Dresden, Baron von Engelhardt's observatory, lat. + 51° 2′ 16″·8, long. 0^{h} 54^{m} 54^{s}·8 E. A 12-inch equatorial refractor by Grubb (mounted 1880), used for observations of comets and double stars.

Düsseldorf (Bilk, originally a suburb, now part of the city), lat. + 51° 12′ 25″, long. 0^{h} 27^{m} 5^{s}·5 E. Founded and endowed by Professor Benzenberg (died 1846); best known by the discovery of twenty-one minor planets by R. Luther; the principal instrument is a 4½-inch refractor.

Gotha. In 1791 an observatory was founded by Duke Ernest II. at Seeberg, lat. + 50° 56′ 5″·2, long. 0^{h} 42^{m} 55^{s}·8 E., on a hill a few miles from Gotha, the chief instrument being a large transit instrument by Ramsden. Through the labours, principally theoretical, of the successive directors, Zach, Lindenau, Encke, and Hansen, the institution ranked with the first observatories, but the distance from Gotha and the decay of the buildings made it necessary to build a new observatory at Gotha in 1857, lat. + 50° 56′ 37″·5, long. 0^{h} 42^{m} 50^{s}·5 E. This observatory received the instruments from Seeberg, including a small transit circle by Ertel (made in 1824), also a new equatorial by Repsold of 4½-inches aperture.

Göttingen, university observatory, lat. + 51° 31′ 47″·9, long. 0^{h} 39^{m} 46^{s}·5 E. An observatory had existed here during the 18th century, where Tobias Mayer worked. In 1811 a new building was constructed. Besides his mathematical works, Gauss found time to engage in important geodetic and magnetic observations. In 1867-69 a catalogue of stars between the equator and – 2° decl. was made by Copeland and Börgen. The principal instruments are a meridian circle by Repsold (4½-inches aperture), another by Reichenbach (4½-inches), several refractors from 3 to 5 inches aperture, &c.

Hamburg, lat. + 53° 33′ 7″·0, long. 0^{h} 39^{m} 53^{s}·7 E. Built in the year 1825. With a meridian circle of 4-inches aperture by Repsold, C. Rümker observed the places of 12.000 stars. An equatorial refractor of 10-inches aperture was mounted in 1868, used for observations of star-clusters, comets, and minor planets.

Kiel, royal observatory, lat. + 54° 20′ 29″·7, long. 0^{h} 40^{m} 35^{s}·8 E. Contains the instruments removed from Altona in 1872, also an 8-inch refractor by Steinheil. The office of the *Astronomische Nachrichten* has been here since 1872.

Königsberg, university observatory, lat. + 54° 42′ 50″·6, long. 1^{h} 21^{m} 58^{s}·9 E. Built 1813; Bessel was the director till his death in 1846, and nearly all his celebrated investigations were carried out here, *e.g.*, observations of fundamental stars, zone observations of stars from 15° to + 45° decl., researches on refraction, heliometric observations, by which the annual parallax of the star 61

Cygni was first determined, &c., published in the first 21 volumes of the *Beobachtungen auf der k. Sternwarte zu Königsberg*. The instruments are a meridian circle by Reichenbach and Ertel, of 4-inches aperture (mounted 1819), another of the same dimensions by Repsold (1841), a 6-inch heliometer by Utzschneider (1829), &c.

Leipsic, university observatory lat. + 51° 20′ 20″·5, long. 0^h 49^m 30^s·2 E. Erected 1787-90 on the "Pleissenburg"; possessed only small instruments, the largest being a 4½-inch refractor by Fraunhofer (1830) with which from 1848 D'Arrest observed minor planets, comets, and nebulæ. In 1861 a new observatory was erected under the direction of Bruhns, lat. + 51° 20′ 6″·3, long. 0^h 49^m 34^s·0 E., with a refractor of 8½-inches aperture by Steinheil and a meridian circle by Pistor and Martins of 6·3-inches aperture mounted. The former is used for observing double stars, nebulæ, and comets, the latter for observing stars between + 5° and + 15° decl. In 1881 Dr Engelmann mounted an 8-inch equatorial refractor by Clark and Repsold in a small private observatory close to the university observatory.

Lilienthal, near Bremen, lat. + 53° 8′ 25″, long. 0^h 36^m 1^s E. J. H. Schröter's private observatory; from 1779 to 1813. Contained a number of reflectors by Herschel and Schrader, the largest being of 27-feet focal length and 20-inches aperture (movable round the eye-piece), used for physical observations, chiefly of planets. Destroyed during the war in 1813; the instruments (which had been bought by the Government in 1800) were, for the greater part, sent to the Göttingen observatory.

Mannheim, lat. + 49° 29′ 10″·9, long. 0^h 33^m 50^s·5 E. Built in 1772; except C. Mayer's observations of distant companions to bright stars, very few observations were published until the observatory was restored in 1860, when a 6-inch refractor by Steinheil was procured, with which Schönfeld determined the positions of 500 nebulæ. In 1879 the observatory was moved to Karlsruhe.

Munich, at Bogenhausen, royal observatory, lat. + 48° 8′ 45″·5, long. 0^h 46^m 26^s·1 E. Founded in 1809; a meridian circle by Reichenbach was mounted in 1824, an 11-inch equatorial refractor by Fraunhofer in 1835. The former was used from 1840 for zone observations (about 80,000) of telescopic stars, the resulting 34,000 places of which were published in six catalogues; the latter was for some years used by Lamont for observing satellites and nebulæ. Afterwards Lamont chiefly devoted his attention to terrestrial magnetism.

Potsdam, lat. + 52° 22′ 56″, long. 0^h 52^m 17^s E. "Astrophysical observatory," founded in 1874, devoted to spectroscopic, photographic, and other physical observations. An equatorial refractor by Schröder of 11½-inches aperture, another by Grubb of 8-inches aperture, spectroscopes, photometers, &c. Results are published in 4to volumes.

Spires, observatory of the lyceum, lat. + 49° 18′ 56″, long. 0^h 33^m 45^s·5 E., established in 1827. With a meridian circle by Ertel, Schwerd observed in 1827-29 the positions of circumpolar stars. Discontinued many years ago.

Strasburg, university observatory, lat. + 48° 34′ 59″·7, long. 0^h 31^m 4^s·7 E. Finished in 1881 (observations made in a temporary observatory from 1872); an 18-inch equatorial refractor by Merz; altazimuth of 5½-inches aperture, meridian circle of 6½-inches aperture, and a 6½-inch orbit sweeper, all by Repsold.

Wilhelmshafen (Prussia), naval observatory, lat. + 53° 31′ 52″·2, long. 0^h 32^m 35^s·2 E.; situated on the Jahde to the north of Oldenburg. Founded in 1874; meridian circle by Repsold of 4½-inches aperture, and meteorological, magnetical, and tide-registering instruments.

Austria-Hungary.

Vienna, imperial and royal observatory, lat. + 48° 12′ 35″·5, long. 1^h 5^m 31^s·7 E. On the university building an observatory was founded in 1756. Owing to the unsuitable locality and the want of instruments, very few observations of value were taken until the observatory was rebuilt in 1826, when some better instruments were procured, especially a meridian circle of 4-inches aperture, and a 6-inch refractor by Fraunhofer (mounted in 1832), used for observations of planets and comets. The *Annalen* commenced to appear in 1821; besides observations made at Vienna, they have contained Piazzi's original observations and Oeltzen's catalogue of stars between + 45° and + 80° decl. from Argelander's observations. From 1874 to 1879 a large and magnificent building (with four domes, the central one being 45 feet in diameter) was erected at Währing, north-west of the city, lat. + 48° 13′ 55″·4, long. 1^h 5^m 21^s·5 E. In addition to the old instruments, two equatorial refractors were erected, one by Clark of 11¾-inches aperture, another by Grubb of 27-inches aperture (mounted 1882).

Vienna (Josephstadt), private observatory of Th. von Oppolzer, lat. + 48° 12′ 53″·8, long. 1^h 5^m 25^s·3 E. Established in 1865; 5-inch refractor by Merz, 4-inch meridian circle.

Prague, university observatory, lat. + 50° 5′ 18″·8, long. 0^h 57^m 41^s·4 E. Founded in 1751 at the Collegium Clementinum, on a high tower. Very few astronomical observations have been taken here; at present only magnetic and meteorological work is attended to, as a 6-inch refractor by Steinheil and a 4-inch meridian circle cannot be mounted for want of a proper locality.

Senftenberg (in the east of Bohemia), lat. + 50° 5′ 55″, long. 1^h 5^m 51^s E. Baron von Senftenberg's observatory; established in 1844. Observations of comets and planets made with small instruments till the owner's death (1858).

Olmütz, lat. + 49° 35′ 40″, long. 1^h 9^m 0^s E. Herr von Unkrechtsberg's observatory; 5-inch refractor by Merz. Julius Schmidt observed planets and comets from 1852 to 1858.

Kremsmünster (Upper Austria), lat. + 48° 3′ 23″·8, long. 0^h 56^m 32^s·2 E. Founded in 1748 at the gymnasium of the Benedictines. 3-inch meridian circle (mounted in 1827), used for observing minor planets; 5½-inch refractor (mounted in 1856), used for comets and minor planets.

Pola (sea-coast, Austria), naval observatory, lat. + 44° 51′ 49″, long. 0^h 55^m 23^s·5 E. Founded in 1871; meridian circle of 6-inches aperture by Simms, 6-inch refractor by Steinheil, magnetic and meteorological instruments. Twenty-eight minor planets were discovered here from 1874 to 1880 by J. Palisa.

Cracow, university observatory, lat. + 50° 3′ 50″·0, long. 1^h 19^m 51^s·1 E. Possesses only small instruments.

Budapest (Ofen), royal observatory. Founded 1777; a new building was erected in 1813, and new instruments (a 6-inch refractor by Fraunhofer and a meridian circle by Reichenbach) provided, with which comets and planets were observed. Nothing has been heard of this observatory for the last fifty years.

O'Gyalla (near Komorn, Hungary), lat. + 47° 52′ 43″·4, long. 1^h 12^m 45^s·6 E. Nicolas de Konkoly's observatory. Established in 1871, rebuilt and enlarged in 1876, devoted to spectroscopy and physical astronomy generally; there is a large workshop attached. A 10-inch silvered glass reflector by Browning was in use up to 1881, when it was disposed of and a 0-inch equatorial refractor (O.G. by Merz) mounted in its place; also a 6-inch refractor by Merz, and many spectroscopes and minor instruments. Results are published in 4to volumes.

Kalocsa (south of Budapest), lat. + 46° 31′, long. 1^h 15^m ± E. Observatory of the Jesuit college, founded in 1878 by Cardinal Haynald; 7-inch refractor by Merz.

Herény (Vas, Hungary), lat. + 47° 16′ 37″, long. 1^h 6^m 24^s·7 E. E. and A. von Gothard's observatory. Founded in 1881; 10-inch reflector by Browning.

Switzerland.

Zurich, lat. + 47° 22′ 40″·0, long. 0^h 34^m 12 6 E. An observatory existed since 1759; handed over to the Polytechnic School in 1855; new building erected in 1863. A 6-inch refractor by Merz and Kern, two transit instruments, &c. Sun-spots are regularly observed, but the institution is chiefly devoted to educational purposes.

Neuchâtel, lat. + 46° 59′ 51″·0, long. 0^h 27^m 50^s·2 E. Erected in 1858; meridian circle of 4½-inches aperture by Ertel.

Geneva, lat. + 46° 11′ 58″·8, long. 0^h 24^m 36^s·8 E. Founded in 1773; a new building erected in 1830. The observatory has been the centre of the important geodetic operations carried on in Switzerland since 1861. A 10-inch refractor (O.G. by Merz) was presented by the director Plantamour in 1880.

Spain and Portugal.

Madrid, royal observatory, lat. + 40° 24′ 29″·7, long. 0^h 14^m 45^s·4 W. Observations are made of comets, sun-spots, &c., with an equatorial by Merz.

Cadiz, naval observatory, at San Fernando, lat. + 36° 27′ 41″·5, long. 0^h 24^m 49^s·6 W. Founded in 1797.

Lisbon, royal observatory, lat. + 38° 42′ 31″·3, long. 0^h 36^m 44^s·7 W. A large refractor was mounted in 1863.

Coimbra, university observatory, lat. + 40° 12′ 25″·8, long. 0^h 33^m 34^s·5 W. Founded 1792. An astronomical ephemeris has been published from 1804.

Italy.

Turin, university observatory, lat. + 45° 4′ 6″, long. 0^h 30^m 48^s·4 E. Founded in 1790 by the Academy of Science; rebuilt in 1820 on a tower of the Palazzo Madama, where a meridian circle by Reichenbach of 4-inches aperture was mounted; handed over to the university in 1865.

Milan, originally observatory of Brera College, now royal observatory of Brera, lat. + 45° 27′ 59″·2, long. 0^h 36^m 46^s·1 E. Founded in 1763. The publication of an annual ephemeris from 1775 to 1875 and important theoretical works absorbed most of the time of the directors Oriani and Carlini, and the instruments were rather insufficient. In 1875 an 8-inch refractor by Merz was mounted, with which Schiaparelli has made valuable observations of Mars. An 18-inch refractor has been ordered from Merz.

Padua, university observatory, lat. + 45° 24′ 2″·5, long. 0^h 47^m 29^s·0 E. Founded in 1761. In 1837 a meridian circle by Starke of 4-inches aperture was mounted, with which stars from Bessel's zones were re-observed; the results were published in five catalogues. A 4½-inch refractor by Merz and Starke (1858) has served to observe comets, spectra of solar prominences, &c.

Gallarate, near Lago Maggiore, from 1860 to 1879, Baron Dembowski's observatory. From 1852 to 1859 Baron Dembowski had observed double stars at Naples with a 5-inch dialyte by Plössl, and a small transit circle by Starke. From 1860 he used a 7-inch refractor by Merz.

Modena, university observatory, lat. + 44° 38′ 52″·8, long. 0^{h} 43^{m} $42^{s}\cdot8$ E. Founded in 1819. There is a meridian circle by Reichenbach, but very little astronomical work has been done.

Bologna, university observatory, lat. + 44° 29′ 47″·0, long. 0^{h} 45^{m} $24^{s}\cdot5$ E. Founded in 1724 on a tower of the university building. Ephemerides were published from 1715 to 1836, but observations have only been made occasionally. A 3½-inch meridian circle was mounted in 1846.

Florence. In 1774 a museum of science and natural history was established, part of which was used as an observatory, lat. + 43° 46′ 4″·1, long. 0^{h} 45^{m} $1^{s}\cdot5$ E. Very few observations were made; only Donati's discoveries of six comets and his early observations of star-spectra deserve to be noticed. A new observatory was finished in 1872 at Arcetri, but is very badly built, so that two fine refractors by Amici of 11- and 9½-inches aperture (the mountings unfinished) can only find limited application.

Rome, observatory of the Roman College, lat. + 41° 53′ 53″·7, long. 0^{h} 49^{m} $54^{s}\cdot7$ E. Established in 1787. Little was done until De Vico became director in 1838, when numerous observations of satellites, comets, &c., were commenced with a 6½-inch refractor by Cauchoix. In 1858 a new observatory was erected on the unfinished piles of the church of St Ignatius, and furnished with a 9-inch refractor by Merz, a meridian circle by Ertel of 3½-inches aperture (in use from 1842), a 3-inch refractor for observing sun-spots, &c. With these instruments, to which were later added powerful spectroscopes, Secchi has made a great many observations, chiefly relating to spectrum analysis and physical astronomy.

Rome, observatory of the Capitol, lat. + 41° 53′ 33″·6. Established in 1848; belongs to the university; small transit circle and a 4½-inch refractor by Merz. The latter is used by Respighi for observations of solar prominences.

Naples, royal observatory, situated at Capo di Monte, lat. + 40° 51′ 45″·4, long. 0^{h} 57^{m} $0^{s}\cdot9$ E. Erected in 1812-19 (an observatory commenced in 1790 at the Royal Museum had been left unfinished); furnished with a number of instruments, among which a 4-inch meridian circle and two repeating circles by Reichenbach, a 6½-inch equatorial by Reichenbach and Fraunhofer, &c. Very little was done until De Gasparis entered the observatory, where he has discovered nine minor planets and made other observations, partly with a 6-inch Merz refractor.

Palermo, royal observatory, lat. + 38° 6′ 44″, long. 0^{h} 53^{m} $25^{s}\cdot0$ E. Erected in 1790 on a tower of the royal palace. The principal instruments were a reversible vertical circle by Ramsden of 5-feet diameter, with a 3-inch telescope, and a transit instrument of 3-inches aperture. With these Piazzi observed the stars contained in his celebrated *Catalogue of* 7641 *Stars* (1814); this work led him to the discovery of the first minor planet, Ceres, on 1st January 1801. The activity was revived in 1857, when a meridian circle by Pistor and Martins of 5-inches aperture was mounted and a 9½-inch refractor ordered from Merz. The latter has been used by Tacchini for spectroscopic work, chiefly on the sun.

Etna. In 1879-80 an observatory was built at the "Casa degl' Inglesi," 9650 feet above the sea. During the summer months a 12-inch object-glass by Merz is to be used here for solar observations, while there is to be a duplicate mounting for it at Catania for use during the winter.

GREECE.

Athens, lat. + 37° 58′ 20″, long. 1^{h} 34^{m} $55^{s}\cdot7$ E. Commenced in 1845; founded by Baron Sina. There is a refractor of 6½-inches aperture, which has been used by Julius Schmidt (died 1884) for observations of the physical appearance of the moon, planets, and comets.

RUSSIA.

St Petersburg, observatory of the Academy of Sciences, lat. + 59° 56′ 29″·7, long. 2^{h} 1^{m} $13^{s}\cdot5$ E. Founded in 1725, restored in 1803; meridian circle by Ertel and other instruments. A small university observatory was founded in 1880.

Pulkowa, Nicholas Central Observatory, lat. + 59° 46′ 18″·7, long. 2^{h} 1^{m} $18^{s}\cdot7$ E. Finished in 1839. Was under the direction of F. G. W. Struve till 1861, since then of his son O. Struve; the staff consists now of the director, four astronomers, four assistants, two computers, and a secretary. The principal instruments are:—a transit instrument by Ertel of 6-inches aperture and 8½-feet focal length; a vertical circle by Ertel of 6-inches aperture and 6½-feet focal length (the circle of 3½-feet diameter has been redivided by Repsold),—these two instruments have been used for determining standard places of stars for the epochs 1845 and 1865; a meridian circle by Repsold (6-inches aperture, 4-feet circles), used since 1841 to observe all stars north of − 15° decl. down to the 6th mag., and all others observed by Bradley; a prime vertical transit by Repsold with 6½-inches aperture, used for determining the constant of aberration; a 7½-inch heliometer by Merz, which has been very little used; an equatorial refractor by Merz of 22-feet focal length and 14·9-inches aperture (remounted by Repsold in 1880), which has been used incessantly by O. Struve since 1841 to observe double stars. A 30-inch refractor is now in process of construction, the object-glass being made by Clark, the mounting by Repsold. In addition to numerous memoirs and papers by the various astronomers, published by the Academy of St Petersburg, the *Pulkowa Observations* are published in large 4to volumes (10 vols. published up to 1883).

Åbo (Finland), university observatory, lat. + 60° 26′ 56″·8, long. 1^{h} 29^{m} $8^{s}\cdot3$ E. Founded in 1819. With the meridian circle by Reichenbach of 4-inches aperture, Argelander observed the 560 stars (chiefly stars with proper motion) contained in the Åbo catalogue. In consequence of a great fire in 1827 the university and observatory were moved to Helsingfors.

Helsingfors (Finland), university observatory, lat. + 60° 9′ 43″·3, long. 1^{h} 39^{m} $49^{s}\cdot2$ E. Erected in 1832-35; furnished with a 6½-inch refractor and the instruments from Åbo, including a transit instrument by Fraunhofer of 5½-inches aperture. With the last-named instrument, furnished with a divided arc, Krüger has observed the stars between + 55° and + 65° decl.

Dorpat, university observatory, lat. + 58° 22′ 47″·1, long. 1^{h} 46^{m} $53^{s}\cdot6$ E. Founded in 1808; from 1814 under the direction of F. G. W. Struve. With a meridian circle by Reichenbach observations were made from 1822 to 1843 of 2874 stars, chiefly double stars (Struve's *Positiones mediæ*, 1852), while the 9½-inch refractor by Fraunhofer was used from 1824 to 1837 for measuring double stars (*Mensuræ micrometricæ*, 1837, also *Catalogus novus stellarum duplicium*, 1827). Dorpat was also the centre of important geodetic works. Mädler, who succeeded Struve in 1840, continued the observations of double stars. The meridian circle has been used since 1870 for observations of stars between + 70° and + 75° decl.

Vilna, lat. + 54° 41′ 0″, long. 1^{h} 41^{m} $11^{s}\cdot9$ E. Founded in 1753. From time to time observations of planets have been made with a 6-inch refractor (Merz, 1845) and minor instruments. Of late years the observatory has been devoted to astronomical physics; a photoheliograph was in operation from 1869 to 1876.

Warsaw, university observatory, lat. + 52° 13′ 5″·7, long. 1^{h} 24^{m} $7^{s}\cdot4$ E. Erected in 1820-24; meridian circle by Reichenbach, 6-inch refractor by Merz.

Plonsk (Poland), Dr Jedrzejewicz's observatory, lat. + 52° 37′ 38″·8, long. 1^{h} 22^{m} 4^{s} E. Established in 1875; a 6½-inch refractor by Steinheil is being used for observations of double stars.

Moscow, university observatory, lat. + 55° 45′ 19″·8, long. 2^{h} 30^{m} $17^{s}\cdot0$ E. An observatory was built in 1825-32; the present building was erected about 1850. There is a 10·7-inch refractor by Merz (used for observations of planets and comets and spectroscopic observations of the sun), a meridian circle by Repsold of 5·3-inches aperture, &c. The *Annals*, published since 1874, contain many researches on the nature of comets by the director, Bredichin.

Kasan, university observatory, lat. + 55° 47′ 24″·2, long. 3^{h} 16^{m} $28^{s}\cdot9$ E. Founded in 1814, restored in 1842; 10-inch refractor by Merz, meridian circle by Repsold.

Kharkoff, lat. + 50° 0′ 10″·2, long. 2^{h} 24^{m} $54^{s}\cdot7$ E.

Kieff, university observatory, lat. + 50° 27′ 11″·1, long. 2^{h} 2^{m} $0^{s}\cdot6$ E. Erected in the years 1840-45; has a 9-inch refractor, a meridian circle, and smaller instruments.

Odessa, university observatory, lat. + 46° 28′ 36″·2, long. 2^{h} 3^{m} $2^{s}\cdot4$ E. Recently established; 5-inch refractor by Steinheil.

Nikolaieff, naval observatory, lat. + 46° 58′ 20″·6, long. 2^{h} 7^{m} $54^{s}\cdot1$ E. Erected in 1824; meridian circle by Ertel with 4-inches aperture, 9½-inch refractor by Repsold.

Tiflis. Founded in 1863 to assist the geodetic operations in the Caucasian provinces.

SWEDEN, NORWAY, AND DENMARK.

Stockholm, lat. + 59° 20′ 33″·2, long. 1^{h} 12^{m} $14^{s}\cdot0$ E., is under the Academy of Sciences. Founded in 1750; is best known by Wargentin's observations of Jupiter's satellites, carried on for many years. Meridian circle by Ertel of 4½-inches aperture, 7-inch equatorial refractor by Repsold; the latter is now being employed by Gyldén for researches on the annual parallax of bright stars.

Upsala, university observatory, lat. + 59° 51′ 31″·5, long. 1^{h} 10^{m} $30^{s}\cdot6$ E. Founded in 1730, but very little was done until the observatory acquired a 9-inch refractor by Steinheil, which has been used by the present director, Schultz, for micrometric observations of 500 nebulæ.

Lund, university observatory, lat. + 55° 41′ 52″·0, long. 0^{h} 52^{m} $45^{s}\cdot0$ E. Built in 1866 (an observatory had existed since about 1760, but only with very small instruments); 9½-inch equatorial refractor, object-glass by Merz, used for observations of double stars and minor planets; meridian circle by Repsold of 6½-inches aperture, used for observing stars between + 35° and + 40° decl.

Christiania, university observatory, lat. + 59° 54′ 43″·7, long.

0^{h} 42^{m} 53^{s}·6 E. Erected in 1831; meridian circle by Ertel of 4-inches aperture, now used to observe stars between + 65° and + 70° decl.; a 4½-inch equatorial by Repsold, and a 7-inch refractor by Merz; magnetical instruments (which were extensively used by the first director, Hansteen).

Copenhagen, university observatory, lat. 55° 40′ 53″·0, long. 0^{h} 50^{m} 19^{s}·8 E. Founded in 1641 on the top of a high tower; the locality was so very unsuitable that Römer (the inventor of the transit instrument and modern equatorial, died 1710) established his own observatory at Vridlösemagle, at some distance from the city. The observatory on the tower was burned in 1728, restored in 1741 and 1780. A new observatory was erected in 1861, lat. +55° 41′ 13″·6, long. 0^{h} 50^{m} 19^{s}·2 E. It is furnished with an equatorial refractor by Merz of 11-inches aperture, with which D'Arrest made observations of 1900 nebulæ; a meridian circle by Pistor and Martins of 4½-inches aperture, with which Schjellerup observed 10,000 stars between +15° and −15° decl.; and a meridian transit instrument of 6½-inches aperture, intended for zone observations of very faint stars.

Holland and Belgium.

Leyden, university observatory, lat. + 52° 9′ 20″·3, long. 0^{h} 17^{m} 56^{s}·2 E. Founded already in 1632, but the instruments were always very small, and hardly any observations were taken until Kaiser became director in 1837. A 6-inch refractor by Merz was now provided, and in 1858-60 a new observatory was erected, and furnished with a 7-inch refractor by Merz and a meridian circle by Pistor and Martins of 6·3-inches aperture. These instruments have since been in constant use, the refractor for measures with a double-image micrometer, the meridian circle principally for observations of stars between + 30° and + 35° decl., and of southern standard stars. There is a large collection of minor instruments and apparatuses for special researches. *Annalen der Sternwarte in Leyden* appear in 4to volumes.

Utrecht, university observatory, lat. + 52° 5′ 10″·5, long. 0^{h} 20^{m} 31^{s}·7 E. Seems to have existed already during the 18th century; a new building was erected in 1855, but there are only small instruments, except a 10-inch object-glass by Steinheil on Gauss's plan, which seems to be a failure.

Brussels, royal observatory, lat. + 50° 51′ 10″·7, long. 0^{h} 17^{m} 28^{s}·6 E. Erected in 1829-34. A transit instrument by Gambey and a mural circle by Troughton have been used for observations of stars having proper motion, but the institution was while under the direction of Quetelet chiefly devoted to physics and meteorology. In 1877 a 6-inch refractor by Merz was mounted, and a meridian circle by Repsold and a 15-inch refractor by Cooke have been mounted in a temporary manner, pending the erection of a new observatory at some distance from the city. The *Annales de l'Observatoire de Bruxelles* (28 vols. 4to) contain, besides the observations, many investigations on special subjects.

United States.

Albany (New York), Dudley Observatory, lat. + 42° 39′ 49″·5, long. 4^{h} 54^{m} 59^{s}·2 W. Erected in 1851-56 by subscription; equatorial refractor by Fitz of 13-inches aperture, meridian circle by Pistor and Martins of 8-inches aperture, now used for observing stars between + 1° and + 5° decl., transit instrument of 6·4-inches aperture by the same makers.

Allegheny (Pennsylvania), lat. + 40° 27′ 41″·6, long. 5^{h} 20^{m} 2^{s}·9 W. Founded in 1860 in connexion with the university; 13-inch equatorial refractor by Fitz (improved by Clark), mounted in 1867; several spectroscopes and other instruments for researches on solar energy.

Amherst (Massachusetts), lat. + 42° 22′ 15″·6, long. 4^{h} 50^{m} 7^{s}·3 W. Founded in 1857 as an annex to the college; 7¼-inch refractor by Clark.

Annapolis (Maryland), lat. + 38° 58′ 53″·5, long. 5^{h} 5^{m} 56^{s}·5 W. U.S. Naval Academy observatory, used for instruction only; 4-inch meridian circle by Repsold, 7¾-inch refractor by Clark, and smaller instruments.

Ann Arbor (Michigan), lat. + 42° 16′ 48″·0, long. 5^{h} 34^{m} 55^{s}·2 W. Belongs to the university of Michigan; erected in 1854; meridian circle by Pistor and Martins of 6½-inches aperture, 12½-inch equatorial refractor by Fitz. The observatory is known by the works of the successive directors, Brünnow and Watson; the latter discovered twenty-one minor planets here.

Cambridge (Massachusetts), Harvard College observatory, lat. + 42° 22′ 48″·3, long. 4^{h} 44^{m} 31^{s}·0 W. Erected in 1839. Equatorial refractor of 15-inches aperture by Merz, with which W. C. Bond discovered a satellite of Saturn (Hyperion) in 1848, and which was afterwards used by G. P. Bond to observe the nebula of Orion,—it is now employed by Pickering for extensive photometric observations of fixed stars and satellites; a meridian circle by Troughton and Simms with 8¼-inches aperture, mounted in 1870, used for observations of standard stars and stars between + 50° and + 55° decl. The *Annals* of the observatory (13 vols. 4to) form one of the most important collections of astronomical researches. Since 1877 the means of the institution have been increased by public subscription, and a large staff of assistants has since been actively employed on photometric and meridian work.

Chicago (Illinois), Dearborn Observatory, lat. + 41° 50′ 1″·0, long. 5^{h} 50^{m} 26^{s}·8 W. Attached to the university; founded by subscription in 1862. The principal instrument is an 18½-inch equatorial refractor by Clark (mounted in 1864, but not used till 1877), with which Burnham has continued his observations and discoveries of double stars, commenced with a 6-inch refractor. There is also a 6-inch meridian circle by Repsold.

Cincinnati (Ohio), lat. + 39° 6′ 26″·5, long. 5^{h} 37^{m} 58^{s}·9 W. In 1842 an observatory was founded by subscription, and furnished with an equatorial refractor of 11¼-inches aperture by Merz. In 1873 the observatory was removed to a distance from the city, to Mount Lookout, lat. + 39° 8′ 35″·5, long. 5^{h} 37^{m} 41^{s}·4 W. The refractor has been almost exclusively devoted to observations of double stars (*Publications of the Cincinnati Observatory*, 5 parts, 8vo).

Clinton (New York), Litchfield Observatory of Hamilton College, lat. + 43° 3′ 17″·0, long. 5^{h} 1^{m} 27^{s}·4 W. Erected by subscription, 1852-55; equatorial refractor of 13½ inches by Spencer, employed by C. H. F. Peters for construction of celestial charts (Nos. 1-20 published in 1882), in the course of which work he has discovered forty-one minor planets.

Georgetown (District of Columbia), college observatory, lat. + 38° 54′ 26″·2, long. 5^{h} 8^{m} 18^{s}·3 W. Erected in 1844; 6-inch refractor and small meridian circle, both by Simms.

Glasgow (Missouri), Morrison Observatory, lat. + 39° 16′ 16″·8, long. 6^{h} 11^{m} 18^{s}·0 W. Founded in 1876; attached to the university; 12¼-inch equatorial refractor by Clark, used for observations of comets, planets, and double stars; meridian circle by Simms of 6-inches aperture.

Hanover (New Hampshire), Dartmouth College observatory, lat. + 43° 42′ 15″, long. 4^{h} 49^{m} 8^{s}·0 W. Founded in 1853; 9½-inch equatorial by Clark, used by C. A. Young (up to 1878) for spectroscopic observations of the sun; meridian circle by Simms of 4-inches aperture.

Hastings (New York), Prof. Henry Draper's observatory, lat. + 40° 59′ 25″, long. 4^{h} 55^{m} 29^{s}·7 W. Built in 1860; 28-inch reflector by the owner, 11-inch refractor (with photographic lens) by Clark, both used up to the owner's death (1882) for celestial and spectrum photography. The first photograph of the nebula of Orion was taken here in 1880.

Madison (Wisconsin), Washburn Observatory, lat. + 43° 4′ 36″·7, long. 5^{h} 57^{m} 37^{s}·9 W. Erected at the expense of Governor Washburn in 1878; belongs to the university. Meridian circle by Repsold of 4·8-inches aperture, 15½-inch equatorial refractor by Clark, used for observations of nebulæ and double stars. *Publications* in 8vo volumes.

Mount Hamilton (California), Lick Observatory of the university of California, lat. + 37° 21′ 3″, long. 8^{h} 6^{m} 26^{s}·7 W., about 4250 feet above sea-level. Is being erected in pursuance of the will of the late James Lick, and is to contain a 36-inch refractor by Clark. The suitability of the site was tested in 1879 by Burnham, who observed for some weeks with his 6-inch refractor. A 12-inch refractor and a 5-inch photoheliograph were used for observing the transit of Venus in 1882.

New Haven (Connecticut), Winchester Observatory of Yale College, lat. + 41° 18′ 36″·5, long. 4^{h} 51^{m} 42^{s}·2 W. An observatory had existed since 1830, possessing among other instruments a 9-inch refractor by Clark and a meridian circle by Ertel. In 1880 a bureau for verifying chronometers and thermometers was established, and in 1881 the observatory was rebuilt, and furnished with a 6-inch heliometer by Repsold, and an 8-inch equatorial refractor by Grubb.

New York, L. M. Rutherfurd's observatory, lat. + 40° 43′ 48″·5, long. 4^{h} 55^{m} 56^{s}·6 W. 13-inch refractor by Rutherfurd and Fitz, used for celestial photography.

Northfield (Minnesota), Carleton College observatory, lat. + 44° 27′ 40″·8, long. 6^{h} 12^{m} 35^{s}·9 W. Erected in 1878; 8¼-inch refractor by Clark.

Princeton (New Jersey). Attached to the college are two observatories,—the "J. C. Green School of Science observatory," lat. + 40° 20′ 57″·8, long. 4^{h} 58^{m} 37^{s}·6 W., erected in 1877, and furnished with a 9½-inch refractor by Clark; and the Halsted observatory, in which a 23-inch refractor by Clark was mounted in 1883.

Rochester (New York), Warner Observatory, lat. + 43° 8′ 15″, long. 5^{h} 11^{m} 20^{s} W. Erected by H. H. Warner in 1879-80; has a 16-inch refractor by Clark.

Washington (D.C.), U.S. naval observatory, lat. + 38° 53′ 38″·8, long. 5^{h} 8^{m} 12^{s}·1 W. Observations were commenced in a temporary observatory in 1838; the naval observatory was organized in 1842; observations commenced in 1845. For some years a large amount of zone observations were taken with three meridian instruments, but as Maury, who held the office of superintendent from 1844 to 1861, devoted himself exclusively to meteorology, the astronomical work was considered of less importance. Since 1861 the observations have again been published in annual 4to volumes, the appendices to which contain many important memoirs by the five astronomers attached to the institution. In addition to these and the superintendent (a naval officer) there are three assistants. The instruments are :—a mural circle by Troughton and Simms of 4 inches; a transit instrument by Ertel of 5·3-inches aperture,—these two instruments have been used to observe a catalogue of 11,000 fixed stars; a 9·6-inch equatorial refractor by Merz, used for observing minor planets and comets; a meridian circle by Pistor and Martins of 8·5-inches aperture, mounted in 1865, and used for observing standard stars and planets; a 26-inch equatorial refractor by Clark, mounted in 1873, and used for observations of satellites and difficult double stars,—with this instrument Hall discovered the satellites of Mars in 1877. A new observatory is now being built, the former locality being too near the Potomac river.

Williamstown (Massachusetts), lat. + 42° 42′ 49″, long. $4^h\ 52^m\ 33^s{\cdot}5$ W. Founded in 1836; 7½-inch refractor by Clark; meridian circle of 4½-inches aperture by Repsold, mounted in 1882.

MEXICO.

Chapultepec (about 2 miles south-west of Mexico), national observatory, lat. + 19° 25′ 17″·5, long. $6^h\ 36^m\ 38^s{\cdot}2$ W. Erected in 1877-80; a 15-inch equatorial refractor by Grubb was procured in 1882; there is also an altazimuth by Simms, &c. In 1883 the observatory was moved to Tacubaya.

SOUTH AMERICA.

Santiago (Chili), national observatory, lat. − 33° 26′ 42″·0, long. $4^h\ 42^m\ 42^s{\cdot}4$ W. In 1849 the U.S. Government sent an astronomical expedition to Chili to observe Venus and Mars, in order to determine the solar parallax. When the expedition returned in 1852, the Government of Chili bought all the instruments—a 6-inch meridian circle by Pistor and Martins, a 6⅓-inch refractor by Fitz, &c. Meridian observations of southern stars, observations of Mars in opposition, of the parallax of α Centauri, &c., were carried on by Moesta till 1863 (from 1860 in a new observatory). Since the retirement of Moesta very little has been heard of the institution, although it soon after received a 9½-inch refractor by Merz and Repsold. Two volumes of *Observations* have been published.

Lima (Peru). In 1866 a meridian circle of 7-inches aperture and a 10½-inch refractor were procured from Eichens, but we are not aware of any astronomical work having been done at Lima.

Rio de Janeiro (Brazil), imperial observatory, lat. − 22° 54′ 23″·8, long. $2^h\ 52^m\ 41^s{\cdot}4$ W. Founded in 1845; no work done until 1871. The principal instruments are a meridian circle by Dollond, an altazimuth, a 9½-inch refractor by Henry, &c. A *Bulletin* was commenced in 1881.

Cordova (Argentine Republic), national observatory, lat. − 31° 25′ 15″·4, long. $4^h\ 16^m\ 45^s{\cdot}1$ W. Erected in 1871, under the direction of B. A. Gould, who has here constructed his *Uranometria Argentina*, an atlas of all the stars visible to the naked eye from the south pole to + 10° decl., with their apparent magnitudes. With a meridian circle by Repsold of 5-inches aperture 105 000 zone observations of stars between − 23° and − 80° decl. have been made, while an 11-inch refractor by Fitz, with photographic object-glass, has been employed for taking photographs of southern star-clusters. The results are being published in 4to volumes.

AFRICA.

Cape of Good Hope, royal observatory, lat. − 33° 56′ 3″·4, long. $1^h\ 13^m\ 55^s{\cdot}0$ E. Founded in 1820; erected in 1825-29, about 3½ miles from Cape Town. Observations were commenced by Fallows in 1829 with a transit instrument by Dollond of 5-inches aperture and a mural circle by Jones. After the death of Fallows (1831), T. Henderson observed from 1832-33, chiefly the moon and Mars for determining their parallaxes, and α Centauri for annual parallax. He was succeeded as "His Majesty's astronomer" by Thomas Maclear, who undertook to verify and extend the arc of meridian measured by Lacaille in 1751-53, which work occupied the observatory staff for a number of years. The results of the meridian observations were therefore first published by Maclear's successors in the form of three star catalogues for 1840, 1850, and 1860. In 1849 a 7-inch equatorial refractor by Merz was mounted, and in 1855 a new meridian circle, a facsimile of the one at Greenwich, superseded the older instruments. With the equatorial comets, occultations of stars, &c., were observed. Maclear was succeeded by E. J. Stone (1870 to 1879), who, in addition to bringing out much of his predecessor's work, devoted himself and the staff to observations of stars, embodied in a catalogue of 12,441 stars for the epoch 1880. Under the present astronomer, D. Gill, standard stars between the equator and − 23° decl., as also stars suitable for investigations on refraction, are observed, while a 4-inch heliometer by Repsold is privately employed by the astronomer for researches on annual parallax.

Besides the observatory of *Lacaille* in Cape Town, already mentioned (lat. − 33° 55′ 16″·1, long. $1^h\ 13^m\ 41^s$ E.), another temporary observatory, at Feldhausen, lat. − 33° 58′ 56″·6, long. $1^h\ 13^m\ 51^s$ E., 6 miles from Cape Town, deserves to be mentioned. It was here that Sir John Herschel observed nebulæ and double stars from 1834 to 1838 with a reflector of 18¼-inches aperture; the results were published in a large 4to volume in 1847.

Durban (Natal). Erected in 1882; 8-inch equatorial refractor by Grubb.

Algiers (Algeria), national observatory, lat. + 36° 45′ 2″·7, long. $0^h\ 12^m\ 11^s{\cdot}4$ E. Recently founded.

St Helena, lat. − 15° 55′ 26″·0, long. $0^h\ 22^m\ 54^s{\cdot}6$ W. Erected in 1829, with a transit instrument and mural circle; M. Johnson observed the places of 606 southern stars from 1829 to 1833.

INDIA.

Madras, Government observatory, lat. + 13° 4′ 8″·1, long. $5^h\ 20^m\ 59^s{\cdot}4$ E. In operation since the beginning of this century. In 1831 a transit instrument and a mural circle, both of 3¾-inches aperture, by Dollond were mounted, and with these T. G. Taylor observed 11,000 stars, published in a large *Catalogue* (1845); a *Subsidiary Catalogue* of 1440 stars appeared in 1854. Taylor's successor, Jacob, chiefly devoted himself to double stars. A meridian circle by Simms was mounted in 1858, and in 1865 an 8-inch equatorial refractor, also by Simms, was put up, and the observations have been vigorously continued under the direction of Pogson. Eight volumes in 4to of *Observations* were published from 1832 to 1854. In a small private observatory at Madras, E. B. Powell observed double stars with a 4-inch refractor by Simms from 1853.

Lucknow. An observatory was founded by the king of Oude, and observations were made with a transit instrument and mural circle by Major Wilcox from 1841 till his death in 1848. Both instruments and manuscripts were destroyed during the mutiny in 1857.

Trivandrum, lat. + 8° 30′ 32″, long. $5^h\ 7^m\ 59^s$ E. Founded by the rajah of Travancore in 1836, and furnished with a 5-inch refractor and a transit instrument by Dollond, and two mural circles by Jones and Simms. The building was badly constructed, and the instruments could not be properly placed, so that no astronomical work could be done, but valuable magnetical and meteorological observations were made by J. A. Broun from 1852 to 1863.

CHINA.

Peking. The Jesuit missionaries under Verbiest erected in 1673 new instruments in the old observatory built in 1279 by Ko Show King. Observations were made and published at least up to 1770. The Russian embassy now maintains a meteorological observatory at Peking.

Hong Kong. In 1883 the colonial Government established an observatory, furnished with a 6-inch refractor, a small transit instrument, and full equipment of magnetical and meteorological instruments.

TURKESTAN.

Tashkend. Founded in 1874 to assist in the geodetic operations of the Russian general staff; 6-inch refractor and meridian circle by Repsold.

AUSTRALIA.

Paramatta (New South Wales), lat. − 33° 48′ 50″, long. $10^h\ 4^m\ 6^s{\cdot}3$ E. Erected by Sir Thomas Macdougall Brisbane, in 1821; handed over to the New South Wales Government in 1826; furnished with a transit instrument and a mural circle by Troughton, with which observations of southern stars were made by C. Rümker and Dunlop in the years 1822 to 1826, and from which a catalogue of 7385 stars was deduced (1835). The value of this catalogue is, however, lessened by instrumental imperfections. Observations were also made of comets, double stars, and nebulæ. From about 1835 no observations seem to have been made; the observatory was abolished in 1855.

Sydney (New South Wales), lat. − 33° 51′ 41″·1, long. $10^h\ 4^m\ 50^s{\cdot}6$ E. Founded in 1855; furnished with the instruments from Paramatta, and a very inferior meridian circle by Jones (improved by Simms). In 1861 a 7¼-inch refractor by Merz, and in 1874 an 11½-inch equatorial refractor by Schröder were mounted, and have been regularly used for observations of double stars. In 1879 a meridian circle by Simms of 6-inches aperture was acquired.

Windsor (New South Wales), lat. − 33° 36′ 28″·9, long. $10^h\ 3^m\ 21^s{\cdot}7$ E. Private observatory of Mr J. Tebbutt, who has devoted himself since 1861 to discoveries and observations of comets, using a 4½-inch refractor by Cooke.

Melbourne (Victoria), lat. − 37° 52′ 7″·2, long. $9^h\ 39^m\ 38^s{\cdot}8$ E. Founded in 1853 at Williamstown. In 1861 a meridian circle by Simms of 5-inches aperture was mounted, but in 1863 the observatory was moved to Melbourne, lat. − 37° 49′ 53″·4, long. $9^h\ 39^m\ 54^s{\cdot}8$ E. The instrumental equipment was further increased by "the great Melbourne telescope," a Cassegrain reflector, equatorially mounted, of 4-feet aperture and 20-feet focal length, made by Th. Grubb and erected in 1869, since when it has been used for observations of nebulæ and lunar photography; there is also an 8-inch refractor by Cooke, used for observations of comets, &c. The results of the meridian work from 1861 to 1875 are published in five 8vo volumes, and a *First Melbourne Catalogue* of 1227 stars was published in 1874.

Adelaide (South Australia), lat. $-34°55'33''\cdot8$, long. $9^h 14^m 21^s\cdot3$ E. In operation since 1861; has been gradually improved, and contains now an 8-inch equatorial by Cooke, and a transit circle has been ordered. (J. L. E. D.)

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OBSIDIAN, a volcanic glass, said to have been named after its discoverer Obsidius. It is usually of black, brown, or grey colour, and in some varieties banded or striated. The colour is generally due not so much to the vitreous mass itself as to the presence of minute foreign bodies or microlites, which in some cases appear to be incipient crystals of felspar, while in others they probably consist of such minerals as augite, hornblende, biotite, and magnetite. These microscopic enclosures are occasionally arranged in curved lines, producing beautiful examples of fluidal structure (see GEOLOGY, vol. x., p. 230, fig. 2). Spherulites are not uncommon in obsidian, and are sometimes sufficiently large to impart a distinctly globular structure to the stone. Other varieties are rich in microscopic pores, or may even present to the naked eye a vesicular texture. It is notable that certain kinds of obsidian possess a peculiar metallic sheen, which has been attributed by Professor Zirkel to the presence of minute ovoid enclosures, and not to a porous structure, as had been previously suspected. There can be no doubt that obsidian has been formed by the rapid cooling of a felspathic lava. It is found chiefly in Iceland, the Lipari Islands, Melos and other isles of the Greek archipelago, the Caucasus, Siberia, Mexico, Peru, and New Zealand.

Obsidian breaks with a beautifully conchoidal fracture, yielding sharp-edged fragments, which have been largely used in various parts of the world as arrow-points, spear-heads, and rude knives. For these purposes it was extensively employed, under the name of *itztli*, by the ancient Mexicans, who quarried it at the Cerro de las Navajas, or "Hill of Knives," near the head-waters of the Great Barauca. Obsidian has also been used as a mirror,—a purpose for which its strong lustre has recommended it. By the ancient Greeks and Romans it was worked as a gem-stone; and, in consequence of its having been often imitated in black glass, there arose among collectors of gems in the last century the curious practice of calling all antique pastes "obsidians." Even at the present day the bottle-green varieties of obsidian are occasionally cut and polished as ornamental stones. They bear some resemblance to peridotes and tourmalines, but are deficient in hardness.

OCCAM, WILLIAM OF (d. c. 1349), the great English schoolman (*Doctor invincibilis*), was born in the village of Ockham in the county of Surrey in the end of the 13th century. Scarcely any traces of his early life remain. Unattested tradition says that the Franciscans persuaded him while yet a boy to enter their order, sent him to Oxford to Merton College, and to Paris, where he was first the pupil, then the successful rival, of the celebrated John Duns Scotus. He was at the height of his fame as a lecturer in the university of Paris when the famous quarrel arose between Philip the Fair and Pope Boniface VIII., but it does not appear that he took any part in the strife.[1] He probably left France about 1314, and there are obscure traces of his presence in Germany, in Italy, and in England during the following seven years. We only know that in 1322 he appeared as the provincial of England at the celebrated assembly of the Franciscan order at Perugia, and that there he headed the revolt of the Franciscans against Pope John XXII. His share in this revolt and his writings to justify his position gave rise to his trial for heresy before the bishops of Ferrara and Bologna, which resulted in his imprisonment for seventeen weeks in the dungeons of the papal palace at Avignon. He and his companions—Michael of Cesena, general of the order, and Bonagratia—managed to escape, and found their way to Munich, where they formed the most conspicuous members of that band of Franciscans who aided Louis of Bavaria in his long contest with the papal curia. "Defend me with the sword and I will defend you with the pen," was Occam's proposal to Louis; and from their haven of refuge at Munich the recusant Franciscans sent forth books and pamphlets refuting the extravagant pretensions of papal authority. Michael of Cesena died in 1342, and Occam, who had received from him the official seal of the order, was recognized as general by his party. The date of his death and the place of his burial are both uncertain. He probably died at Munich in 1349, and was buried in the graveyard of the Franciscan convent. Some writers assert that he was reconciled to Rome, and in proof of submission sent the official seal to William Farinerius, who had been appointed general of the order by the pope; others declare that, like Cesena and Bonagratia, he died excommunicate.

William of Occam was the most prominent intellectual leader in an age which witnessed the disintegration of the old scholastic realism, the rise of the theological scepticism of the later Middle Ages, the great contest between pope and emperor which laid the foundations of modern theories of government, and the quarrel between the Roman curia and the Franciscans which showed the long-concealed antagonism between the theories of Hildebrand and Francis of Assisi; and he shared in all these movements.

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[1] The famous *Disputatio super Potestate Prælatis Ecclesiæ, atque Principibus Terrarum commissa*, which belongs to this controversy, and has been commonly attributed to Occam, was probably written by Peter Dubois, a Parisian lawyer.

The common account of his philosophical position, that he reintroduced nominalism, which had been in decadence since the days of Roscellinus and Abelard, by teaching that universals were only *flatus vocis*, is scarcely correct. The expression is nowhere found in his writings. He revived nominalism by collecting and uniting isolated opinions upon the meaning of universals into a compact system, and popularized his views by associating them with the logical principles which were in his day commonly taught in the universities. He linked the doctrines of nominalism on to the principles of the logic of Psellus, which had been introduced into the West in the *Summulæ* of Peter of Spain, and made them intelligible to common understandings. His philosophical teaching contains little that was new; and all the details of nominalism had been taught by writers who preceded him. The problem of mediæval philosophy, however differently stated, was the same question which faces modern thinkers. How comes it that things which are seen as separate individual objects can be thought of in classes, and so science created? What underlies the possibility of using common nouns when everything apprehended by the senses is a separate subsisting phenomenon? Realism solved the problem by supposing something *in rerum natura* which actually corresponded to the class, and whose proper name was the common noun; nominalism explained that the logical faculties of the mind grouped individuals by its own powers, and that universals were creations of the mind which thought. The three chief positions in the nominalist solution of the possibility of a common knowledge were all the common property of scholastic thinkers before Occam's day. It had been currently taught (by Ægidius and by Antonius Andreas) that the principal use of universals, whatever they were in themselves, was to serve as logical predicates, and in this way bring a variety of subjects together, or, in other words, group individual things in a class. Many of the schoolmen (Walter Burleigh, Durandus, &c.) declared that this logical function of universals was the one thing about them that deserved notice and constituted their essential nature. Durandus and others had asserted that all that universals did was in this logical fashion to bring together several individual objects in such a way that they could be denoted by the same common term. These propositions really exhaust the essential doctrines of nominalism, and they were all stated and were the common property of scholastic philosophy before Occam's time. What he did was to make nominalism simpler by introducing a way of putting the theory suggested by the Byzantine logic. Psellus and his followers explained many difficulties in logic by showing that in speech words were used like the figures of arithmetic or the signs of algebra. There is no reason why x should mean four sheep except the will of the algebraist who starts with that assumption. In the same way, there is no reason why the word "triangle" should stand for the thought it expresses, or the thought for the infinitude of individual triangles; but by *suppositio* the one is used for the other, and we can reason with word or thought just as the algebraist can do with his signs. Universals, said Occam, bore the same relation to the infinite number of individuals that signs do to the things signified. The universal, be it a thought or a word, is nothing but a sign which by *suppositio* is beforehand taken to denote a number of individual things, and is thus the common noun denoting them all.

This way of explaining community of knowledge and of defending nominalism went a good deal deeper, and became a theory of knowledge which led Occam into what was called theological scepticism. Most of the adherents of the mystical schools of the Middle Ages held that the doctrines of the church were isolated truths, each of which was to be received by a species of enthusiastic intuition, and were incapable either of systematic arrangement in a body of divinity or of being intelligibly comprehended by the mind. Before Occam appeared, mystics taught a theory of theological scepticism which declared that the truths of the Christian faith were to be taken on trust, although the reason might find logical flaws in each one of them. Occam made this theological scepticism almost a commonplace by basing it on his theory of knowledge. All knowledge, he taught, contained a double inadequacy, which arose from the needs of thinking and of expressing thought in language. Words were but signs, inadequate representations of the thoughts they stood for, and the thoughts themselves were inadequate symbols used by *suppositio* instead of the individual objects which they represented. The real individual thing was apprehended by a *vis intuitiva*, in sense, vision, or touch, &c., but, when the mind begins to think or to argue, error may creep in, for thoughts are inadequate expressions, stereotyped aspects, and words are only signs of signs. Theological knowledge is like all other knowledge, theological argumentation has the inadequacy that belongs to every process of thought. The *Centilogium Theologicum* usually appended to Occam's *Commentary on the Sentences* of Peter the Lombard contains a consistent application of this theory of knowledge to theological dogmas, every one of which is shown to be irrational, but at the same time true in the vision of faith. The most interesting application of his method, however, is to be found in the *Tractatus de Sacramento Altaris*, in which, while accepting as a matter of faith the mediæval doctrine of the real presence, Occam shows that a much more rational theory might be propounded, and actually sets forth a theory of the Eucharist which was afterwards adopted almost verbatim by Luther, and which is now known as consubstantiation.

Occam was best known during his lifetime and in the succeeding centuries for the part he took in the prolonged contest between Louis of Bavaria and the papal curia. Louis had been legally elected emperor of Germany, but the pope, who claimed that his power to crown gave him the right to veto any election, refused to acknowledge Louis, and espoused the cause of his rival. The contest was prolonged during more than a quarter of a century, and its interest lies chiefly in the writings of a group of men who, sheltered at Munich, published their views on the relations between civil and religious authority, and on the rights of nations. The most remarkable of the many publications which this controversy called forth was undoubtedly the *Defensor Pacis* of Marsilius of Padua, which appeared in 1324 or 1326, and which was the prediction of the modern, as Dante's *De Monarchia* (1311-13) was the epitaph of the mediæval state. Occam published several treatises in which, while he confines himself more to the details of the controversy going on before him, there are evident traces of sympathy with the opinions of Marsilius. Pope Clement VI. has left on record that Marsilius "was taught his errors by and got them from" William of Occam; if this be true, the Italian jurist must have had private intercourse with the great English schoolman, for all Occam's genuine writings on the controversy appeared after the *Defensor Pacis*. In the *Opus nonaginta dierum* (1330-33), and in its successors, the *Tractatus de dogmatibus Johannis XXII. papæ* (1333-34), the *Compendium errorum Johannis XXII. papæ* (1335-38), and in the *Defensorium contra errores Johannis XXII. papæ* (1335-39), Occam only incidentally expounds his views as a publicist; the books are mainly, some of them entirely, theological, but they served the purpose of the emperor and of his party, because they cut at the root of the spiritual as well as of the temporal supremacy of the pope. In his writing *Super potestate summi pontificis octo quæstionum decisiones* (1339-42) Occam attacks the temporal supremacy of the pope, insists on the independence of kingly authority, which he maintains is as much an ordinance of God as is spiritual rule, and discusses what is meant by the state. His views on the independence of civil rule were even more decidedly expressed in the *Tractatus de jurisdictione imperatoris in causis matrimonialibus*, in which, in spite of the mediæval idea that matrimony is a sacrament, he demands that it belongs to the civil power to decide cases of affinity and to state the prohibited degrees. His last work, *De Electione Caroli VI.*, restates his opinions upon temporal authority and adds little that is new.

In all his writings against Pope John XXII. Occam inveighs against the pope's opinions and decisions on the value of the life of poverty in the practice of religion. The *Compendium errorum* selects four papal constitutions which involved a declaration against evangelical poverty, and insists that they are full of heresy. Occam was a sincere Franciscan, and believed with his master that salvation was won through rigid imitation of Jesus in His poverty and obedience, and up to his days it had always been possible for Franciscans to follow the rules of their founder within his order. But Pope John XXII. took advantage of a dispute between the more zealous Franciscans and others who had departed from the strict rule of their founder to condemn the doctrine of evangelical poverty, and to excommunicate those who held it. This made many Franciscans question whether, when the pope set his opinion against that of Francis their founder, the pope could be infallible; and some of them were so convinced of the necessity of evangelical poverty for a truly Christian life that they denounced the pope when he refused them leave to practise it as Antichrist, or the being who stood between Christians and the means of holy living. After Occam's days the opinions of Francis prevailed in many quarters, but the genuine Franciscans had no place within the church. They were Fraticelli, Beghards, Lollards, or other confraternities unrecognized by the church, and in steady opposition to her government.

There is no good monograph on Occam. For an account of his logic, see Prantl, *Geschichte der Logik* (1855-70); for his philosophy, see Stöckl, *Geschichte der Philosophie des Mittelalters* (1864-66), vol. ii.; for his publicist writings, see Riezler, *Die literarischen Widersacher der Päpste zur Zeit Ludwig des Baiers* (1874). See also Lindsay's article on "Occam and his connexion with the Reformation," in the *Brit. Quart. Review*, July 1872. (T. M. L.)

OCEAN. See SEA.

OCEANIA. See POLYNESIA.

OCELOT. The smaller spotted or striped species of the genus *Felis* (see MAMMALIA, vol. xv. p. 435), of both the Old and the New World, are commonly called tiger-cats. Of these, one of the best-known and beautifully marked forms, peculiar to the American continent, has received the name of Ocelot (*Felis pardalis*), though zoologists are still undecided whether under this designation several distinct species have not been included, or whether all the ocelots are to be referred to a single species showing great individual or racial variation. Their fur has always a tawny yellow or reddish-grey ground colour, and is marked with black spots, aggregated in streaks and blotches, or in elongated rings enclosing an area which is rather darker than the general ground colour. They range through the wooded parts of tropical America, from Arkansas in the north as far south as Paraguay, and in their habits resemble the other smaller members of the cat tribe, being ready climbers and exceedingly bloodthirsty.

Ocelot.

OCHINO, BERNARDINO (1487-1564), Italian Reformer, was born at Siena in 1487. At an early age he entered the order of Observantine Friars, and rose to be its general, but, craving a stricter rule, transferred himself in 1534 to the newly-founded order of Capuchins. He had already become famous for zeal and eloquence, and was the intimate friend of the noble Spaniard Juan de Valdès, of Bembo, Vittoria Colonna, Pietro Martire, Carnesecchi, and others destined to incur the suspicion of heresy, either from the moderation of their characters or from the evangelical tincture of their theology. In 1538 he was elected vicar-general of his order; in 1539, urged by Bembo, he visited Venice and delivered a remarkable course of sermons, showing a decided tendency to the doctrine of justification by faith, which appears still more evidently in his dialogues published the same year. He was suspected and denounced, but nothing ensued until the establishment of the Inquisition in Rome in June 1542, at the instigation of the austere zealot Caraffa. Ochino almost immediately received a citation to Rome, and set out to obey it about the middle of August. According to his own statement, he was deterred from presenting himself at Rome by the warnings of Cardinal Contarini, whom he found at Bologna, dying of poison administered by the reactionary party. He turned aside to Florence, and after some hesitation escaped across the Alps to Geneva. He was cordially received by Calvin, and published within two years several volumes of *Prediche*, controversial tracts rather than sermons, explaining and vindicating his change of religion. He also addressed replies to Vittoria Colonna, Tolomei, and other Italian sympathizers who were reluctant to go to the same length as himself. His own breach with the Roman Church was decisive and irreparable, and illustrated the justice of Luther's description of justification by faith alone as the *articulus stantis vel cadentis ecclesiæ*, the vital point whose acceptance or rejection drew everything else along with it. In 1545 he became minister of the Italian Protestant congregation at Augsburg, which he was compelled to forsake when, in January 1547, the city was occupied by the imperial forces. He found an asylum in England, where he was made a prebendary of Canterbury, received a pension from Edward VI.'s privy purse, and composed his capital work, the *Tragedy*. This remarkable performance, originally written in Latin, is extant only in the translation of Bishop Ponet, a splendid specimen of nervous English. The conception is highly dramatic; the form is that of a series of dialogues. Lucifer, enraged at the spread of Christ's kingdom, convokes the fiends in council, and resolves to set up the pope as Antichrist. The state, represented by the emperor Phocas, is persuaded to connive at the pope's assumption of spiritual authority; the other churches are intimidated into acquiescence; Lucifer's projects seem fully accomplished, when Heaven raises up Henry VIII. and his son for their overthrow. The conception bears a remarkable resemblance to that of *Paradise Lost*; and it is nearly certain that Milton, whose sympathies with the Italian Reformation were so strong must have been acquainted with it. Several of Ochino's *Prediche* were also translated into English by a lady, Anna Cook, afterwards wife of Sir Nicholas Bacon; and he published numerous controversial treatises on the Continent. In 1553 the accession of Mary drove him from England. He became pastor of the Italian congregation at Zurich, composed principally of refugees from Locarno, and continued to write books which, repeating the history of his early works, gave increasing evidence of his alienation from the strict orthodoxy around him. The most important of these was the *Labyrinth*, a discussion of the freedom of the will, covertly assailing the Calvinistic doctrine of predestination. In 1563 the long-gathering storm of obloquy burst upon the occasion of the publication of his *Thirty Dialogues*, in one of which his adversaries maintained that he had justified polygamy under colour of a pretended refutation. His dialogues on divorce and the Trinity were also obnoxious. No explanation was allowed. Ochino was banished from Zurich, and, after being refused a shelter by other Protestant cities, directed his steps towards Poland, at that time the most tolerant state in Europe. He had not resided there long when an edict appeared banishing all foreign dissidents. Flying from the country, he encountered the plague at Pinczoff; three of his four children were carried off; and he himself, worn out by misfortune, expired in solitude and obscurity at Schlakau in Moravia, about the end of 1564. His reputation among Protestants was at the time so bad that he was charged with the authorship of the treatise *De tribus Impostoribus*, as well as with having carried his alleged approval of polygamy into practice. It was reserved for his recent biographer Dr Benrath to justify him, and to represent him as a fervent evangelist and at the same time as a speculative thinker with a passion for free inquiry, always learning and unlearning and arguing out difficult questions with himself in his dialogues, frequently without attaining to any absolute conviction. The general tendency of his mind, nevertheless, was counter to tradition, and he is remarkable as resuming in his individual history all the phases of Protestant theology from Luther to Socinus. He is especially interesting to Englishmen for his residence in England, and the probable influence of more than one of his writings upon Milton.

All attainable information respecting Ochino is collected in Dr Benrath's excellent German biography translated into English by Miss Helen Zimmern, with a preface by the Rev. W. Arthur, London, 1876. (R. G.)

OCHRE. See PIGMENTS.

OCKLEY, SIMON (1678-1720), Orientalist, was born at Exeter in 1678. He was educated at Queens' College, Cambridge, and graduated B.A. in 1697, M.A. in 1701, and B.D. in 1710; he became fellow of Jesus College and vicar of Swavesey, and in 1711 was chosen Arabic professor of the university. He had a large family, and his latter days were embittered by pecuniary embarrassments, which form the subject of a chapter in D'Israeli's *Calamities of Authors*. The preface to the second volume of his *History of the Saracens* is dated from Cambridge castle, where he lay a prisoner for debt. He died in the year 1720. His chief work is *The History of the Saracens*, in 2 vols. 8vo, 1708-18, which long enjoyed a great reputation; unfortunately Ockley took as his main authority a MS. in the Bodleian of Pseudo-Wákidí's *Futúḥ al-Shám*, which is rather historical romance than history.

O'CLERY, MICHAEL (born c. 1575). See CELTIC LITERATURE, vol. v p. 307.

O'CONNELL, DANIEL (1775-1847), born on 6th August, 1775, near Cahirciveen, a small town in Kerry, Ireland, was sprung from a race the heads of which had been Celtic chiefs, had lost their lands in the wars of Ireland, and had felt the full weight of the harsh penal code which long held the Catholic Irish down. His ancestors in the 18th century had sent recruits to the famous brigade of Irish exiles in the service of France, and those who remained at home either lived as tenants on the possessions of which they had once been lords, or gradually made money by smuggling, a very general calling in that wild region. Thus he inherited from his earliest years, with certain traditions of birth and high station, a strong dislike of British rule in Ireland and of the dominant owners of the soil, a firm attachment to his proscribed faith, and habitual skill in evading the law; and these influences may be traced in his subsequent career. O'Connell learned the rudiments at a school in Cork, one of the first which the state in those evil days allowed to be opened for Catholic teaching; and a few years afterwards he became a student, as was customary with Irish youths of his class, in the colleges of St Omer and Douai. His great abilities, it is said, were there perceived by the principals, and their peculiar training undoubtedly left a permanent mark on his mind and nature, for the casuistry and the diction of the Romish priesthood distinctly appear in his speeches and writings, and he had much of the ecclesiastic in his manners and bearing. These years, too, in France had, in another way, a decided effect in forming his judgment on political questions of high moment. He was an eye-witness on more than one occasion of the folly and excesses of the French Revolution; and these scenes not only increased his love for his church, but strongly impressed him with that dread of anarchy, of popular movements ending in bloodshed, and of communistic and socialistic views which characterized him in after life. To these experiences, too, we may partly ascribe the reverence for law, for the rights of property, and for the monarchical form of government which he appears to have sincerely felt; and, demagogue as he became in a certain sense, they gave his mind a deep Conservative tinge. In 1798 he was called to the bar of Ireland, and though, as professing a still degraded creed, he was shut out from the chance of promotion, though he could not even obtain a silk gown, and though, what was of more importance, he was subjected in a variety of ways to caste hostility, he rose before long to the very highest eminence among contemporary lawyers and advocates. This position was in the main due to a dexterity in conducting causes, and especially in examining witnesses, in which he had no rival at the Irish bar, and here his profound sagacity, observant cunning, and intuitive knowledge of the native character enabled him to accomplish wonders, even at the present day not wholly forgotten. He was, however, a thorough lawyer besides, inferior in scientific learning to two or three of his most conspicuous rivals, but well-read in every department of law, and especially a master in all that relates to criminal and constitutional jurisprudence. As an advocate, too, he stood in the very highest rank; in mere oratory he was surpassed by Plunket, and in rhetorical gifts by Bushe, the only speakers to be named with him in his best days at the Irish bar; but his style, if not of the most perfect kind, and often disfigured by decided faults, was marked by a peculiar subtlety and manly power, and produced great and striking effects. On the whole, in the art of winning over juries he had scarcely an equal in the law courts.

To understand, however, O'Connell's greatness we must look to the field of Irish politics. From early manhood he had turned his mind to the condition of Ireland and the mass of her people. The worst severities of the penal code had been, in a certain measure, relaxed, but the Catholics were still in a state of vassalage, and they were still pariahs compared with the Protestants. The rebellion of 1798 and the union had dashed the hopes of the Catholic leaders, and their prospects of success seemed very remote when, in the first years of the present century, the still unknown lawyer took up their cause. Up to this juncture the question had been in the hands of Grattan and other Protestants, and of a small knot of Catholic nobles and prelates; but their efforts had not accomplished much, and they aimed only at a kind of compromise, which, while conceding their principal claims, would have placed their church in subjection to the state. O'Connell inaugurated a different policy, and had soon given the Catholic movement an energy it had not before possessed. Himself a Catholic of birth and genius, unfairly kept back in the race of life, he devoted his heart and soul to the cause, and his character and antecedents made him the champion who ultimately assured its triumph. Having no sympathy with the rule of "the Saxon," he saw clearly how weak was the hold of the Government and the Protestant caste on the vast mass of the Catholic nation; having a firm faith in the influence of his church, he perceived that it might be made an instrument of immense political power in Ireland; and, having attained a mastery over the lawyer's craft, he knew how a great popular movement might be so conducted as to elude the law and yet be in the highest degree formidable. With these convictions, he formed the bold design of combining the Irish Catholic millions, under the superintendence of the native priesthood, into a vast league against the existing order of things, and of wresting the concession of the Catholic claims from every opposing party in the state by an agitation, continually kept up, and embracing almost the whole of the people, but maintained within constitutional limits, though menacing and shaking the frame of society. He gradually succeeded in carrying out his purpose: Catholic associations, at first small, but slowly assuming larger proportions, were formed in different parts of the country; attempts of the Government and of the local authorities to put them down were skilfully baffled by legal devices of many kinds; and at last, after a conflict of years, all Catholic Ireland was arrayed to a man in an organization of enormous power, that demanded its rights with no uncertain voice. O'Connell, having long before attained an undisputed and easy ascendency, stood at the head of this great national movement; but it will be observed that, having been controlled from first to last by himself and the priesthood, it had little in common with the mob rule and violence which he had never ceased to regard with aversion. His election for Clare in 1828 proved the forerunner of the inevitable change, and the Catholic claims were granted the next year, to the intense regret of the Protestant Irish, by a Government avowedly hostile to the last, but unable to withstand the overwhelming pressure of a people united to insist on justice. The result, unquestionably, was almost wholly due to the energy and genius of a single man, though the Catholic question would have been settled, in all probability, in the course of time; and it must be added that O'Connell's triumph, which showed what agitation could effect in Ireland, was far from doing his country unmixed good.

O'Connell joined the Whigs on entering parliament, and gave effective aid to the cause of reform. The agitation, however, on the Catholic question had quickened the sense of the wrongs of Ireland, and the Irish Catholics were engaged ere long in a crusade against tithes and the established church, the most offensive symbols of their inferiority in the state. It may be questioned whether O'Connell was not rather led than a leader in this; the movement, at least, passed beyond his control, and the country for many months was terrorized by scenes of appalling crime and bloodshed. Lord Grey, very properly, proposed measures of repression to put this anarchy down, and O'Connell opposed them with extreme vehemence, a seeming departure from his avowed principles, but natural in the case of a popular tribune. This caused a breach between him and the Whigs; but he gradually returned to his allegiance to them when they practically abolished Irish tithes, cut down the revenues of the established church, and endeavoured to secularize the surplus. By this time O'Connell had attained a position of great eminence in the House of Commons: as a debater he stood in the very first rank, though he had entered St Stephen's after fifty; and his oratory, massive and strong in argument, although too often scurrilous and coarse, and marred by a bearing in which cringing flattery and rude bullying were strangely blended, made a powerful, if not a pleasing, impression. O'Connell steadily supported Lord Melbourne's Government, gave it valuable aid in its general measures, and repeatedly expressed his cordial approval of its policy in advancing Irish Catholics to places of trust and power in the state, though personally he refused a high judicial office. These were not the least useful years of his life, and they clearly brought out the real character and tendencies of his views on politics. Though a strict adherent of the creed of Rome, he was a Liberal, nay a Radical, as regards measures for the vindication of human liberty, and he sincerely advocated the rights of conscience, the emancipation of the slave, and freedom of trade. But his rooted aversion to the democratic theories imported from France, which were gradually winning their way into England, only grew stronger with advancing age; he denounced Chartism in unmeasured terms; the sovereign had no more loyal subject; and if, as became him, he often condemned the tyranny of bad Continental Governments, he reverenced the constitution and laws of England interpreted in a generous spirit. His conservatism, however, was most apparent in his antipathy to socialistic doctrines and his tenacious regard for the claims of property. He actually opposed the Irish Poor Law, as encouraging a communistic spirit; he declared a movement against rent a crime; and, though he had a strong sympathy with the Irish peasant, and advocated a reform of his precarious tenure, it is difficult to imagine that he could have approved the cardinal principle of the Irish Land Act, the judicial adjustment of rent by the state.

O'Connell changed his policy as regards Ireland when Peel became minister in 1841. He declared that a Tory régime in his country was incompatible with good government, and he began an agitation for the repeal of the union. One of his motives in taking this course no doubt was a strong personal dislike of Peel, with whom he had often been in collision, and who had singled him out in 1829 for what must be called a marked affront. O'Connell, nevertheless, was sincere and even consistent in his conduct: he had denounced the union in early manhood as an obstacle to the Catholic cause; he had spoken against the measure in parliament; he believed that the claims of Ireland were set aside or slighted in what he deemed an alien assembly; and, though he had ceased for some years to demand repeal, and regarded it as rather a means than an end, he was throughout life an avowed repealer. It should be observed, however, that in his judgment the repeal of the union would not weaken the real bond between Great Britain and Ireland; and he had nothing in common with the rebellious faction who, at a later period, openly declared for the separation of the two countries by force. The organization which had effected such marvellous results in 1828-29 was recreated for the new project. Enormous meetings, convened by the priesthood, and directed or controlled by O'Connell, assembled in 1842-43, and probably nine-tenths of the Irish Catholics were unanimous in the cry for repeal. O'Connell seems to have thought success certain; but he had not perceived the essential difference between his earlier agitation and this. The enlightened opinion of the three kingdoms for the most part approved the Catholic claims, and as certainly it condemned repeal. After some hesitation Peel resolved to put down the repeal movement. A vast intended meeting was proclaimed unlawful, and O'Connell was arrested and held to bail, with ten or twelve of his principal followers. He was convicted after the trials that followed, but they were not good specimens of equal justice, and the sentence was reversed by the House of Lords, with the approbation of competent judges. The spell, however, of O'Connell's power had vanished; his health had suffered much from a short confinement; he was verging upon his seventieth year; and he was alarmed and pained by the growth of a party in the repeal ranks who scoffed at his views, and advocated the revolutionary doctrines which he had always feared and abhorred. Before long famine had fallen on the land, and under this visitation the repeal movement, already paralysed, wholly collapsed. O'Connell died soon afterwards, on 15th May 1847, at Genoa, whilst on his way to Rome, profoundly afflicted by his country's misery, and by the failure of his late high hopes, yet soothed in dying by sincere sympathy, felt throughout Ireland and largely in Europe, and expressed even by political foes. He was a remarkable man in every sense of the word; Catholic Ireland calls him her "Liberator" still; and history will say of him that, with some failings, he had many and great gifts, that he was an orator of a high order, and that, agitator as he was, he possessed the wisdom, the caution, and the tact of a real statesman. O'Connell married in 1802 his cousin Mary O'Connell, by whom he had three daughters and four sons. Of the latter, all have at one time or another had seats in parliament. (W. O. M.)

O'CONNOR, Feargus Edward (1796-1855), Chartist leader, was born in 1796, and entered parliament as member for the county of Cork in 1832. Though a zealous supporter of repeal, he endeavoured to supplant O'Connell as the leader of the party, an attempt which aroused against him the popular antipathy of the Irish. When, therefore, in 1834 he was unseated on petition, he resolved to go to England, where he established the *Northern Star* newspaper, and became a vehement advocate of the Chartist movement. In 1847 he was returned for Nottingham, and in 1848 he presided at a Chartist demonstration in London, which caused great alarm. (See Chartism, vol. v. p. 434.) The eccentricity and extravagance which had characterized his opinions from the beginning of his career gradually became more marked until they developed into insanity. He began to conduct himself in a strange and disorderly manner in the House of Commons, and in 1853 he was found to be of unsound mind by a commission of lunacy. He died at London 30th August 1855, and was buried in Kensal Green cemetery.

OCTAVIA. (1.) Octavia, daughter of Caius Octavius, prætor, 61 B.C., and sister of the emperor Augustus, was married to C. Marcellus, one of the bitterest enemies of Julius Cæsar. In 41 her husband died, and she was married immediately to Antony, with the design of securing peace between her brother and her new husband. Her beauty and her high character are praised in the warmest terms by all authorities, and at first Antony devoted himself to her, and seemed to have forgotten his jealousy of her brother and his old love for Cleopatra. But his affection for his wife was not strong enough to counterbalance the feelings that weighed against it. In the year 36 he went off to the Parthian war and to meet Cleopatra, and, when in the following year Octavia brought out troops and money to him, he refused to see her and bade her go back to Rome. She sent the money to him and returned to his house, where she educated his son by a former wife along with her own children. In 32 Antony formally divorced her, but she always protected his children, even those of Cleopatra. She died 11 B.C., and was buried with the highest honours by the state. (2.) Octavia, daughter of the emperor Claudius, was married in her twelfth year to Nero (*q.v.*). A Latin tragedy on her fate is attributed, though wrongly, to Seneca.

OCTOBER, the eighth month of the old Roman year, which began in spring. By the Julian arrangement, while retaining its old name, it became the tenth month, and had thirty-one days assigned to it. The meditrinalia, when a libation of new wine was made in honour of Meditrina, were celebrated on the 11th, the faunalia on the 13th, and the equiria, when the "equus October" was sacrificed to Mars in the Campus Martius, on the 15th. The principal ecclesiastical feasts in October are those of St Luke on the 18th and of St Simon and St Jude on the 28th. By the Slavs this is called "yellow month," from the fading of the leaf; to the Anglo-Saxons it was known as Winter-fylleth, because at this full moon (fylleth) winter was supposed to begin. It corresponds partly to the Vendémiaire and partly to the Brumaire of the first French republic.

OCTOPUS. See Cuttlefish, vol. vi. p. 735; and Mollusca, vol. xvi. p. 669 *sq.*

OCYDROME, a word formed from *Ocydromus*, meaning "swift-runner," and suggested by Wagler in 1830 as a generic term for the New-Zealand bird called in the then unpublished manuscripts of the elder Forster *Rallus troglodytes*, and so designated in 1788 by Gmelin, who knew of it through Latham's English description. Wagler's suggestion has since been generally adopted, and the genus *Ocydromus* is accepted by most ornithologists as a valid group of *Rallidæ*; but the number of species it contains is admittedly doubtful, owing to the variability in size and plumage which they exhibit, and their correct nomenclature must for the present be considered uncertain. Mr Buller in his *Birds of New Zealand* identifies the "Wood-hen," observed in great abundance on the shores of Dusky Bay in 1773 by Cook and his companions on his second voyage, with the *Gallirallus fuscus* described and figured by Du Bus in 1847, and accordingly calls it *O. fuscus*; but it cannot be questioned that the species from this locality —which appears to have a somewhat limited range in the Middle Island,[1] and never to be met with far from the sea-coast, where it lives wholly on crustaceans and other marine animals—is identical with that of the older authors just mentioned. In 1786 Sparrman, who had also been of Cook's company, figured and described as *Rallus australis* a bird which, though said by him to be that of the southern coast of New Zealand, differs so much from the *R. troglodytes* as to compel a belief in its specific distinctness; and indeed his species has generally been identified with the common "*Weka*" of the Maories of the Middle Island, which can scarcely be the case if his statement is absolutely true, since the latter does not appear to reach so far to the southward, or to affect the sea-shore. It may therefore be fairly inferred that his subject was obtained from some other locality. The North Island of New Zealand has what is allowed to be a third species, to which the name of *Ocydromus earli* is attached, and this was formerly very plentiful; but its numbers are rapidly decreasing, and there is every chance of its soon being as extinct as is the species which tenanted Norfolk Island on its discovery by Cook in 1774, and was doubtless distinct from all the rest, but no specimen of it is known to exist in any museum.[1] Another species, *O. sylvestris*, smaller and lighter in colour than any of the rest, was found in 1869 to linger yet in Lord Howe's Island (*Proc. Zool. Society*, 1869, p. 472, pl. xxxv.). Somewhat differing from *Ocydromus*, but apparently very nearly allied to it, is a little bird peculiar, it is believed, to the Chatham Islands (*Ibis*, 1872, p. 247), and now regarded by Captain Hutton as the type of a genus *Cabalus* under the name of *C. modestus*, while other naturalists consider it to be the young of the rare *Rallus dieffenbachi*. So far the distribution of the Ocydromine form is wholly in accordance with that of most others characteristic of the New-Zealand sub-region; but a curious exception is asserted to have been found in the *Gallirallus lafresnayanus* of New Caledonia, which, though presenting some structural differences, has been referred to the genus *Ocydromus*.

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[1] It also occurs in Stewart Island, and singularly enough on the more distant group known as the Snares. The *Gallirallus brachypterus* of Lafresnaye, of which the typical (and unique?) specimen from an unknown locality is in the Caen Museum, has also been referred to this species, but the propriety of the act may be doubted.

The chief interest attaching to the Ocydromes is their inability to use in flight the wings with which they are furnished, and hence an extreme probability of the form becoming wholly extinct in a short time. Of this inability there are other instances among the *Rallidæ* (see MOORHEN, vol. xvi. p. 808); but here we have coupled with it the curious fact that in the skeleton the angle which the scapula makes with the coracoid is greater than a right angle, a peculiarity shared only, so far as is known, among the *Carinatæ* by the Dodo. The Ocydromes are birds of dull plumage, and mostly of retiring habits, though the common species is said to show great boldness towards man, and, from the accounts of Cook and the younger Forster, the birds seen by them displayed little fear. It is also declared that they will interbreed with common poultry, and more than one writer vouches for the truth of this extraordinary statement. It is to be hoped that the naturalists of New Zealand will not allow the form to become extinct if any effectual means can be taken to perpetuate it; but, should that fate be inevitable, it at least behoves the present generation to see that every possible piece of information concerning the birds be recorded, and every possible preparation illustrating their structure be made, while yet there is time; for, though much has been written on the subject, it is obvious from one of the latest papers (*Trans. New Zealand Institute*, x. p. 213) that there is still more to be learned, some of which may throw further light on the affinities of the birds of the extinct genus *Aptornis*. (A. N.)

ODDFELLOWS, a name adopted by the members of certain social institutions having mystic signs of recognition, initiatory rites and ceremonies, and various grades of dignity and honour. The objects the associations have in view are purely social and benevolent; the sphere of their operations is confined wholly to their own members, and secrecy is enjoined in regard to all benevolent acts. As in the case of most other institutions of a similar kind, a claim of venerable antiquity has been set up for the order of Oddfellows,—the most common account of its origin ascribing it to the Jewish legion under Titus, who, it is asserted, received from that emperor its first charter written on a golden tablet. Statements even more improbable and fantastic have been made regarding its foundation, but Oddfellows themselves now generally admit that the institution cannot be traced to an earlier period than the first half of the 18th century, and explain the name as adopted at a time when the severance into sects and classes was so wide that persons aiming at social union and mutual help were a marked exception to the general rule. Mention is made by Defoe of the society of Oddfellows, but the oldest lodge of which the name has been handed down is the Loyal Aristarcus, No. 9, which met in 1745 "at the Oakley Arms, Borough of Southwark; Globe Tavern, Hatton Garden; or the Boar's Head in Smithfield, as the noble master may direct." The earliest lodges were supported by each member and visitor paying a penny to the secretary on entering the lodge, and special sums were voted to any brother in need. If out of work he was supplied with a card and funds to reach the next lodge, and he went from lodge to lodge until he found employment. Now there is a regular system of periodical dues and collections, with occasional fees proportioned to the dignities or degrees conferred in the lodges. At first each lodge was practically independent of the others, and had its own special rules and government, but a close bond of unity gradually grew up between the large majority of the lodges until they adopted a definite common ritual and became confederated under the name of the Patriotic Order. Towards the end of the century many of the lodges were broken up by State prosecutions on the suspicion that their purposes were "seditious," but the society, changing its name and location, continued to exist in a sort of moribund condition, as the Union Order of Oddfellows, until in 1809 several of the members endeavoured to resuscitate its dormant energies. Finding, however, that it was impossible to excite an interest in anything higher than convivial meetings, they in 1813, at a convention in Manchester, formally seceded from the Union Order and formed the Independent Order of Oddfellows, Manchester Unity, which increased with enormous rapidity, and now overshadows all the minor societies in England. According to the *Oddfellows' Magazine* for October 1883, the membership of the order in 1834 was 32,832, which in 1837 had increased to 80,570 and in 1845 to 239,374, while in January 1883 the numbers had risen to 565,368, the lodges amounting to 4251. In 1881 the receipts were £761,695, the payments £531,335, and the capital £5,291,891. In 1850 the society was legalized and recognized by the state in a corporate capacity. The *Oddfellows' Magazine*, issued by the society, and up to October 1883 published quarterly, now appears monthly. In England there are a large number of minor orders of Oddfellows, which either existed before the Manchester Unity, have seceded from it, or have had an independent origin. Among them are the Ancient Independent Order or Kent Unity, Woolwich, 1805, revived 1861; the Nottingham Ancient Imperial Order, 1812; the London Unity, 1820; the Boston Unity, 1832; the Kingston Unity, 1840; the Norfolk and Norwich Unity, 1849; and the Derby Midland United Order, 1856.

Oddfellowship was introduced into the United States from the Manchester Unity in 1819, and the grand lodge of Maryland and the United States was constituted 22d February 1821. At first the progress of the order was slow, but, as may be supposed from the social characteristics and proclivities of the Americans, as soon as it had gained a firm hold its principles spread with great rapidity, and it now rivals in membership and influence the Manchester Unity, from which it severed its connexion in 1842. In 1843 it issued a dispensation for opening the Prince of Wales Lodge No. 1 at Montreal, Canada. The American society, including Canada and the United States, has its headquarters at Baltimore. In 1882 the membership was said to be 500,000, the income 6,000,000 dollars, and the annual sum disbursed for the relief of members of the order 2,000,000 dollars. Organizations, connected either with the United States or England, have been founded in Germany, Switzerland, Gibraltar and Malta, Australia, New Zealand, the Fiji Islands, the Hawaiian Islands, South Africa, South America, the West Indies, and Barbados.

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[1] As before stated (NESTOR, p. 354 *ante*), the younger Forster remarked that the birds of Norfolk Island, though believed by the other naturalists of Cook's ship to be generally the same as those of New Zealand, were distinguished by their brighter colouring. There can now be little doubt that all the land-birds were specifically distinct. It seems to be just possible that Sparrman's *R. australis*, which cannot be very confidently referred to any known species of *Ocydromus*, may have been from Norfolk Island; but there is little probability of the point ever being determined, though it seems to be worth the attention of ornithologists.

The rules of the different societies, various song-books, and a number of minor books on Oddfellowship have been published, but the most complete and trustworthy account of the institution is that in *The Complete Manual of Oddfellowship, its History, Principles, Ceremonies, and Symbolism*, privately printed, 1879.

ODENATHUS, or ODÆNATHUS (Ὀδαίναθος, אדינת), prince of Palmyra. See PALMYRA and PERSIA.

ODENSE, a city of Denmark, the chief town of the province of the same name, forming the northern part of the island of Fünen (Fyen), lies about 4 miles from Odense Fjord on the Odense Aa, the main portion on the north side of the stream and the modern Albani quarter on the south side. It is a station on the railway route between Copenhagen and western Denmark, and a ship canal 10 feet deep constructed in 1796-1804 affords direct communication with the sea. St Canute's Church, formerly connected with the great Benedictine monastery of the same name, is one of the largest and finest edifices of its kind in Denmark. It is constructed of brick in a pure Gothic style. Originally dating from 1081-93, it was rebuilt in the 13th century, and has been restored since 1864. Under the altar lies Canute, the patron saint of Denmark, who intended to dispute with William of Normandy the possession of England, but was slain in an insurrection at Odense in 1086; Kings John and Christian II. are also buried within the walls. Our Lady's Church, built in the 13th century and restored in 1851-52 and again in 1864, contains a fine carved altar-piece by Claus Berg of Lübeck. Odense castle was erected by Frederick IV., who died there in 1730. The provincial infirmary (1862), the new post-office, the Franciscan hospital, presented to Fünen in 1539 by King Christian III., Frederick VII.'s foundation (1862), the episcopal library (25,000 volumes), and Karen Brahe's library may also be mentioned. As an industrial town Odense has made great progress since the middle of the century; besides a large number of breweries and distilleries, it contains glove-factories, match works, mineral-water works, tobacco-factories, chemical works, &c. The population was 5782 in 1801, 11,122 in 1850, 16,970 in 1870, and 20,804 in 1880.

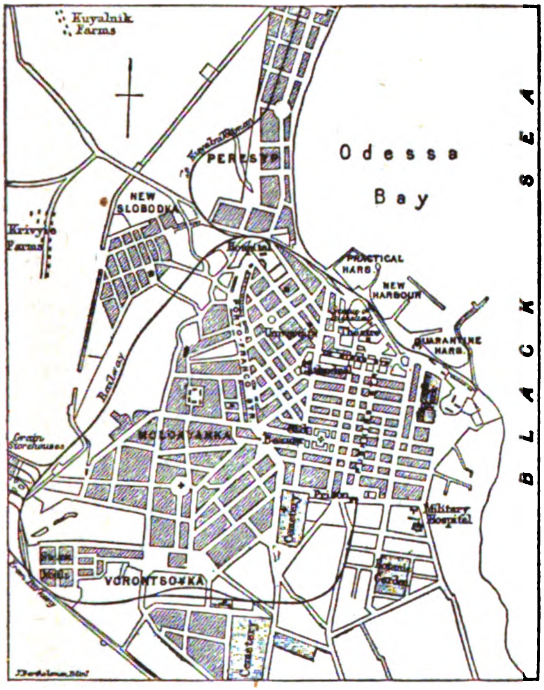
Odense, or Odinsey, originally Odinsve, *i.e.*, Odin's sanctuary, is one of the oldest, as it has long been one of the most important, cities of Scandinavia. St Canute's shrine was a great resort of pilgrims throughout the Middle Ages. In the 16th century the town was the meeting-place of several parliaments, and down to 1805 it was the seat of the provincial assembly of Fünen. It was the first place in Denmark to introduce gas-light (in the close of 1853). Hans Andersen was born in Odense, and Kingo, the Danish hymn-writer, was bishop of the diocese. Paludan-Müller, a native of the neighbouring town of Kjerteminde, was educated in the Odense cathedral school.

ODER (Latin, *Viadrus*; Slavonic, *Vjodr*), one of the principal rivers of Germany, rises on the Odergebirge in the Moravian tableland, in 49° 43′ N. lat. and 17° 35′ E. long., at a height of 1950 feet above the sea, and 14 miles to the east of Olmütz. It is 550 miles long from its source to its mouth in the Baltic Sea, and drains an area of about 50,000 square miles. The first 45 miles of its course lie within Moravia; for the next 15 it forms the frontier between Prussian and Austrian Silesia; while the remaining 490 miles belong to Prussia, where it traverses the provinces of Silesia, Brandenburg, and Pomerania. It flows at first towards the south-east, but on quitting Austria turns towards the north-west, maintaining this direction as far as Frankfort, beyond which its general course is nearly due north. As far as the frontier the Oder flows through a well-defined valley, but, after passing through the gap between the Moravian mountains and the Carpathians and entering the Silesian plain, its valley is wide and shallow and its banks generally low. In its lower course it is divided into numerous branches, forming a large quantity of islands. The main channel follows the left side of the valley and finally expands into the Pommersche or Stettiner Haff, which is connected with the sea by three arms, the Peene, the Swine, and the Dievenow, forming the islands of Usedom and Wollin. The Swine, in the middle, is the main channel for navigation. The chief tributaries of the Oder on the left bank are the Oppa, Glatz Neisse, Katzbach, Bober, and Lausitz Neisse; on the right bank the Malapane, Bartsch, Faule Obra, and Warthe. Of these the only one of importance for navigation is the Warthe, which through the Netze is brought into communication with the Vistula. The Oder is also connected by canals with the Havel and the Spree. The most important towns on its banks are Ratibor, Oppeln, Brieg, Breslau, Glogau, Frankfort, Cüstrin, and Stettin, with the seaport of Swinemünde at its mouth. Glogau and Cüstrin are strongly fortified, and Swinemünde is also defended by a few forts.

The navigation of the Oder is rendered somewhat difficult by the rapid fall of its upper course, amounting above Brieg to 2 feet per mile, and by the enormous quantities of débris brought into it by its numerous mountain tributaries. The German authorities, however, have been unwearied in their efforts to improve the channel, and have now succeeded in securing a minimum depth of 3 feet at low water throughout almost the whole of the Prussian part of the river. Their most important undertaking was the diversion of the river into a new and straight channel in the Oderbruch below Frankfort, by which an extensive detour was cut off and a large tract of swampy country brought under cultivation. The Oder at present begins to be navigable for barges at Ratibor, where it is about 100 feet wide, but the navigable channel will probably soon extend upwards to Oderberg. Sea-going vessels cannot go beyond Stettin. A second Oder-Spree canal, leaving the Oder opposite the mouth of the Warthe and joining the Spree near Berlin, has been determined on; and a canal connecting the Oder and the Danube has also been planned. The traffic on the Oder, which is steadily increasing, is mainly concerned with agricultural produce and timber. Some idea of its extent may be gathered from the fact that 280 river-steamers and 2800 other vessels passed through the Oderbruch (up and down) in 1881 with cargoes amounting in all to 166,500 tons. The river is here about 750 feet wide and 8 feet deep. The fishing is important, particularly in the neighbourhood of Stettin.

Those interested in river navigation or engineering may be referred to the following works: Becker, *Zur Kenntniss der Oder und ihres Flächengebiets* (1868); "Die Deutschen Wasserstrassen" in the *Statistik des Deutschen Reiches* for 1874; Hasse, *Regulation der deutschen Hauptströme* (Breslau, 1880).

ODESSA, one of the most important seaports of Russia, ranks in the empire by its population (225,000) and foreign trade after St Petersburg, Moscow, and Warsaw. It is situated in 46° 28′ N. lat. and 30° 44′ E. long., on the southern shore of a semicircular bay, at the north-western angle of the Black Sea, and is 933 miles distant from Moscow and 403 miles from Kieff. Odessa is the proper seaport for the basins of two great rivers of Russia, the Dnieper, with its tributary the Bug, and the Dniester; the entrances to the mouths of both these offering many difficulties for navigation, trade has from the remotest antiquity selected this spot, which is situated half-way between the estuaries, while the flat ground of the neighbouring steppe allows easy communication with the lower parts of both rivers. The *limans* or lagoons of Haji-bey and Kuyalnik, which penetrate far inland from the neighbourhood of Odessa, are separated from the sea by flat sandy isthmuses. The bay of Odessa, which has an area of 14 square miles and a depth of 30 feet, with a soft bottom, is a dangerous anchorage on account of its exposure to easterly winds. The ships lie, therefore, in two harbours, both protected by moles,—the "quarantine harbour," from 4 to 21 feet deep, and the so-called "practical harbour," for coasting vessels, with a maximum depth of 11 feet. A new one, 1100 yards long and 660 yards wide, was constructed a few years ago. The harbours freeze for a few days in winter, as also does the bay itself occasionally, navigation being interrupted every year for an average of sixteen days. Odessa experiences the influence of the continental climate of the neighbouring steppes; its winters are cold (the average temperature for January being 23°·2, and the isotherm for the entire season that of Königsberg), its summers are hot (72°·8 in July), and the yearly average temperature is 48°·5. The rainfall is scanty (ninety-two rainy days, with 14 inches of rain per annum); and one of the plagues of the city is the chalky dust, which is raised in clouds by the strong winds to which it is exposed. The city is built on a terrace from 100 to 150 feet in height, which descends by steep crags to the sea, and on the other side is continuous with the level of the steppe, which is covered with a layer of "black earth"; the subsoil consists of clay, gravel, and a soft Tertiary sandstone, which is used for building, but readily disintegrates under atmospheric agencies. Catacombs whence this sandstone has been taken extend underneath the town and the suburbs, not without some danger to the buildings. The water-supply is inadequate. Drinking-water was formerly shipped from the Crimea, and the poorer classes had to supply themselves from cisterns and bad wells. An aqueduct, 27 miles long, now brings water from Mayaki on the Dniester.



Plan of Odessa.

The general aspect of Odessa is that of a wealthy west-European city. Its chief embankment, bordered with tall and handsome houses, forms a fine promenade; a superb flight of steps descends to the sea from its central square, which is adorned with a statue of Richelieu. The central parts of the city have broad streets and squares, bordered with fine buildings and mansions in the Italian style, and with good shops. But even on the best streets poor houses surrounded with open yards occur side by side with richly-decorated palaces; and in close association with elegant carriages and rich dresses one sees the open car of the peasant and the dirty dress of the Jew or the Bulgarian. The cathedral, finished in 1849, can accommodate 5000 persons; it contains the tomb of Count Worontzoff, a former governor-general, who contributed much towards the development and embellishment of the city. The "Palais Royal," with its parterre and fountains, and the spacious public park are fine pleasure-grounds, whilst in the ravines that descend to the sea the dirty houses of the poorer classes are massed. The shore is occupied by immense granaries, some of which look like palaces, and large storehouses take up a broad space in the west of the city. Odessa, which has a circumference of 6 miles, consists of the city proper, containing the old fort (now a quarantine establishment) and surrounded by a boulevard, where was formerly a wall marking the limits of the free port, of the suburbs Novaya and Peresyp, extending northward along the lower shore of the bay, and of Moldavanka to the south-west. A number of villas and cottages surround the city: the German colonies Liebenthal and Lustdorf are bathing-places.

Odessa is the real capital, intellectual and commercial, of the so-called Novorossia, which includes the governments of Bessarabia and Kherson. In the official subdivision of Russia it is only the chief town of the district of the same name in the government of Kherson. It constitutes at the same time an independent "municipal district" or captaincy (*gradonachalstvo*), which covers 182 square miles and includes a dozen villages, some of which have from 2000 to 3000 inhabitants. Odessa, like St Petersburg and Moscow, received in 1863 a new municipal constitution, with an elective mayor, municipal assembly, and executive council. It is also the chief town of the Novorossian educational district, and has a university, which replaced Richelieu Lyceum in 1865, and now has about 400 students. The young scientific society at the university is very active in investigating the natural history of southern Russia and of the Black Sea, and has already published some valuable *Transactions*. There are also an historical society with a museum containing rich collections from the Hellenic, Genoese, Venetian, and Mongolo-Tatar periods of the history of the Black Sea coast, a society of agriculture, a public library, and many educational institutions.

The population of Odessa is rapidly increasing. In 1814, twenty years after its foundation, it had 25,000 inhabitants; this figure steadily grew in succeeding years, Worontzoff allowing all sorts of people, runaway serfs included, to settle in the steppes of Bessarabia and Kherson, while at the same time the privileges of a free port, granted in 1817 and abolished only in 1857, attracted great numbers of merchants of all nationalities. In 1850 Odessa had 100,000 inhabitants, 185,000 in 1873, and at present (1884) the number exceeds 225,000. Of these the great majority are Great Russians and Little Russians; but there are also large numbers of Jews (67,000, exclusive of Karaites, against 50,000 in 1873), as well as of Italians, Greeks, Germans, and French (to which nationalities the chief merchants belong), as also of Roumanians, Servians, Bulgarians, Tatars, Armenians, Lazes, Georgians, &c. These nationalities do not live in perfect harmony, and the continual commercial antagonism between the Greeks and the Jews often leads to scenes of disorder. A numerous floating population of labourers, attracted at certain periods by pressing work in the port, and afterwards left unemployed owing to the enormous fluctuations in the corn trade, is one of the features of Odessa. It is estimated that there are no less than 35,000 people living from hand to mouth in the utmost misery, partly in the extensive labyrinth of the catacombs beneath the city.

The leading occupations of the inhabitants are connected with exporting, shipping, and manufactures. These latter have extended rapidly within the last twenty years, but their aggregate production (in the *gradonachalstvo* of Odessa) does not exceed 20,000,000 roubles (about £2,000,000). To this total the principal items are contributed by the steam flour-mills (about £650,000 in 1879), the manufacture of tobacco (£200,000) and of machinery (£200,000), after which come tanneries, soap-works, chemical-works, biscuit-factories, rope-works, and carriage-works. The foreign trade, chiefly in corn, has immensely increased of late, since Odessa was brought into railway communication with central Russia. Grain was exported in 1880 to the amount of 1,040,400 quarters (2,445,120 quarters in 1878). This figure is subject, however, to great fluctuations. The other articles of export are flour, wool, tallow, hides, cattle (about 140,000 head), soap, ropes, and spirits, the value of the aggregate amount of exports reaching 42,000,000 roubles in 1880, against 65,000,000 roubles in 1879, and 85,815,000 in 1878. The chief articles of import are tea (£1,600,000 in 1881), coffee, rice, cotton, tobacco, coal, oil, leather, paper, fruits, wine, and all kinds of manufactured ware, for an aggregate sum of 47,775,000 roubles in 1880. Odessa also carries on a brisk trade with other seaports of Russia, and, besides the 1508 ships (282 Russian and 650 English) engaged in foreign trade which entered the port of Odessa in 1879, it was visited by 2700 coasting vessels. Odessa is in regular steam communication with all the chief ports of the Black Sea and the Mediterranean, as also with London. The Russian Navigation Company sends its steamers by the Suez Canal to Chinese, Indian, and Russian Pacific ports, and has a numerous fleet on the Dnieper, Dniester, and Bug. The commercial fleet of Odessa in 1880 numbered 101 steamers (44,000 tons) and 178 sailing ships (19,800 tons). The total revenue of the town in 1882 was 1,938,000 roubles, and the expenditure 1,883,000 roubles,—the chief items being, for charitable institutions 434,000 roubles, for the army 213,000, for administration and police 309,000, and for public instruction 138,000.

History.—The bay of Odessa was colonized by Greeks at a very early period, and their ports—Istrianorum Portus and Isiacorum Portus on the shores of the bay, and Odessus and the modern Skopeli at the mouth of the Tiligul *liman*—carried on a lively trade with the neighbouring steppes. These towns disappeared in the 3d and 4th centuries, leaving nothing but heaps of ruins; and for ten centuries thenceforward no settlements in these tracts are mentioned. All that is known is that in the 6th century the space between the mouths of the Dnieper and the Dniester was occupied by the Antes, and in the 9th century by the Tivertsy, both of Slavonian origin. In the 14th century this region belonged to the Lithuanians, and in 1396 Olgerd defeated in battle three Tatar chiefs, one of whom, Bek-Haji, had recently founded, at the place now occupied by Odessa, a fort which received his name. The Lithuanians, and subsequently the Poles, kept the country under their dominion until the 16th century, when it was seized by the Tatars, who still permitted, however, the Lithuanians to gather salt in the neighbouring lakes. Later on the Turks left a garrison at Haji-bey, and founded in 1764 the fortress Yanidunia. In 1769 the Zaporog Cossacks made a raid on Haji-bey and burned its suburbs, but could not take the fort; and, after the destruction of the Zaporojskaya Sech, the runaway Zaporogians settled close by Haji-bey in what is now the "quarantine ravine." In 1787 the Cossack leader Chepega again attacked Haji-bey and burned all its storehouses, and two years later the Russians, under the French captain De Ribas, took the fortress by assault. In 1791 Haji-bey and the Otchakoff region were conceded to Russia. De Ribas and the French engineer Voland were entrusted in 1794 with the erection of a town and the construction of a port at Haji-bey; the former was allowed to distribute about 100,000 acres of land freely to new settlers, and two years later Haji-bey, renamed Odessa, had 3153 permanent inhabitants, besides the military, and was visited by 86 foreign vessels. In 1803 Odessa became the chief town of a separate municipal district or captaincy, the first captain being the duke of Richelieu, who did very much for the development of the young city and its improvement as a seaport. In 1824 Odessa became the seat of the governors-general of Novorossia and Bessarabia. Since that time it has steadily increased its foreign trade and extended its commercial relations. In 1866 it was brought into railway connexion with Kieff and Kharkoff *via* Balta, and with Jassy in Roumania. (P. A. K.)

ODEYPOOR, or **Udaipur**. See Chutia Nagpur, vol. v. p. 768.

ODIN, or **Wodan**. See Germany, vol. x. p. 474, and Mythology, above, p. 156.

ODOACER, or **Odovacar** (*c.* 434-493), the first barbarian ruler of Italy on the downfall of the Western empire, was born in the district bordering on the middle Danube about the year 434. In this district the once rich and fertile provinces of Noricum and Pannonia were being torn piecemeal from the Roman empire by a crowd of German tribes, among whom we discern four, who seem to have hovered over the Danube from Passau to Pesth, namely, the Rugii, Scyrri, Turcilingi, and Heruli. With all of these Odoacer was connected by his subsequent career, and all seem, more or less, to have claimed him as belonging to them by birth; the evidence slightly preponderates in favour of his descent from the Scyrri.

His father was Ædico or Idico, a name which suggests Edeco the Hun, who was suborned by the Byzantine court to plot the assassination of his master Attila. There are, however, some strong arguments against this identification. A certain Edica, chief of the Scyrri, of whom Jordanes speaks as defeated by the Ostrogoths, may more probably have been the father of Odoacer, though even in this theory there are some difficulties, chiefly connected with the low estate in which he appears before us in the next scene of his life, when as a tall young recruit for the Roman armies, dressed in a sordid vesture of skins, on his way to Italy, he enters the cell of Severinus, a noted hermit-saint of Noricum, to ask his blessing. The saint had an inward premonition of his future greatness, and in blessing him said, "Fare onward into Italy. Thou who art now clothed in vile raiment wilt soon give precious gifts unto many."

Odoacer was probably about thirty years of age when he thus left his country and entered the imperial service. By the year 472 he had risen to some eminence, since it is expressly recorded that he sided with the patrician Ricimer in his quarrel with the emperor Anthemius. In the year 475, by one of the endless revolutions which marked the close of the Western empire, the emperor Nepos was driven into exile, and the successful rebel Orestes was enabled to array in the purple his son, a handsome boy of fourteen or fifteen, who was named Romulus after his grandfather, and nicknamed Augustulus, from his inability to play the part of the great Augustus. Before this puppet emperor had been a year on the throne the barbarian mercenaries, who were chiefly drawn from the Danubian tribes before mentioned, rose in mutiny, demanding to be made proprietors of one-third of the soil of Italy. To this request Orestes returned a peremptory negative. Odoacer now offered his fellow-soldiers to obtain for them all that they desired if they would seat him on the throne. On the 23d August 476 he was proclaimed king; five days later Orestes was made prisoner at Placentia and beheaded; and on the 4th September his brother Paulus was defeated and slain in the pine-wood near Ravenna. Rome at once accepted the new ruler. Augustulus was compelled to descend from the throne, but his life was spared.

Odoacer was forty-two years of age when he thus became chief ruler of Italy, and he reigned thirteen years with undisputed sway. Our information as to this period is very slender, but we can perceive that the administration was conducted as much as possible on the lines of the old imperial government. The settlement of the barbarian soldiers on the lands of Italy probably affected the great landowners rather than the labouring class. To the herd of *coloni* and *servi*, by whom in their various degrees the land was actually cultivated, it probably made little difference, except as a matter of sentiment, whether the master whom they served called himself Roman or Rugian. We have one most interesting example, though in a small way, of such a transfer of land with its appurtenant slaves and cattle, in the donation made by Odoacer himself to his faithful follower Pierius.[1] Few things bring more vividly before the reader the continuity of legal and social life in the midst of the tremendous ethnical changes of the 5th century than the perusal of such a record.

The same fact, from a slightly different point of view, is illustrated by the curious history (recorded by Malchus) of the embassies to Constantinople. The dethroned emperor Nepos sent ambassadors (in 477 or 478) to Zeno emperor of the East, begging his aid in the reconquest of Italy. These ambassadors met a deputation from the Roman senate, sent nominally by the command of Augustulus, really no doubt by that of Odoacer, the purport of whose commission was that they did not need a separate emperor. One was sufficient to defend the borders of either realm. The senate had chosen Odoacer, whose knowledge of military affairs and whose statesmanship admirably fitted him for preserving order in that part of the world, and they therefore prayed Zeno to confer upon him the dignity of patrician, and entrust the "diocese" of Italy to his care. Zeno returned a harsh answer to the senate, requiring them to return to their allegiance to Nepos. In fact, however, he did nothing for the fallen emperor, but accepted the new order of things, and even addressed Odoacer as patrician. On the other hand, the latter sent the ornaments of empire, the diadem and purple robe, to Constantinople as an acknowledgment of the fact that he did not claim supreme power. Our information as to the actual title assumed by the new ruler is somewhat confused. He does not appear to have called himself king of Italy. His kingship seems to have marked only his relation to his Teutonic followers, among whom he was "king of the Turcilingi," "king of the Heruli," and so forth, according to the nationality with which he was dealing. By the Roman inhabitants of Italy he was addressed as "dominus noster," but his right to exercise power would in their eyes rest, in theory, on his recognition as patricius by the Byzantine Augustus. At the same time, he marked his own high pretensions by assuming the prefix Flavius, a reminiscence of the early emperors, to which the barbarian rulers of realms formed out of the Roman state seem to have been peculiarly partial. His internal administration was probably, upon the whole, wise and moderate, though we hear some complaints of financial oppression, and he may be looked upon as a not altogether unworthy predecessor of Theodoric.

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[1] Published in Marini's *Papiri Diplomatici* (Rome, 1815, Nos. 82 and 83) and in Spangenberg's *Juris Romani Tabulæ* (Leipsic, 1822, pp. 164-173), and well worthy of careful study.

In the history of the papacy Odoacer figures as the author of a decree promulgated at the election of Felix II. in 483, forbidding the pope to alienate any of the lands or ornaments of the Roman Church, and threatening any pope who should infringe this edict with anathema. This decree, a strange one to proceed from an Arian sovereign, was probably suggested by some of the Roman counsellors of the king, and seems to have been accepted at the time without protest. It was, however, loudly condemned in a synod held by Pope Symmachus (502) as an unwarrantable interference of the civil power with the concerns of the church.

The chief events in the foreign policy of Odoacer were his Dalmatian and Rugian wars. In the year 480 the ex-emperor Nepos, who ruled Dalmatia, was traitorously assassinated in Diocletian's palace at Spalato by the counts Viator and Ovida. In the following year Odoacer invaded Dalmatia, slew the murderer Ovida, and reannexed Dalmatia to the Western state. In 487 he appeared as an invader in his own native Danubian lands. War broke out between him and Feletheus, king of the Rugians. Odoacer entered the Rugian territory, defeated Feletheus, and carried him and "his noxious wife" Gisa prisoners to Ravenna. In the following year Frederick, son of the captive king, endeavoured to raise again the fallen fortunes of his house, but was defeated by Onulf, brother of Odoacer, and, being forced to flee, took refuge at the court of Theodoric the Ostrogoth, at Sistova on the lower Danube.

This Rugian war was probably an indirect cause of the fall of Odoacer. His increasing power rendered him too formidable to the Byzantine court, with whom his relations had for some time been growing less friendly. At the same time, Zeno was embarrassed by the formidable neighbourhood of Theodoric and his Ostrogothic warriors, who were almost equally burdensome as enemies or as allies. In these circumstances arose the plan of Theodoric's invasion of Italy, a plan by whom originated it would be difficult to say. Whether the land when conquered was to be held by the Ostrogoth in full sovereignty, or administered by him as lieutenant of Zeno, is a point upon which our information is ambiguous, and which was perhaps intentionally left vague by the two contracting parties, whose chief anxiety was not to see one another's faces again. The details of the Ostrogothic invasion of Italy belong properly to the life of Theodoric. It is sufficient to state here that he entered Italy in August 489, defeated Odoacer at the Isontius (Isonzo) on the 28th of August, and at Verona on the 30th of September. Odoacer then shut himself up in Ravenna, and there maintained himself for four years, with one brief gleam of success, during which he emerged from his hiding-place and fought the battle of the Addua (11th August 490), in which he was again defeated. A sally from Ravenna (10th July 491) was again the occasion of a murderous defeat. At length, the famine in Ravenna having become almost intolerable, and the Goths despairing of ever taking the city by assault, negotiations were opened for a compromise (25th February 493). John, archbishop of Ravenna, acted as mediator. It was stipulated that Ravenna should be surrendered, that Odoacer's life should be spared, and that he and Theodoric should be recognized as joint rulers of the Roman state. The arrangement was evidently a precarious one, and was soon terminated by the treachery of Theodoric. He invited his rival to a banquet in the palace of the Lauretum on the 15th of March, and there slew him with his own hand. "Where is God?" cried Odoacer when he perceived the ambush into which he had fallen. "Thus didst thou deal with my kinsmen," shouted Theodoric, and clove his rival with the broadsword from shoulder to flank. Onulf, the brother of the murdered king, was shot down while attempting to escape through the palace garden, and Thelan, his son, was not long after put to death by order of the conqueror. Thus perished the whole race of Odoacer.

Literature.—The chief authorities for the life of Odoacer are the so-called "Anonymus Valesii," generally printed at the end of Ammianus Marcellinus; the *Life of Severinus*, by Eugippius; the chroniclers, Cassiodorus and "Cuspiniani Anonymus" (both in Roncalli's collection); and the Byzantine historians, Malchus and John of Antioch. A fragment of the latter historian, unknown when Gibbon wrote, is to be found in the fifth volume of Müller's *Fragmenta Historicorum Græcorum*. Among modern students, Pallmann (*Geschichte der Volkerwanderung*, vol. ii.) has investigated the history of Odoacer the most thoroughly. (T. H.)

O'DONNELL. (1) HENRY JOSEPH (1769-1834), count of La Bisbal, a native of Spain, was descended from the O'Donnells who left Ireland after the battle of the Boyne;[1] he early entered the Spanish army, and in 1810 became general, receiving a command in Catalonia, where in that year he earned his title and the rank of field-marshal. Henry Joseph afterwards held posts of great responsibility under Ferdinand VII., whom he served on the whole with constancy; the events of 1823 compelled his flight into France, where he was interned at Limoges, and where he died in 1834. (2) LEOPOLD (1809-1867), Duke of Tetuan, Spanish general and statesman, the second son of Henry Joseph O'Donnell, was born at Santa Cruz, Teneriffe, on 12th January 1809. He fought in the army of Queen Christina, where he attained the rank of general of division; and in 1840 he accompanied the queen into exile. He failed in an attempt to effect a rising in her favour at Pamplona in 1841, but took a more successful part in the movement which led to the overthrow and exile of Espartero in 1843. From 1844 to 1848 he served the new Government in Cuba; after his return he entered the senate. In 1854 he became war minister under Espartero, and in 1856 he plotted successfully against his chief, becoming head of the cabinet from the July revolution until October. This rank he again reached in July 1858; and in December 1859 he took command of the expedition to Morocco, and received the title of duke after the surrender of Tetuan. Quitting office in 1863, he again resumed it in June 1865, but was compelled to resign in favour of Narvaez in 1866. He died at Bayonne on 5th November 1867.

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[1] A branch of the family settled in Austria, and General Karl O'Donnell, count of Tyrconnel (1715-1771), held important commands during the Seven Years' War. The name of a descendant figures in the history of the Italian and Hungarian campaigns of 1848 and 1819.

ODORIC (c. 1286-1331), styled of Pordenone, one of the notable travellers to the farther East in the Middle Ages, and a *Beatus* of the Roman Church, was born at Villa Nuova, a hamlet near the town of Pordenone in Friuli, in or about 1286, and, according to ecclesiastical biographers, in early years took the vows of the Franciscan order and joined their convent at Udine, the capital of Friuli. Under CHINA (vol. v. p. 628) the remarkable opening of communication, both commercial and ecclesiastical, with that country during the first half of the 14th century has been spoken of. There had arisen also during the latter half of the 13th century an energetic missionary action, extending all over the East, on the part of both the new orders of Preaching and Minorite (or Dominican and Franciscan) Friars, and houses of those orders, of the last especially, became established in Persia, in what is now southern Russia, in Tartary, and in China.

Friar Odoric was despatched to the East about 1316-18, and did not return till near 1330, but, as regards intermediate dates, all that we can deduce from his narrative or other evidence is that he was in western India soon after 1321, and that he spent three years in China between 1322 and 1327. His route to the East lay by Constantinople and Trebizond to Erzeroum, and thence to Tabríz and Sultániya, in all of which places the order had houses. From Sultániya he proceeded by Kashán and Yezd, and turning thence followed a somewhat devious route by Persepolis, Shiráz, and Baghdád to the Persian Gulf. At Ormuz he embarked for India, landing at Tana, still the chief station of the island of Salsette, and which was then one of the chief ports of western India. At this city four brethren of his order, three of them Italians and the fourth a Georgian, had shortly before met death at the hands of the Mohammedan governor, who held the place under the dominion of the sovereign of Delhi (then Ghaiás-suddín Tughlak). The bones of the martyred friars had been collected by Friar Jordanus of Severac, a Dominican, who carried them to Supera—the *Suppara* of the ancient geographers, near the modern Bassein, about 26 miles north of Bombay—and buried them there. Odoric tells that he disinterred these relics and carried them with him on his farther travels. In the course of these he visited Malabar, touching at Pandaráni (20 miles north of Calicut), at Cranganore, and at Quilon, proceeding thence, apparently, to Ceylon and to the shrine of St Thomas at Mailapur near Madras. From India he sailed in a Chinese junk to Sumatra, visiting various ports on the northern coast of that island, then Java, the coast (it would seem) of Borneo, Champa (South Cochin China), and Canton, at that time known to western Asiatics as *Chín-Kalán* or Great China (Maháchín). Thence he went on to the great ports of Fuhkeen, at one of which, Zayton or Chwanchow (see CHINCHEW, vol. v. p. 673), he found two houses of his order; in one of these he deposited the bones of the brethren who had suffered in India. From Fu-chau he struck across the mountains into Che-keang and visited Hang-chow, then renowned under the name of *Cansay* ("King-sze," or royal residence) as one of the greatest cities in the world, of the splendours of which Marco Polo, Ibn Batuta, and others have given such notable details. Passing northward by Nan-king and crossing the Great Kiang, Odoric embarked on the Great Canal and travelled to CAMBALUC or Peking, where he remained for three years, attached, no doubt, to one of the churches founded by Archbishop John of Monte Corvino, at this time in extreme old age. Turning westward in the neighbourhood of the Great Wall and through Shensi, the adventurous traveller entered Tibet, and appears to have visited Lhasa. But no distinct indication of his homeward route is given, though it may be gathered from fragmentary notices that he passed through Khorasan, and so probably by Tabríz to Europe, reaching Venice in the end of 1329 or beginning of 1330. During a part at least of these long journeys the companion of Odoric was Friar James, an Irishman, as appears from a record in the public books of Udine, showing that shortly after Odoric's death a present of two marks was made to this Irish friar, *Socio beati Odorici, amore Dei et Odorici*. Shortly after his return Odoric betook himself to the Minorite house attached to St Antony's at Padua, and it was there that in May 1330 he related the story of his travels, which was taken down in homely Latin by Friar William of Solagna. Travelling towards the papal court at Avignon, Odoric fell ill at Pisa, and, turning back to Udine, the capital of his native province, died in the convent there, 14th January 1331. The fame of his vast journeys appears to have made a much greater impression on the laity of his native territory than on his Franciscan brethren. The latter were about to bury him without delay or ceremony, but the "gastald" or chief magistrate of the city interfered and appointed a public funeral; rumours of his wondrous travels, and of posthumous miracles were diffused, and excitement spread like wildfire over Friuli and Carniola; the ceremony had to be deferred more than once, and at last took place in presence of the patriarch of Aquileia and all the local dignitaries. The sanctity of Odoric was now fully recognized, and was taken up at last by his own community, who employed an eminent preacher to declaim to the people the history and pious deeds of this brother, whom they probably had regarded till now only as an eccentric, who told questionable stories about the Grand Cham and islands of the anthropophagi. Popular acclamation made him an object of devotion, the municipality erected a noble shrine for his body, his fame as saint and traveller had spread far and wide before the middle of the century, but it was not till four centuries later (1755) that the papal authority formally sanctioned his beatification. A bust of Odoric was set up at Pordenone in 1881.

The numerous MSS. of Odoric's narrative that have come down to our time (upwards of forty are known), and chiefly from the 14th century, show how speedily and widely it acquired popularity. It does not deserve the charge of general mendacity brought against it by some, though the language of other writers, who have spoken of the traveller as a man of learning, is still more injudicious. Like most of the mediæval travellers, he is indiscriminating in accepting strange tales; but, whilst some of these are the habitual stories of the age, many particulars which he relates attest the genuine character of the narrative, and some of those which Tiraboschi and others have condemned as mendacious interpolations are the very seals of truth. Odoric's credit was not benefited by the liberties which Sir John Mandeville took with it. The substance of that knight's alleged travels in India and Cathay is stolen in bulk from Odoric, though largely amplified with fables from other sources and from his own invention, and garnished with his own unusually clear astronomical notions. We may indicate a few passages which stamp Odoric as a genuine and original traveller. He is the first European who distinctly mentions the name of Sumatra. The cannibalism and community of wives which he attributes to certain races of that island do certainly belong to it, or to islands closely adjoining. His description of sago in the archipelago is not free from errors, but they are the errors of an eye-witness. In China his mention of Canton by the name of Chín-Kalán, his description of the custom of fishing with tame cormorants, of the habit of letting the finger-nails grow extravagantly, and of the compression of women's feet, as well as of the division of the empire into twelve, provinces, with four chief ministers, are all peculiar to him among the travellers of that age; Marco Polo omits them all.

The narrative was first printed at Pesaro in 1513, in what Apostolo Zeno calls *lingua inculta e rozza*, probably, therefore, in a Venetian dialect. Ramusio's collection first contains it in the 2d vol. of the 2d edition (1574), in which are given two versions, differing curiously from one another, but without any prefatory matter or explanation. Another (Latin) version is given in the *Acta Sanctorum* (Bollandist) under 14th January. The curious discussion before the papal court respecting the beatification of Odoric forms a kind of blue-book issued *ex typographia rev. cameræ apostolicæ*, Rome, 1755. Professor Kunstmann of Munich devoted one of his valuable papers to Odoric's narrative (*Histor.-Polit. Blättern von Phillips und Görres*, vol. xxxviii.). The collection called *Cathay and the Way Thither*, by Colonel Yule (Hak. Soc., 1866), contains a careful translation and commentary, &c. A new edition in Italian has been recently issued in Italy, but it is not of value. (H. Y.)

ODYSSEUS is of all the Greek heroes the most typical representative of the Greek race. The quality on which he prides himself (*Od.*, ix. 19) is his cunning and ready wit; his inventive genius never fails in the greatest danger. But his cunning is not of the narrow kind that is incompatible with real wisdom; he is not troubled by scruples, but he uses nobly and liberally a power that he has acquired by craft; he is fond of adventure and yet full of prudence, very cautious and yet in case of need brave. It is a character that in the hands of Homer is very fine, but which in those of almost all other writers becomes repulsive. He was son of Laertes and Anticleia, and king of Ithaca, a small rocky island on the western side of Greece. He married Penelope, but very soon after his marriage he was summoned to the Trojan war. Unwilling to go, he feigned madness, yoked an ox and a horse together, but Palamedes discovered his deceit by means of his care for his infant child Telemachus; afterwards Odysseus revenged himself by compassing the death of Palamedes. Obliged to go to the war, he distinguished himself as the wisest councillor of the Greeks, and finally, the capture of Troy, which the bravery of Achilles could not accomplish, was attained by Odysseus's stratagem of the wooden horse. After the death of Achilles the Greeks adjudged his armour to Odysseus as the man who had done most to make the war successful. When Troy was captured he set sail for Ithaca, but was carried by unfavourable winds to the coast of Africa. After encountering many adventures in all parts of the unknown seas, among the lotus-eaters and the Cyclopes, in the isles of Æolus and Circe and the perils of Scylla and Charybdis, among the Læstrygons, and even in the world of the dead, having lost all his ships and companions, he barely escaped with his own life to the island of Calypso, where he was detained eight years, an unwilling lover of the beautiful nymph. Then at the command of Zeus he was sent homewards, but was again wrecked on the island of Phæacia, whence he was conveyed to Ithaca in one of the wondrous Phæacian ships. Here he found that a host of suitors, taking advantage of the youth of his son Telemachus, were wasting his property and trying to force Penelope to marry one of them. The stratagems and disguises by which he with a few faithful friends slew the suitors are described at length in the *Odyssey*.

There is no doubt that the personality of Odysseus developed out of some germ in primitive religious myth; but it is almost hopeless to seek for the early form, so completely has it been transformed. In many heroes of poetry and mythology the chief interest lies in tracing the growth of the conception from the divine form of early religion to the Greek hero of poetry; but in the case of Odysseus the supreme interest attaches to the perfect form as it appears in Homer, the typical representative of the old sailor-race whose adventurous voyages educated and moulded the Hellenic race. The period when the character of Odysseus grew among the Ionian bards was when the Ionian ships were beginning to penetrate to the farthest shores of the Black Sea, and to the western side of Italy, but when Egypt had not yet been freely opened to foreign intercourse by Psammetichus and his successors. The tale of Odysseus gives us the form in which the voyages, the perils, the strange races of foreign lands, and the rich spoils of the sailors were mirrored in the minds of the nation and sung by its poets.

ŒCOLAMPADIUS,[1] John (1482-1531), was born at Weinsberg, a small town in the north of the modern kingdom of Würtemberg, but then belonging to the Palatinate. He went to school at Weinsberg and Heilbronn, and when twelve years old entered the university of Heidelberg, where he took his bachelor's degree in 1501. He seems at first to have intended to study for the profession of law, and went to Bologna, but soon returned to Heidelberg and betook himself to theology. He became a zealous student of the new learning and passed from the study of Greek to that of Hebrew. He went from Heidelberg to Tübingen, and thence to Stuttgart, making the acquaintance of Erasmus, Hedio, and Reuchlin, and after some earlier essays in preaching became pastor at Basel in 1515, serving under Christopher von Uttenheim, the evangelical bishop of Basel. From the beginning the sermons of Œcolampadius had "Christ the crucified" as their theme, and his first reformatory zeal showed itself in a protest against the introduction of legends of the saints into Easter sermons. While in Basel, preaching did not absorb all his energies; he was in daily intercourse with learned friends at the university, and pursued his literary researches and humanist studies. In 1518 he published his *Greek Grammar*. The same year he was asked to become pastor in the high church in Augsburg. Germany was then ablaze with the questions raised by Luther's theses, and his introduction into this new world seems to have compelled Œcolampadius to severe self-examination, which ended in his entering a convent and becoming a monk. A short experience sufficed to convince him that the monkish was not the ideal Christian life (*amisi monachum, inveni Christianum*), for in the beginning of 1522 he became private chaplain to the famous Franz von Sickingen. He left his service in the end of the same year and returned to Basel. Zwingli's famous disputation at Zurich (in 1523) fired the minds of many in Switzerland, and among others stirred Œcolampadius to make a more decided stand for reformation. He began to imitate Zwingli and preach Reformed doctrine. To his surprise he found that the humanists of the university did not countenance him in his zeal for evangelical truth. When "disputations" were held, they prohibited the students and teachers from attending. After more than a year of earnest preaching, after four public disputations had been held, in which the popular verdict had been given in favour of Œcolampadius and his friends, the authorities of Basel began to see the necessity of some reformation. They began with the convents, and Œcolampadius was able to refrain in public worship on certain festival days from some practices he believed to be superstitious. Basel was slow to accept the Reformation; the news of the Peasants' War and the inroads of Anabaptists prevented progress; but at last, in 1525, it seemed as if the authorities were resolved to listen to schemes for restoring the purity of worship and teaching. In the midst of these hopes and difficulties Œcolampadius married, in the beginning of 1528, Wilibrandis Rosenblatt, the widow of Ludwig Keller, who proved to be *non rixosa vel garrula vel vaga*, he says, and made him a good wife. After his death she married Capito, and, when Capito died, Bucer. She died in 1564. In 1528 the mass and image worship were at last abolished by authority, and Œcolampadius's five years' struggle was ended. He lived on, growing in influence in Basel and throughout south Germany, three years longer, and died in November 1531.

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[1] Hussgen or Heussgen, changed to Hausschein, and then into the Greek equivalent.

Œcolampadius was not a great theologian, like Luther, Zwingli, or Calvin, and yet he was a trusted theological leader. With Zwingli he represented the Swiss views at the unfortunate conference at Marburg, and had proved himself, by his defence of Zwingli's doctrine of the Lord's Supper against both Brenz and Luther, an able controversialist. He was a man of very wide sympathies. His readiness to sympathize with the early Reformatory movements in France and his eager welcome of the Waldenses were of great value to the Swiss Church.

Compare Herzog, *Leben Joh. Œcolampads u. die Reformation der Kirche zu Basel*, 1843; Hagenbach, *Johann Œcolampad u. Oswald Myconius, die Reformatoren Basels*, 1859.

OEDENBURG (Hungarian, *Sopron*), one of the oldest and most prepossessing towns in Hungary, the chief place of a district of its own name, lies 3 miles to the west of the Lake of Neusiedl and 35 miles to the south-south-east of Vienna. It possesses several churches (one of which was built with the contents of a Turkish military chest found buried here), three convents, a Protestant lyceum with a theological department, a Roman Catholic gymnasium, several other schools and charitable institutions, a museum, and a theatre. The inhabitants, most of whom are of German descent, are mainly engaged in making wine, of which the district yields a quality little inferior to Tokay. The crystallized fruits of Oedenburg form a well-known article of commerce; and a trade in grain and manufactures of beetroot-sugar, starch, and cloth are also carried on. Large cattle-markets are held here. The population in 1880 was 23,222.

Oedenburg, the Roman station Sopronium, was created a royal free town in the 11th century in return for help afforded to the king of Hungary against the Bulgarians. In 1619 it was pillaged by Bethlen Gabor. At a diet held here in 1681 the Hungarian Protestants presented the so-called "Oedenburg Articles," claiming the restitution of their churches and estates. The province of Oedenburg is rich in corn, fruit, cattle, and coal.

ŒDIPUS, a Theban hero, is placed by genealogists among the descendants of Cadmus. His father Laius ordered him to be exposed as soon as he was born; he grew up ignorant of his parentage, and meeting his father once in a narrow way he quarrelled with him and slew him. The country was ravaged by a monster, the Sphinx; Œdipus by his cunning solved the riddle that the Sphinx proposed to its victims, freed the country, and married his own mother, Jocaste, or, as Homer calls her, Epicaste. In the *Odyssey* it is said that the gods disclosed the impiety. Epicaste hanged herself, and Œdipus lived as king in Thebes tormented by the Erinnyes of his mother. In the tragic poets the tale takes a different form. Œdipus fulfils an ancient prophecy in killing his father; he is the blind instrument in the hands of fate. The further treatment of the tale by Æschylus is unknown. Sophocles describes in his *Œdipus the King* how Œdipus was resolved to pursue to the end the mystery of the death of Laius, and thus unravelled the dark tale, and in horror put out his own eyes. The sequel of the tale is told in *Œdipus at Colonus*. Banished from the land by his sons, he is tended by the loving care of his daughters. He comes to Attica and dies in the grove of the Eumenides at Colonus, in his death welcomed and pardoned by the fate which had pursued him throughout his life. This view of the myth, which reads in it a parable of the mystery of life, of the overwhelming might of fate and the weakness of man, of the final reconciliation of discord in death, is due to the tragic poets, is unknown in the epic poets, and is still more foreign to the primitive mythic form, where Œdipus and his father embody the vicissitudes of the annual life of nature: the son, the young year, slays his father, the old year, is wedded to his own mother, but finally loses his eyes, his light, and his life. The winter king is a god who slays his own father; this is a trait that occurs time after time in mythology.

OEHLENSCHLÄGER, ADAM GOTTLOB (1779-1850), the greatest of modern Danish poets, was born in Vesterbro, a suburb of Copenhagen, on the 14th of November 1779. His father, a Schleswiger by birth, was at that time organist to, and later on became keeper of, the royal palace of Frederiksberg; he was a very brisk and cheerful man. The poet's mother, on the other hand, who was partly German by extraction, suffered from depressed spirits, which afterwards deepened into melancholy madness. Adam and his sister Sofia were allowed their own way throughout their childhood, and were taught nothing, except to read and write, until their twelfth year. At the age of nine Adam began to make fluent verses. Three years later, while walking in Frederiksberg Gardens, he attracted the notice of the poet Edvard Storm, and the result of the conversation was that he received a nomination to the college called "Posterity's High School," an important institution of which Storm was the principal. Storm himself taught the class of Scandinavian mythology, and thus Oehlenschläger received his earliest bias towards the poetical religion of his ancestors. Most other branches of study the boy continued to neglect, and thought most about the romances and dramas which he proposed to write. He was confirmed in 1795, and was to have been apprenticed to a tradesman in Copenhagen. To his great delight there was a hitch in the preliminaries, and he returned to his father's house. He now, in his eighteenth year, suddenly took up study with great zeal, but soon again abandoned his books for the stage, where a small position was offered him. In 1797 he actually made his appearance on the boards in several successive parts, but soon discovered that he possessed no real histrionic talent, even though he was trained by the great actor Michael Rosing. The brothers Oersted, the eminent savants, with whom he had formed an intimacy fruitful of profit to him, persuaded him to quit the stage, and in 1800 he entered the university of Copenhagen as a student. He was doomed, however, to disturbance in his studies, first from the death of his mother, next from his inveterate tendency towards poetry, and finally from the attack of the English upon Copenhagen in April 1801, which, however, inspired a dramatic sketch which is the first thing of the kind by Oehlenschläger that we possess. His promise was already widely felt, and, even in 1800, Baggesen, in departing for Germany, had publicly invested the youth with the laurel that he himself was resigning. It was in the summer of 1802, when Oehlenschläger had an old Scandinavian romance, as well as a volume of lyrics, in the press, that the young Norse philosopher, Henrik Steffens, came back to Copenhagen after a long visit to Schelling in Germany full of new romantic ideas. His lectures at the university, in which Goethe and Schiller were for the first time revealed to the Danish public, created a great sensation. Steffens and Oehlenschläger met one day at Dreier's Club, and after a conversation of sixteen hours, which has become famous in the history of anecdote, the latter went home, suppressed his two coming volumes, and wrote at a sitting his splendid poem *Guldhornene*, in a manner totally new to Danish literature. The result of his new enthusiasm speedily showed itself in a somewhat hasty volume of poems, published in 1803, now chiefly remembered as containing the lovely piece called *Sanct-Hansaften-Spil*. The next two years saw the production of several exquisite works, in particular *Thors Reise til Jotunheim*, the charming poem in hexameters called *Langelandsreisen*, and the bewitching piece of fantasy *Aladdin's Lampe*. At the age of twenty-six Oehlenschläger was now universally recognized, even by the opponents of the romantic revival, as the leading poet of Denmark. He found no difficulty in obtaining a grant for foreign travel from the Government, and he left his native country for the first time, joining Steffens at Halle in August 1805. Here he wrote the first of his great historical tragedies, *Hakon Jarl*, which he sent off to Copenhagen, and then proceeded for the winter months to Berlin, where he associated with Humboldt, Fichte, and the leading men of the day. In the spring of 1806 he went on to Weimar, where he spent several months in daily intercourse with Goethe. The autumn of the same year he spent with Tieck in Dresden, and proceeded in December to Paris. Here he resided eighteen months and wrote his three famous masterpieces, *Baldur hin Gode*, *Palnatoke* (1807), and *Axel og Valborg* (1808). In July 1808 he left Paris and spent the autumn and winter in Switzerland as the guest of Madame de Stael-Holstein at Coppet, in the midst of her famous circle of wits. In the spring of 1809 Oehlenschläger went to Rome to visit Thorwaldsen, and in his house wrote his tragedy of *Correggio*, in German; he translated this into Danish the following year. After an absence of nearly five years he hurriedly returned to Denmark in the spring of 1810, partly to take the chair of æsthetics at the university of Copenhagen, partly to marry the sister-in-law of Rahbek, to whom he had been long betrothed. His first course of lectures dealt with his Danish predecessor Evald, the second with Schiller. From this time forward his literary activity became very great; in 1811 he published the Oriental tale of *Ali og Gulhyndi*, and in 1812 the last of his great tragedies, *Stærkodder*. From 1814 to 1819 he, or rather his admirers, were engaged in a long and angry controversy with Baggesen, who represented the old didactic school. This contest seems to have disturbed the peace of Oehlenschläger's mind, and to have undermined his genius. His talent may be said to have culminated in the glorious cycle of verse-romances called *Helge*, published in 1814. The tragedy of *Hagbarth og Signe*, 1815, showed a distinct falling-off in style. In 1817 he went back to Paris, and published *Hroars Saga* and the tragedy of *Fostbrödrene*. In 1818 he was again in Copenhagen, and wrote the idyll of *Den lille Hyrdedreng* and the Eddaic cycle called *Nordens Guder*. His next productions were the tragedies of *Erik og Abel* (1820) and *Væringerne i Miklagaard* (1826), and the epic of *Hrolf Krake* (1829). It was in the last-mentioned year that, being in Sweden, Oehlenschläger was publicly crowned with laurel in front of the high altar in Lund cathedral by Bishop Esaias Tegnér, as the "Scandinavian King of Song." His last volumes were *Tordenskjold* (1833), *Dronning Margrethe* (1833), *Sokrates* (1835), *Olaf den Hellige* (1836), *Knud den Store* (1838), *Dina* (1842), *Erik Glipping* (1843), and *Kiartan og Gudrun* (1847), none of which, with the exception, perhaps, of *Dina*, can in any way be said to be worthy of his early reputation. On his seventieth birthday, 14th November 1849, a public festival was arranged in his honour, and he was decorated by the king of Denmark under circumstances of great pomp. Just two months later, on the 20th of January 1850, he sank, conscious to the last, and was buried in the cemetery of Frederiksberg.

With the exception of Holberg, there has been no Danish writer who has exercised so wide an influence as Oehlenschläger. His great work was to awaken in the breasts of his countrymen an enthusiasm for the poetry and religion of their ancestors, and this he performed to so complete an extent that his name remains to this day synonymous with Scandinavian romance. He supplied his countrymen with romantic tragedies at the very moment when all eyes were turned to the stage, and when the old-fashioned pieces were felt to be inadequate. His plays, partly, no doubt, in consequence of his own early familiarity with acting, fulfilled the stage-requirements of the day, and were popular beyond all expectation. Several of them still keep the stage in spite of their rhetoric. The earliest are the best,—Oehlenschläger's dramatic masterpiece being, without doubt, his first tragedy, *Hakon Jarl*. In his poems and plays alike his style is limpid, elevated, profuse; his flight is sustained at a high pitch without visible excitement. His fluent tenderness and romantic zest have been the secrets of his extreme popularity. Although his inspiration came from Germany, he is not much like a German poet, except when he is consciously following Goethe; his analogy is much rather to be found among the English poets, his contemporaries. His mission towards antiquity reminds us of Scott, but he is, as a poet, a better artist than Scott; he has sometimes touches of exquisite diction and of overwrought sensibility which recall Coleridge to us. In his wide ambition and profuseness he possessed some characteristics of Southey, although his style has far more vitality. With all his faults he was a very great writer, one of the principal pioneers of the romantic movement in Europe, and he will probably not cease to retain the position which he won so easily at the summit of the Scandinavian Parnassus. (E. W. G.)

OELS, the chief town of a circle in Prussian Silesia, and the capital of a mediatized principality of its own name, lies in a sandy plain on the Oelsa, 18 miles to the north-east of Breslau. The prince's château, dating from 1558, contains a good library and a collection of pictures. The Schlosskirche was originally built about 980. The other buildings are unimportant. The inhabitants, numbering 10,157 in 1880, are chiefly engaged in making shoes and growing vegetables for sale at Breslau. There is also a manufactory of agricultural implements, and a trade is carried on in grain and flax.

The town of Oels was founded about 940, and appears as the capital of an independent principality at the beginning of the 14th century. The principality, with an area of 750 square miles and about 150,000 inhabitants, passed through various hands and was finally inherited by the ducal family of Brunswick in 1792. The present proprietor is the reigning duke of Brunswick.

See W. Häusler, *Geschichte des Fürstenthums Oels* (Breslau, 1883).

ŒNANTHIC ACID AND ETHER. Liebig and Pelouze, by distilling large quantities of wine, obtained from the very last fractions of the distillate an oil which in a very high degree exhibited the generic smell common to all wines,—the smell which a small remnant of any kind of wine left in an open bottle exhibits after the "bouquet" is gone. They recognized the oil as the ethyl-ether of a particular acid of the composition $(C_{14}H_{26}O_3)H_2$, which they called "œnanthic acid." An oil similar to Liebig and Pelouze's œnanthic ether was isolated by Wöhler from quince-peel. Liebig and Pelouze's results were called in question by Delffs, who by experiments of his own arrived at the result that their œnanthic acid is identical with pelargonic, $C_9H_{17}O_2 . H$, which latter is known as a component of the volatile oil of *Pelargonium roseum*. A. Fischer examined an "œnanthic ether" manufactured by Lichtenberger at Hambach in the Rhenish Palatinate, and found it to be a mixture of the ethyl-ethers of caprylic and capric acids, $C_8H_{16}O_2$ and $C_{10}H_{20}O_2$, and fatty acids higher than capric. The general impression amongst chemical wine-specialists seems to be that Liebig and Pelouze's œnanthic acid was a mixture of capric, caprylic, and other fatty acids. The notion of œnanthic acid must not be mixed up with that of œnanthylic acid, $C_7H_{13}O_2 . H$, the acid of primary heptyl-alcohol, $C_7H_{16}O$. The aldehyde $C_7H_{14}O$, intermediate between the two, is procured by the destructive distillation of castor oil, and from it the acid is easily prepared by oxidation with dilute chromic acid.

ŒNOMAUS was king of Olympia, where his wooden house was still shown in the Altis, the sacred precinct, when Pausanias visited it. It was fated that he should be slain by the husband of his daughter Hippodamia. His father, the god Ares-Hippios, gave him winged horses swift as the wind, and he promised his daughter to the man who could outstrip him in the chariot race; those suitors who were beaten died by his hand. Pelops, by the treachery of Myrtilus, the charioteer of Œnomaus, won the race and married Hippodamia. Pelops is conceived as a stranger from Asia Minor, and Œnomaus is obviously the representative of a race of Ares-worshippers who were conquered by, or amalgamated with, an immigrant race, who brought with them the new religion of Zeus, but who kept up the old worship of Ares in the country where they settled.

OESEL, one of the largest islands in the Baltic, forming with Abro, Mohn, Runo, &c., a district of the Russian government of Livonia, lies across the mouth of the Gulf of Riga, between 57° 55′ and 58° 40′ N. lat., has a length from south by west to north by east of about 45 miles, and according to Strelbitsky contains an area of 1010 square miles. It is separated from Courland to the south by the Strait of Dosmesnes, from the island of Dagö to the north by the Söla Sound, and from the smaller island of Mohn on the north-east by the Little Sound. Its undulating surface, well watered by numerous streams, and consisting mainly of clay and disintegrated limestone, is largely occupied by woodland and pasture, but also allows the cultivation of considerable quantities of grain, flax, hemp, and potatoes. The coasts are bold and steep, and, especially towards the north and west, form precipitous limestone cliffs. Like those of Shetland, the Oesel ponies are prized for their smallness. The population, numbering 50,566 in 1870, is mainly Protestant in creed, and, with the exception of the nobility, the clergy, and some of the townsfolk, Esthonian by race. The chief town, Arensburg (Esthonian, *Kurre Saare*), on the south coast at the mouth of the Peddus, is a place of from 3000 to 4000 inhabitants, with two churches (a Greek and a Lutheran), two hospitals, an orphanage, and a trade in grain, potatoes, whisky, and fish.

Oesel at an early period belonged to the Teutonic knights, and was governed by its bishops till 1561, when it passed into the hands of the Danes. By them it was surrendered to the Swedes by the peace of Brömsebro (1645), and, along with Livonia, it was united to Russia in 1721. Arensburg, dating as a castle from the 14th century, became a town in 1563.

ŒTA. See Thessaly.

OFEN. See Buda, vol. iv. p. 423.

OFFENBACH, the principal manufacturing town in the grand duchy of Hesse-Darmstadt, lies on the left bank of the Main, 5 miles above Frankfort. The most interesting building in the town is the old Renaissance château of the counts of Isenburg, while the most conspicuous modern edifices are the five churches, the synagogue, the new residence of the Isenburg family, and the town-hall. The manufactures of Offenbach are of the most varied description, including carriages, machinery, hardwares, chemicals, aniline dyes, soap, perfumery, candles, chicory, gingerbread, tobacco and cigars, shoes, hats, felt goods, wax-cloth, paper, varnish, white lead, types, canvas, and woollen cloth. Its characteristic industry, however, is the manufacture of portfolios, pocket-books, albums, and other fancy goods in leather, which are largely exported to England, the United States, and other countries. The population in 1880 was 28,449, including 17,566 Protestants and 8782 Roman Catholics.

The earliest mention of Offenbach is in a document of 970. In 1486 it came into the possession of the imperial counts of Isenburg, and in 1816, on their mediatization, was assigned to Hesse. It owes its prosperity partly to the fact that it became the residence of the Isenburg family in 1685, but mainly to the industry of the French Protestant refugees who settled here at the end of the 17th and the beginning of the 18th century.

OFFENBACH, Jacques (1819-1880), the inventor of the latest form of the modern *opéra bouffe*, was born at Cologne, of Jewish parents, 21st June 1819. His talent for music was developed at a very early age; and in 1833 he was sent to Paris to study the violoncello at the conservatoire, where, under the care of Professor Vaslin, he became a fairly good performer, notwithstanding his utter want of that earnestness which alone can make a true artist. In 1834 he was admitted into the orchestra of the Opéra Comique as a "ripieno" violoncellist; and here his unrivalled tact and natural quickness of perception enabled him to acquire an amount of experience which he was not slow to turn to profitable account. His next appointment was that of conductor at the Théâtre Français, where, in 1848, he made his first success as a composer in the "Chanson de Fortunio," in Alfred de Musset's play *Le Chandelier*. From this time forward his life became a ceaseless struggle for the attainment of popularity. His power of production was inexhaustible; and, since he was ready to repeat himself without scruple whenever it answered his purpose to do so, the demand upon his ideas was invariably met with a rapidity which fairly astonished both theatrical managers and the general public. His first complete work, *Pepito*, was produced at the Opéra Comique in 1853. This was soon followed by a crowd of dramatic trifles, which daily gained in favour with Parisian audiences, and eventually effected a complete revolution in the popular taste of the period. Encouraged by these early successes, Offenbach now boldly undertook the delicate task of entirely remodelling both the form and the style of the light-musical pieces which have so long been welcomed with acclamation by the frequenters of the smaller theatres in Paris. With this purpose in view he obtained a lease of the Théâtre Comte in the Passage Choiseul, re-opened it under the title of the Bouffes Parisiens, and night after night attracted crowded audiences by a succession of brilliant trifles which never failed to make their mark, though not one of them possessed substance enough to enable it to retain its vitality after the appearance of its successor upon the stage. Beginning with *Les Deux Aveugles* and *Le Violoneux*, the series was continued with almost unexampled rapidity, until, in 1867—twelve years after the opening of the theatre—its triumph culminated in *La Grande Duchesse de Gérolstein*, perhaps the most popular opéra bouffe that ever was written, not excepting even his *Orphée aux Enfers*, produced in 1858. From this time forward the success of Offenbach's pieces became an absolute certainty. He never failed. Without a trace of true genius or a thought of reverence for art, he possessed a talent so brilliant and a facility of invention so prolific that, in place of following the public taste, as he had so cleverly done at the outset of his career, he was able to lead it whither he would; and the new form of opéra bouffe, which he had gradually endowed with as much consistency as it was capable of assuming, was accepted as the only one worth cultivating. That it should live is simply impossible. It has, indeed, found imitators in Lecocq and other aspirants of a younger generation; and some of these have attained successes not much less brilliant than those of Offenbach himself. But to be really enduring an art-form must be based upon some stronger principle than a mere desire for the attainment of popular favour; and so far is this from being the case with what is now universally accepted as the genuine opéra bouffe that it would be impossible to strain the point so far as to admit its connexion with any form of art whatever. But no artistic consideration dimmed the brilliancy of Offenbach's success. His theatre continued to flourish, and his works found their way to every town in Europe in which a theatre existed. Their want of refinement formed no obstacle to their popularity, and perhaps even contributed to it. In twenty-five years he produced no less than sixty-nine complete dramatic works, some of which were in three or even in four acts. Among the latest of these were *Le Docteur Ox*, founded on a story by Jules Verne, and *La Boîte au Lait*, both produced in 1877, and, though not among his brightest triumphs, sufficiently successful to show that the reign of his popularity has not yet come to an end. Offenbach died in 1880.

OGAM. See Celtic Literature, vol. v. p. 306.

OGDEN, a flourishing city of the United States, in

Weber county, Utah, 37 miles by rail north of Salt Lake City, at the confluence of the Weber and Ogden rivers. It is one of the most important railway junctions of the Western States; the Union Pacific, the Central Pacific, and the Utah Central Railroads, as well as a line which will ultimately join the Northern Pacific at Garrison, all meet at this point. The ground-plan of the city is spacious, the drainage good, and the climate exceedingly healthy. In manufactures and general industry it bids fair to rival Salt Lake City. Conspicuous among its buildings are the court-house with its white cupola, and the central school, which is one of the best in Utah. The population was 3127 in 1870, and 6069 in 1880.

OGDENSBURG, a city and port of entry of the United States, in St Lawrence county, New York, on the St Lawrence river, at the mouth of the Oswegatchie, 72 miles below Lake Ontario. It is an important railway junction (the terminus of the Ogdensburg and Lake Champlain, the Utica and Black River, and the Rome, Watertown, and Ogdensburg Railroads), and the headquarters of the Northern Transportation Company's line of steamers; and ferry steamers connect it with Prescott on the Canadian side of the river. Ogdensburg is regularly laid out, and shade-trees are so numerous that it is popularly called "Maple City." Among its buildings that used by the United States post-office and courts and the great Roman Catholic church of St Jean Baptiste are of some note. A very extensive trade is carried on in timber and flour. The population was 7409 in 1860, 10,076 in 1870, and 10,341 in 1880.

The site of Ogdensburg was first occupied by the Indian settlement of La Presentation founded by Abbé Piquet for the Christian converts of the Five Nations. Garrisoned by the British in 1776, the fort continued to be held by them after the revolution till 1796 (Jay's treaty). In 1812 it was attacked and in 1813 captured by a British force; and again in 1838, having become a rallying point for the Canadian malcontents under Von Schultze, it was regularly besieged and taken. The village was incorporated in 1817, and named after Samuel Ogden, the proprietor. The city charter dates from 1868.

OGLETHORPE, JAMES EDWARD (1696-1785), general, the founder of the State of Georgia, was born in London 21st December 1696, the son of Sir Theophilus Oglethorpe of Godalming, Surrey. He entered Corpus Christi College, Oxford, in 1714, but in the same year joined the army of Prince Eugène. Through the recommendation of the duke of Marlborough he became aide-de-camp to the prince, and he served with distinction in the campaign against the Turks, 1716-17, more especially at the siege and capture of Belgrade. After his return to England he was in 1722 chosen member of parliament for Haslemere. He devoted much attention to the improvement of the circumstances of poor debtors in London prisons; and for the purpose of providing an asylum for persons who had become insolvent, and for oppressed Protestants on the Continent, he projected the settlement of a colony in America between Carolina and Florida. A full account of the enterprise and the subsequent relation of Oglethorpe to the colony will be found in the article GEORGIA, vol. x. p. 437. In 1745 Oglethorpe was promoted to the rank of major-general. His conduct in connexion with the Scottish rebellion of that year was the subject of inquiry by court-martial, but he was acquitted. In 1765 he was raised to the rank of general. He died at Cranham Hall, Essex, 1st July 1785.

OGOWAY, or OGOWE (*Ogooawai*, *Ogobai*), a river of West Africa which falls into the Atlantic in the neighbourhood of 1° S. lat., or 400 miles north of the mouth of the Congo. The extent of its delta (70 to 80 miles from north to south), and the immense volume of water which it brings down when in flood, gave origin to the belief that it must either be a bifurcation of the Congo or one of the leading arteries of the continent. The former view was set aside by the fact that the two rivers did not rise at the same season of the year; but so recently as 1876 Czerny advocated the identity of the Ogoway with Schweinfurth's famous Uelle (Welle), with Nachtigal's Bahr-Kuta, and with Barth's river of Kubanda, thus taking it right across to the neighbourhood of the Nile basin. It appears, however, that the head-streams of the Ogoway rise in the hilly country about 200 or 300 miles from the coast of the Atlantic (though the actual course of the river is 500 to 600 miles), and its extraordinary volume is to be explained by their draining an extensive tract on both sides of the equator which is deluged with tropical rains. Savorgnan de Brazza claims to have reached (1882) the sources of the river in a rugged, sandy, and almost treeless plateau, which forms the watershed between its basin and that of the Congo, whose main stream is only 140 miles distant. Cutting its way athwart the gneiss and schists of the various ranges of the Sierra Complida, the main stream of the Ogoway (often called the Okanda from one of the tribes on its banks) is interrupted with cataracts and rapids (at Fare, 26 feet, and Dume, for example) till within a comparatively short distance from the confluence with its principal left-hand affluent, the Ngunie, in 0° 35' S. lat. and 10° 25' E. long. Even in the upper part of its course, however, it often attains a great width, and below this confluence it spreads out into an average of 8000 feet, at the same time showing a tendency to split into a number of secondary channels, some of which connect it on the north with the great Ajingo Lake, and on the south with the still larger Jonanga Lake. The northmost branch of the delta—the Nazareth river, which falls into Nazareth Bay to the north of Cape Lopez—has in the driest period of the year a depth of from 20 to 30 feet, and its water is drinkable even at flood-tide. The southern arms discharge into the extensive Cama or Nkomi Lagoon and the Rio Fernão Vaz. With the exception of the Ngunie, which has been ascended 40 miles as far as the Samba falls, the affluents of the Ogoway—the Passa, Lolo, Shebe, Ivindo, Ofue, &c.—are but very partially known; and some of those from the north may prove to have a longer course than is at present supposed. The Ogoway rises in March and April, and again in October and November; it is navigable for steamers in its low-water condition as far as the junction of the Ngunie.

Though Bowditch called attention in 1817 to the existence of the river, it was not till 1857-59 that its exploration was begun by Du Chaillu. It has since been made known by the labours of Serval and Griffon du Ballay, R. B. N. Walker, Aymés, the marquis de Compiègne, A. Marche, Oskar Lenz, and Savorgnan de Brazza. English and German factories were founded about 1868 at Adelina Longa (Adaûlinaûlonga), and at Franceville, a station of the International African Association, in 1880.

See Petermann's *Mittheil.*, 1872, pp. 5-10; 1875, pp. 121-130; 1879, pp. 103-108; and 1883, pp. 177-184, with map; *Proc. R. G. Soc.*, 1878 (Walker's narrative); *Bull. de la Soc. de Géogr.*, Paris, 1877; *Zeitsch. der Ges. f. Erdk.*, Berlin, 1875 and 1876 (the former Lenz's narrative, the latter a résumé of the course of discovery by Czerny).

OGYGES, in the legends of Attica and Bœotia, was an early king in whose reign a great flood had overwhelmed the land. A similar legend was current in Phrygia, where the flood was said to have taken place in the reign of Nannacus. No facts are known connecting Ogyges with any religious cultus in Greece, and it is highly probable that the tale was of Oriental origin, introduced into this district of Greece by foreign colonists or traders. The Gephyræi, who emigrated from Bœotia into Attica, and who are said by Herodotus to have been of Phœnician origin, may have brought the story of the flood with them.

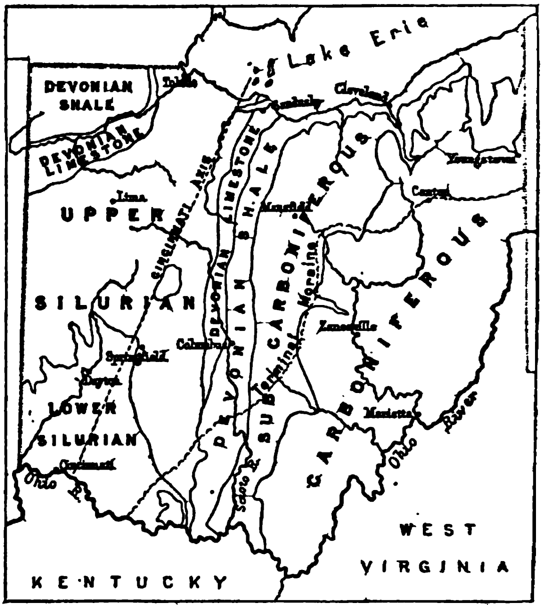
In the *peribolos* of Zeus on the banks of the Ilyssus at Athens a hole was shown through which the waters of the flood had run off, and where religious rites were regularly performed, but this hole was associated rather with Deucalion than with Ogyges.

OHIO, the third of the States of the American Union in point of wealth and population, is situated between 38° 27′ and 41° 57′ N. lat. and between 80° 34′ and 84° 49′ W. long., and is bounded on the N. by Michigan and Lake Erie, on the E. by Pennsylvania, on the E. and S. by the Ohio river, which separates it from the States of West Virginia and Kentucky, and on the W. by Indiana. The greatest length from north to south is about 210 miles, the greatest breadth from east to west about 225 miles and the area 40,760 square miles.

Physical Features.—The surface consists of an undulating plain, generally ranging in elevation between 1550 and 430 feet above sea-level, the portions below 500 feet or above 1400 being comparatively insignificant. The largest connected areas of high land extend from east to west across the central and northern central districts. In some limited districts of central Ohio, especially along the ridge of high land just referred to, and also in a few thousand square miles of north-western Ohio, the natural drainage is somewhat sluggish, and, while the land is covered with its original forest growth, it inclines to swampy conditions; but when the forests are removed and the waterways opened most of it becomes arable, and all of it can be made so without excessive outlay by means of open ditches.

The chief feature in the topography of Ohio is the watershed, which extends across the State from north-east to south-west, and divides its surface into two unequal slopes, the northern, which is much the smaller, sending its waters into Lake Erie and the Gulf of St Lawrence, while the drainage of the other is to the Gulf of Mexico by the Ohio river. The average height of the ridge is about 1100 feet, but it is cut by several gaps, in which the elevation is reduced to about 950 feet. The relief of the State is chiefly due to erosive agencies. The entire drainage area of such a river as, for example, the Muskingum or the Scioto, may be conceived as originally a plain, all portions of which were at approximately the same elevation above the sea. Across this area one main furrow has been drawn, deepening and widening as it advances, and a countless number of narrower and shallower valleys are tributary to it. Fragments of the old plain still remain in the isolated "hills" or tablelands that bound the valleys, and which, though often separated by intervals of miles, still answer to each other with perfect correspondence of altitude and stratification. They rise to a maximum height of 600 feet above the river-channels in the main valleys.

Geology.—The rocky floor is entirely composed of unaltered stratified rocks of Palæozoic age. Not a single trap dyke or volcanic vent intersects them, and not a trace of igneous metamorphism is shown in any portion of their extent. These strata are disposed in plains so nearly horizontal that the dip is nowhere heavy enough to be safely determined by a clinometer. Not only are sharp flexures wanting, but faults deserving the name are found in but a single corner of a single county. A few low folds, one of which is of preponderating importance, traverse the State and redeem its surface from geological monotony. The only structural irregularity is an occasional case of overlap, but even this is seldom of such a character as to interfere with the easy reading of the record. The aggregate thickness of the entire series will reach 5000 feet if the maximum of each stratum is taken into the account, but if the average measurements are used the thickness does not exceed 3500 feet. The main elements of the scale, which extends from the Lower Silurian (upper portion) to the Upper Coal-measures inclusive, are given below, and the geological sketch-map shows how the surface of the State is distributed among the principal formations.



Geological Map of Ohio.

	Feet.	
Glacial Drift	0—300	
Upper barren measures	300	Carboniferous.
Upper productive Coal-measures	200	
Lower barren measures	500	
Lower productive Coal-measures (including Conglomerate group of Penna)	500	
Maxville Limestone	25	Subcarboniferous.
Waverly group	500	
Ohio Black Shale (including Cleveland, Erie, and Huron Shales) (Maximum 1500)	300	Devonian.
Hamilton Shales	25	
Corniferous Limestone	75	
Lower Helderberg Limestone	50	Upper Silurian.
Niagara Limestone	150	
Niagara Shale	50	
Clinton Limestone	25	
Cincinnati group	800	Lower Silurian.

The *Cincinnati* group, which constitutes the surface rock for about 4000 square miles in the south-western corner of the State, consists of alternating layers of blue limestone and calcareous shale, both of which contain great numbers of admirably-preserved fossils. The group is undoubtedly equivalent in part to the Hudson River group of the general scale, and by some geologists the name is counted a synonym, but it has not been proved that the Lower Silurian deposits of south-western Ohio can be definitely correlated with the subdivisions of the series in New York. The formation everywhere yields a cheap and excellent supply of building stone, which is also burned into a dark lime, valued for its hydraulic properties. The shales contain notable quantities of alkalis and phosphates, and the soils into which they very readily weather are proverbial for their fertility. The water-supply of the formation is poor, or rather wanting, the impervious shales refusing admission to the rainfall.

The Cincinnati axis, a low fold which traverses the State from south-west to north-east, constitutes its most influential geological feature. It entered Ohio from Kentucky at the close of Lower Silurian time, and gradually extended itself to the northward, until it had converted the western half of the State into dry land. It has left a clear record of its successive stages in the strata which compose it. It did not advance steadily and equally, and the occasional relapses which it experienced have given rise to cases of overlap. It has a low, flat summit, and, on account of the soluble and easily-eroded materials of which it consists, it has suffered more from denuding agencies than the Upper Silurian strata that enclose

it, and consequently is now cut down to a lower level than they. In other words, the axis has been converted into a basin.

The *Clinton Limestone* generally rises in a terrace-like outcrop around the margin of the eroded Cincinnati beds, and its base is marked by the finest line of springs in the State. In its most characteristic phases it is a crystalline limestone that takes a good polish. In very many localities it yields small quantities of petroleum, which seems to be indigenous. The supply is too limited to be valuable.

The *Niagara* group, also of Upper Silurian age, is of much greater thickness and of proportionally greater economic and scientific importance than the Clinton limestone. As at the Falls, it here consists of a stratum of shale overlain by a massive limestone. It forms the surface rock for about 3000 square miles, but through much of this area it is concealed by heavy beds of Glacial Drift, by which its importance as a factor in the topography and the economic geology of the district is much reduced. In composition the limestone is almost a typical dolomite, but it is still fossiliferous, the fossils occurring as internal casts. It contains a large and interesting fauna. From near the base of the Niagara beds the "Dayton" stone, one of the most valuable building stones of the State, is derived. The formation yields excellent building stones at other horizons also, and its upper beds furnish lime.

The *Lower Helderberg Limestone* occupies even a wider area as a surface formation than the last-named, but is largely covered with Drift deposits. There are whole counties of which it is known to constitute the rocky floor, in which it does not once rise to the surface. It is seen to the best advantage in the north of Highland county, where it yields a remarkably even-bedded building stone. Like the Niagara Limestone, it is a dolomite in composition. It is poor in fossils, but the few that it contains are highly characteristic.

The transition from Upper Silurian to Devonian time which is made in ascending to the next stratum in the scale, the *Corniferous Limestone*, is accomplished without any structural break or irregularity, but there is an abrupt lithological change, the latter stratum being a true carbonate of lime, and an abundant and pronounced Devonian fauna appears in its very lowest beds. The Corniferous Limestone forms a narrow belt on each side of the axis, from central Ohio northward, but by the overlap of the next succeeding formations it is entirely lost in southern Ohio. Even where it constitutes the highest bedded rock it is largely obscured by Drift deposits. At Kelly's Island, Sandusky, Marion, Delaware, and Columbus it is largely worked for building stone, lime, and furnace flux. The earliest vertebrate remains of the Ohio scale are found in this stratum. The box-like skull of a large ganoid fish, *Macropetalichthys sullivanti*, Newberry, occurs near the base of the series, and the teeth and bones of other ganoids and selachians are frequently met with in the higher beds. In the State quarries at Columbus these remains constitute a veritable bone bed, a layer 4 to 6 inches in thickness being in large part composed of them.

A heavy deposit of black shale, the *Ohio Shale* of the table, and the Huron shale of Newberry, directly overlies the Corniferous Limestone in northern and central Ohio, and extends across the State from north to south. It is composed of two black shales, the Cleveland and the Huron, including a blue shale, the Erie, between them. The latter is 1200 feet thick in north-eastern Ohio, but rapidly wedges out as it is followed westward to the axis, and the Cleveland and Huron seem here to be welded into one mass. The black shale contains an average of 8 or 10 per cent. of bituminous matter, a chief source of which is found in a resinous disk of microscopic size that exists in the shale in immense numbers, which Dawson has named *Sporangites huronensis*. Apart from this minute form the shale is almost barren of fossils, but a few have been discovered in it, mostly at the centres of the great concretions which it contains. The gigantic placoderm, *Dinichthys herzeri*, Newberry, was first found in these concretions. Though dating back almost to the first appearance of fishes, Newberry has shown that its nearest relationship is with the *Lepidosiren* of the present day, which zoologists unite in counting as the highest of the entire class. The shale is undoubtedly the source of the natural gas and petroleum of north-eastern Ohio.

The *Waverly* group, which occupies about 7000 square miles of the surface of the State, is in all respects an important formation. It consists of the Bedford shale, the Berea grit, the Berea shale, the Cuyahoga shale, and the Logan group. The Berea grit has unusual geological interest. Its outcrop is a shore-line across the entire State, and it marks with perfect distinctness the eastern limit of the Cincinnati axis at this date. It is everywhere a quarry stone. The Berea stone and the Amherst stone of northern Ohio and the original Waverly stone of the lower Scioto valley belong to this horizon. In strength, durability, beauty, and the economy with which they can be worked, they stand at the head of the building stones of the State, the value of the annual products of these quarries exceeding $1,000,000. The stone is distributed as far east as the seaboard, and as far west as Duluth. Some of it has even found market in England. The Berea grit is the reservoir of the gas and oil distilled from the underlying shales, and it is also the great source of salt water for Ohio. Another building stone of great excellence and beauty comes from the base of the Cuyahoga shale in southern Ohio,—the Buena Vista stone of the Ohio valley.[1]

The *Carboniferous Conglomerate* and the *Coal-measures* have an aggregate thickness of at least 1500 feet, and cover more than 10,000 square miles of the surface of Ohio. The beds of coal, iron-ore, fire-clay, limestone, and cement rock that they contain render insignificant the contributions made by all other formations to the mineral wealth of the State. The Lower Coal-measures, which are here made to include the Conglomerate group of coals of Pennsylvania, contain the seams of coal enumerated below, which are distributed through 500 to 800 feet of strata. The names of the seams that are used in the Pennsylvania scale are adopted here.

13. Upper Freeport coal	11	6. Brookville coal	6
12. Lower Freeport ,,	10	5 Tionesta ,,	5
11. (Upper Kittanning) ,,	—	4. Upper Mercer ,,	4
10. Middle Kittanning ,,	9	3. Lower Mercer ,,	3
9. Lower Kittanning ,,	8	2. Quakertown ,,	2
8. Clarion Upper ,,	7	1. Sharon coal ,,	1
7. Clarion Lower ,,			

All these coals belong to the bituminous division. Thus far they are almost entirely worked in level free mines, and very little is taken from seams less than 3 feet in general thickness. The average thickness in the important fields is 5 feet, and the maximum (a small area of a single district) 13 feet. All of the seams enumerated above are worked, but they have very unequal values. The Middle Kittanning seam is by far the first. The Upper Freeport ranks next in value. The Sharon coal is the most valuable in proportion to its area, furnishing, in fact, the standard of comparison for the open-burning coals of the entire Alleghany field. Both it and the Middle Kittanning seam are used in the raw state in the manufacture of iron, a fact which sufficiently attests their purity and general excellence. In the remaining divisions of the Coal-measures there are 10 or 12 additional seams that are of workable thickness at some of the localities in which they occur, but, with one notable exception, these seams are less steady and reliable than those of the lower measures. The exception is the Pittsburg coal, which is, all things considered, the most important seam of the entire coal-field to which it belongs. It is especially valued as a gas coal, and for the production of steam. Its northern outcrop passes through nine counties, with an approximate length of 175 miles, not counting the sinuosities. The area commonly assigned to it in Ohio exceeds 3000 square miles, but the seam has been proved for only a small fraction of the area claimed. In the production of bituminous coal in the United States Ohio ranked third in 1880, the output for that year being about 6,000,000 tons, but the production is rapidly increasing, and the State inspector of mines reckoned the output in 1882 at 8,000,000 tons.

Iron ore is worked at many horizons in the Coal-measures, in seams ranging from 6 inches to 19 feet in thickness. The charcoal iron of the Hanging Rock district of southern Ohio is chiefly applied to the highest uses, as the manufacture of car-wheels and castings for agricultural and other machinery. Of the 99 furnace-stacks that now stand in Ohio, almost all depend in part, and about half depend entirely, on native ore. The amount mined annually exceeds 500,000 tons. In iron and steel industries Ohio ranks next to Pennsylvania, the value of the annual product being $35,000,000. The clays of the Coal-measures are the basis of a large and rapidly growing manufacture of stone and earthen ware. Ohio now produces one-third of the total product of the United States. In connexion with the salt production, which is large, about half of the bromine of the world is produced in Ohio. The brine of the Tuscarawas valley yields nearly 1 ℔ of bromine to 1 barrel of salt.

Three-fourths of Ohio are covered with the various deposits of the *Drift period*, which consists of "till" or boulder clay, and of the stratified sands and clays of the later stages of the period. These deposits sometimes have a thickness of 300 feet,—their average in north-western Ohio being not less than 50, and in central Ohio not less than 25 feet. In the regions which they cover they exercise a controlling influence upon the relief, drainage, soils, and water-supply. They have filled the valleys of earlier drainage systems, and in many cases have obliterated all traces of their existence. The till is filled with boulders of northern origin derived from the highlands of Canada and from intervening districts. Blocks of large size are sometimes found, some of them showing 2000 cubic feet above ground. In many instances they can be referred by their mineralogical characters to particular localities, or even to particular ledges, from a score of miles to 400 miles distant. The stratified Drift contains vast accumulations of sand, gravel, and clay, all of great economic value. Brick clays of good quality are everywhere accessible. The terminal moraine that forms the boundary of the

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[1] In the total value of quarry products Ohio ranks first among the States, more than $2,500,000 being reported in the census of 1880.

Glacial deposits is not in all cases as conspicuous as in the States to the east of Ohio, but even where it is least distinct soil and vegetation unite to mark the limit of glacial advance very plainly. The moraine passes through the counties of Columbiana, Stark, Wayne, Richland, Holmes, Licking, Fairfield, Ross, Highland, Adams, and Brown, as recently determined by Professor G. F. Wright.

Soils, Forests.—The division of the State into a drift-covered and driftless region coincides with the most important division of the soils. Below the line of the terminal moraine these are "native," or, in other words, they are derived from the rocks that underlie them, or that rise above them in the boundaries of the valleys and uplands. They consequently share the varying constitution of these rocks, and are characterized by considerable inequality and by abrupt changes. All are fairly productive, and some, especially those derived from the abundant and easily-soluble limestones of the Upper Coal-measures, are not surpassed in fertility by any soils of the State. Large tracts of these excellent native soils are found in Belmont, Monroe, Noble, and Morgan counties. Among the thinner and less productive soils, which occupy but a small area, are those derived from the Devonian shales. They are, however, well adapted to forest and fruit production. The chestnut and the chestnut oak, both valuable timber trees, are partial to them, and vineyards and orchards thrive remarkably. The native soils of the Waverly group and of the Lower Coal-measures agree in general characters. They are especially adapted to forest growth, reaching the highest standard in quality of timber product. When these lands are brought under the exhaustive tillage that has mainly prevailed in Ohio thus far, they do not hold out well, but the farmer who raises cattle and sheep, keeps to a rotation between grass and small grains, and does not neglect fruit can do well upon them. The cheap lands of Ohio are found in this belt. The other great division of the soils of Ohio—viz., the Drift soils—are by far the most important, alike from their greater area and their intrinsic excellence. Formed by the commingling of the Glacial waste of all the formations to the north of them, over which the ice has passed, they always possess considerable variety of composition, but still in many cases they are strongly coloured by the formation underneath them. When any stratum of uniform composition has a broad outcrop across the line of Glacial advance, the Drift beds that cover its southern portions will be found to have been derived in large part from the formation itself, and will thus resemble native or sedentary soils. Western Ohio is underlain with Silurian limestones, and the Drift is consequently limestone Drift. The soil is so thoroughly that of limestone land that tobacco, a crop which rarely leaves native limestone soils, is grown successfully in several counties of western Ohio, 100 miles or more north of the terminal moraine. The native forests of the Drift regions were, without exception, hard-wood forests, the leading species being oaks, maples, hickories, the walnut, beech, and elm. The walnut, sugar maple, and white hickory are limited to warm, well-drained limestone land; the white oak characterizes the upland clays, while the red maple, the elm, and several of the oaks stand for the regions of sluggish drainage. This noble growth is rapidly disappearing, but several million acres still remain.

Climate.—There is a difference of at least 40° Fahr. between the average summer and winter temperatures. A central east-and-west belt of the State is bounded by the annual isotherms of 51° and 52°, the average winter temperature being 30° and the average summer temperature 73°. Southern Ohio has a mean annual temperature of 54°, and northern Ohio 49°. The annual range is not less than 100°, and sometimes 130°, the extreme of summer heat reaching 100° in the shade, while "cold waves" in winter may depress the mercury to 30° below zero. Extreme changes are liable to occur in the course of a few hours, especially in winter, when the return trades are violently displaced by north-west winds. In such cases the temperature sometimes falls 60° Fahr. in twenty-four hours; changes of 20° or 30° in a day are not unusual. Still the climate proves itself excellently adapted to the finer growths of vegetation, while its effects on human life and on the domestic animals favour a symmetrical development and a high degree of vigour. The rainfall varies between an average of 46 inches in the Ohio valley and an average of 32 inches on the shore of Lake Erie (spring 10 to 12 inches, summer 10 to 14 inches, autumn 8 to 10 inches, winter 7 to 10 inches). The annual range is considerable. In some years there is an insufficient supply and in some there is a troublesome excess, but disastrous droughts on the large scale are unknown, and disastrous floods are rare.[1] The vast body of water in Lake Erie favourably modifies the climate of the northern margin of the State. The belt immediately adjoining is famous for the fruits that it produces. Extensive vineyards and orchards have been planted along the shore and on the islands adjacent, and have proved very successful. The Catawba wine here grown ranks first among the native wines of eastern North America. Melons of excellent quality are raised in almost every section of the State. The peach is the least certain of all the fruits that are largely cultivated; there is rarely, however, a complete failure on the uplands of southern Ohio. The winters of Ohio are very variable. Snow seldom remains for thirty days at a time over the State at large, but an ice crop rarely fails in northern Ohio, and not oftener than once in three or four years in other portions of the State. In the southern counties cattle, sheep, and horses often thrive on pasture grounds through the entire winter.

Population.—The following table gives the population from 1840 to 1880:—

	POPULATION.			Density per sq. mile.
	Total.	Males.	Females.	
1840	1,519,467	784,100	735,367	37·3
1850	1,980,329	1,016,808	963,521	48·6
1860	2,339,511	1,190,162	1,149,349	57·4
1870	2,665,260	1,337,550	1,327,710	65·3
1880	3,198,062	1,613,936	1,584,126	78·5

In 1880 the coloured population numbered 2½ per cent. of the whole, and the foreign-born 12¼ per cent. (from Germany 6 per cent., and from the United Kingdom 4⅓ per cent.).

Agriculture.—This is the leading industry, employing in 1880 397,495 persons, or about two-fifths of the total number reported as engaged in occupations of all sorts. In 1881 nearly 50,000,000 bushels of wheat and nearly 112,000,000 bushels of Indian corn were produced, the total production of cereals in the State for that year being 188,933,067 bushels, an average of sixty bushels to each inhabitant. The reported orchard products of the year would furnish ten bushels of fruit to each inhabitant, and the dairy products an average of 26 lb. The domestic animals reach a total of 10,000,000. In number and quality of thorough-bred cattle Ohio is scarcely second to any State; in the average of its herds it ranks second to

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[1] Quite recently, however, the Ohio river has twice attained a height unprecedented in its former recorded history. In February 1883 the water rose to a height of 66 feet 4 inches, and in February 1884 to 71 feet 0⅜ inch above the channel bar at Cincinnati, the last rise being nearly 7 feet in excess of the highest mark recorded previous to 1883. These great floods covered the sites of large and prosperous towns, swept away hundreds of dwellings, and inflicted deplorable losses on the residents in the great valley.

Illinois alone. The sheep-growing counties are supplied with the best breeds of sheep, and the wool of south-eastern Ohio has long been famous for unusual strength of fibre. The annual production of wool exceeds 20,000,000 lb, Ohio holding the first rank in this respect among the States of the Union. In the origination of agricultural machinery Ohio has taken a leading part, and in the present manufacture it easily holds the first rank, the value of the annual product exceeding $15,500,000, or one-fourth of the entire product of the United States. The average yield of wheat in the State has been doubled within the last ten years through the use of artificial fertilizers and improved methods of cultivation. An efficient system of crop reports is carried on by a State board of agriculture, and thorough control of the artificial manures sold in the State is maintained by constantly repeated chemical analyses. A State meteorological bureau also renders special service to the agricultural interest.

Manufactures, Towns and Cities.—The manufactured products of the State, according to the census of 1880, have more than twice the value of the farm products, reaching an aggregate of nearly $350,000,000. As a necessary result of the recent development of mining and manufacturing in Ohio, its cities and villages are gaining rapidly in population and wealth. Cincinnati, the largest city of the State and the eighth in the Union, had a population of 255,139 by the census of 1880. The same census credits it with about 30 per cent. of the manufactures of the State, but the reports of its chamber of commerce give it a much greater total than the census tables. Cleveland, the second city of Ohio and the eleventh of the United States, had 160,146 inhabitants, Columbus, the State capital, 51,647, and Toledo 50,137. Dayton (38,678) and Springfield (20,730) in south-western Ohio, Youngstown (15,435), Akron (16,512), and Canton (12,258) in the north-eastern quarter of the State, and Zanesville (18,113) in the central district are all thriving and energetic cities.

Government and Administration.—All legislative power is vested in a general assembly consisting of a senate and house of representatives. Senators and representatives are elected biennially. The executive department consists of a governor, a lieutenant-governor, a secretary of state, a treasurer, and an attorney-general, all elected for a term of two years, with an auditor, elected for four years. The supreme executive power is vested in the governor, who is commander-in-chief of the militia, and may grant reprieves and pardons. The lieutenant-governor is president of the senate. There is also elected triennially a State commissioner of common schools. For the control and superintendence of all public works a board of public works is created, consisting of three members, each elected for three years. There are appointed by the governor, by and with the consent of the senate, a commissioner of railroads and telegraphs for two years, a superintendent of insurance for three years, an inspector of mines for four years, a commissioner of statistics of labour for two years; also a supervisor of public printing, a State librarian, an inspector of leaf tobacco, and a State inspector of oils for two years each, and three commissioners of fisheries for three years each. To investigate the whole system of public charities and the correctional and penal institutions of the State, eight persons, four from each of the leading political parties, are appointed by the governor for four years each to constitute a board of State charities. The judicial power is vested in a supreme court, district courts, common pleas courts, probate courts, and justices of the peace; and the legislature may create courts inferior to the supreme court in one or more counties. The supreme court consists of five judges, elected for five years each. There are nine common pleas districts with three judges each, holding office for five years; each district is divided into three parts, with one judge (and more if the legislature so provide) for each part. The district court is composed of the judges of the common pleas district together with one of the supreme court judges, any three forming a quorum. The original jurisdiction of the district court is concurrent with that of the supreme court; each county has a probate court for probate and testamentary matters. Townships are supplied with justices of the peace. All judges and justices are elected by the people. Clerks of the courts are elected by the people also. The State is divided into two United States districts, a northern and a southern. Each district is divided into an eastern and western division. All elections are by ballot, and every sane male citizen, twenty-one years old and a resident of the State for one year next preceding election, may vote. Education is provided for by taxation and funds arising from the sale of public lands. The insane, blind, and deaf and dumb are supported by the State. A sinking fund, sufficient for discharging annually the interest of the public debt and not less than $100,000 of the principal thereof, is provided from the proceeds of the public works, sale of canal, school, and ministerial lands, and taxation. The State at present is represented in the Congress of the United States by two senators and twenty-one representatives. The legislature of the State is empowered to lay off new or change existing counties. The electors in each county elect three commissioners, for three years each, who constitute the county board. They have the care of the county property, fix the taxes, regulate roads, and provide for idiots, lunatics, and paupers. The other officers are three infirmary directors, an auditor, a secretary of the commissioners, a recorder, a surveyor, a clerk of the court of common pleas, who is also clerk of the district court, each elected for three years; also a treasurer, a sheriff, a coroner, and a prosecuting attorney, each elected for two years. In a county that has in it a city of over 180,000 population there is a board of control, consisting of five members, each elected for three years, which has a final action and jurisdiction in all matters involving expenditure of money. Each county must contain at least 400 square miles of territory. Counties are subdivided into townships, the power to do which resides in the county commissioners. Each township must contain at least 22 square miles, and be at least one election precinct. The officers are three trustees, a clerk, a treasurer, such constables as the trustees may designate, and an assessor, elected annually. The trustees oversee elections, provide for the repairing of roads, make regulations preventing the spread of diseases, provide for cemeteries and libraries if the voters determine to have them, and afford relief to the poor.

Education.—The Continental Congress in 1785, in an ordinance for the survey of the lands north-west of the Ohio, reserved lot number 16 in every township, equivalent to one-thirty-sixth of the township, for the support of public schools. These provisions did not apply to the Virginia military and Connecticut reserves, equal in area to about one-fourth of the entire State, nor to the United States military reservation, embracing nearly 4000 square miles. The convention that framed the State constitution in 1802 requested and obtained of Congress a concession of one-thirty-sixth of the lands in the Virginia and United States military reservations, and a like proportion for education in the Connecticut reserve,—a portion of the latter, however, being set apart in the United States military reservation, the remainder from the public lands in the north-western part of the State (1834). Prior to 1827 the only revenues obtained from such lands were of the nature of rents, and were wholly inadequate. In the year named a law was passed providing for the sale of the school lands, other laws also being enacted for the establishment of a fund for the support of common schools. The result of the sales is somewhat disappointing, since the entire proceeds realised up to 15th November 1882 amount to but $3,686,511·56. This is known as the common school irreducible fund. The State early undertook to supplement the revenue thus acquired by a general tax; the present law provides for a tax of one mill on the dollar. Opportunity for special levies was given as early as 1821 to district officers. At present the law authorizes every board of education to determine the amount of tax to be levied as a contingent fund for all school expenses, not exceeding seven mills on the dollar. As early as 1827 the legislature adopted the policy of making offenders against the laws contribute to the support of the schools by appropriating fines collected to the school funds. This policy still continues. The receipts for school purposes in 1882 exceed $12,000,000:—

State tax (1 mill)	$1,589,268·51
Interest on irreducible fund, 1881	229,692·71
From rents and interest due for sale of lands	20,789·23
Balance on hand, 1881	3,472,577·04
From interest and rent of lands, 1882	250,431·94
Local taxes, 1882	6,168,036·89
Sale of bonds, 1882	510,646·81

Of 1,081,821 young persons of school age 751,101 are enrolled and 483,232 are in daily attendance. The school sessions average 31 weeks in the year, and 24,135 teachers are employed; the illiterates above ten years of age form only 4 per cent. of the total population. The total expenses for the common schools in 1882 were $8,820,914·95.

Higher education was not neglected by the first settlers of the State. In the Ohio Company's purchase two entire townships were granted, upon which the Ohio university was established. In the Symmes's purchase a township of land was granted, which when located served as the foundation for the Miami university. There are now 62 such institutions for learning in the State, employing 457 teachers, having 11,314 students, receiving $411,309 and expending $405,573, with a property valued at $6,203,691.

Of these, 25 are enabled by their charters to confer collegiate degrees. Among the oldest and most prominent of the colleges are Antioch, Denison, Kenyon, Marietta, Oberlin, Ohio Wesleyan, Otterbein, St Xavier's, Western Reserve, and Wittenberg; of those more recently founded three deserve special mention, viz., the university of Cincinnati, the Case School of Applied Science at Cleveland, and the Ohio State university at Columbus. The first two are founded upon private munificence, and each is entering upon a career of great promise. The third, established upon a gift of public lands from the general Government, is specially charged with instruction in the sciences relating to agriculture and the mechanic arts, and is also required to include military training. In addition, therefore, to the ordinary courses of an American college, this institution is obliged to provide full facilities in applied science, and the State makes use of its faculty and equipment for all its official scientific work. The chemical work of the State Board of Agriculture and also of the State Geological Survey is performed here. The Agricultural Experiment Station and the State Meteorological Bureau are both at the university.

Finance.—The receipts of the Ohio treasury for 1882 were $6,270,396·22, and the disbursements $5,630,219·29. The funded State debt at 15th November 1882 was $4,901,665, all at 4 per cent., and the irreducible debt (trust) was $4,393,014·71, making a total State debt of $9,294,679·71, while the municipal and local debts amount to $45,766,351·22, making a total public debt of $55,061,030·93. The value of the realty was $1,116,681,655, and personalty $518,229,079, or a total valuation of $1,634,910,734. The State tax paid was $4,735,748, while the total tax was $30,618,785. Banks numbered 413, with a capital stock of $38,452,855·30; 189 were national, with a stock of $31,464,000, valued at $1,133,792·40. There were 6189 miles of railway,—receipts $46,759,399, expenditure $32,063,654.

History.—Ohio was discovered by La Salle, probably as early as 1670, and the French took formal possession of the whole north-west in 1671. In 1749 all English settlers were warned by the French commandant at Detroit to retire from the region north of the Ohio. The settlements had been made under the third charter granted by King James I. to Virginia (12th March 1611), which ceded to the colony all of the present State of Ohio lying south of 41° N. lat., and that granted by Charles II. to Connecticut (23d April 1662), which ceded to the colony all the territory of the present State lying north of 41° N. lat. The conflicting claims were set at rest by the treaty of Paris in 1763, by which France surrendered to Great Britain all her lands in the north and west as far as the Mississippi. During the progress of the American Revolution, and while the States were struggling to form a union on the basis of the articles of confederation submitted for ratification in 1777, a controversy arose as to the rightful ownership of unoccupied lands. The States appealed to their charters, as did Virginia and Connecticut, for their title to the lands north-west of the Ohio. The opposing States claimed that the unoccupied lands, though charter lands, should be surrendered for the common benefit, to become the property of the new union. The controversy was settled in some cases, as in that of New York, by the abandonment of all claims by the State; in others, among them Virginia and Connecticut, compromises were entered into by which the States made large reservations in the acts of surrender. Virginia reserved for military bounty lands about 3,710,000 acres, lying between the Scioto and Little Miami rivers, and bounded on the south by the Ohio river. Connecticut reserved as a foundation for her school fund a tract extending 120 miles westward of the Pennsylvania line, bounded on the south by 41° N. lat., and by the Connecticut line on the north. The land area extended to about 3,667,000 acres. In 1800 Connecticut surrendered all jurisdictional right over these lands to the United States.

Among the last and most important acts of the Congress of the old confederation was its passing the ordinance of 1787, providing a government for the territory north-west of the Ohio. The ordinance is a remarkable document in many particulars, and especially for the clause in its sixth article, which reads: "There shall be neither slavery nor involuntary servitude in said territory, otherwise than in the punishment of crimes, whereof the party shall have been duly convicted,"—a clause which, after appearing in many State documents, at last became the property of the nation when it was adopted as the thirteenth amendment of the constitution of the United States. The passing of the ordinance was closely connected with the purchase of a million and a half of acres upon the Ohio, and in the Muskingum valley, by the Ohio Company. On 9th July 1788 General St Clair, the governor, and his associates, Judges Parsons, Varnum, and Symmes, formally established the government of the Territory at Marietta, the newly-formed settlement of the company, situated on the Ohio at the mouth of the Muskingum, and named after Marie Antoinette. The next considerable purchase of land was made by Judge Symmes, who secured upwards of 311,000 acres on the Ohio, between the Great and Little Miami rivers. The site of Cincinnati was purchased from Judge Symmes by Mathias Denman of New Jersey, whose surveys marked out in the winter of 1788-89 the town that has since grown to be the leading city of the State. Two expeditions sent against hostile Indians at the head-waters of the Miamis in 1790 and 1791 resulted in such disastrous failure that the settlers began to despair of protection. However, in 1794 General Wayne won a decisive victory over the united tribes near the rapids of the Maumee, and at the treaty of Greenville, contracted a year later with eleven chiefs, secured peace. As a result, the rapid immigration which followed enabled the residents of the Territory to avail themselves of the provisions of the ordinance in organizing a representative government for the Territory by electing a legislature, which held its first session in Cincinnati 24th September 1799. By authority of Congress a convention which met at Chillicothe in November 1802 drafted and on the 29th day of the month signed and ratified for the people the first constitution of Ohio. Several stipulations relative to school lands were made by the convention in the constitution submitted to Congress, which were conceded, and the State was admitted 19th February 1803 as the fourth under the constitution of the United States, and the seventeenth in the roll of the States. Chillicothe, which in 1800 had been made the seat of government for the North-West Territory, continued to be the capital of the State until 1810, when the Government removed to Zanesville for two years. Returning to Chillicothe, it chose Columbus in 1816 as the permanent capital of the State.

In 1821 a movement for internal improvements was inaugurated, which culminated in the construction of a canal from the Ohio to Lake Erie through the valleys of the Scioto and the Muskingum, and another from Cincinnati to Dayton. Fortunately the movement for common schools began at the same period. The canals set free the locked-up produce of the interior, and the State entered upon a new life. The completion of the Cumberland road in 1825, as far as Wheeling on the Ohio, gave the State an outlet to the seaboard. While the canals were yet incomplete the construction of railroads was undertaken. The Mad River and Lake Erie Railroad from Dayton to Sandusky was the first, being chartered in 1832 and actively begun in 1835. In 1852 three through lines had been opened across the State; and its whole social and economic history thenceforward assumed a new character. Since 1840 Ohio has been the third State in the Union in point of population.

The present constitution of the State is the result of a revision of that of 1802 by a convention which assembled in Columbus 6th May 1850, and sat during part of its session at Cincinnati. It completed its work 10th March 1851, and the people ratified the revised constitution 17th June 1851. A second convention of revision was assembled in Columbus 14th May 1873, which, like its predecessor, sat also in Cincinnati. The constitution submitted, practically a new one, was rejected by the people at the October election of 1874. (E. O.—J. T. S.)

OHIO RIVER. See MISSISSIPPI, vol. xvi. p. 518.

OHM, GEORG SIMON (1781-1854), was born at Erlangen in 1781 and educated at the university there. He became professor of mathematics in the Jesuits' college at Cologne in 1817 and in the polytechnic school of Nuremberg in 1833, and in 1852 professor of experimental physics in the university of Munich. He died 6th July 1854.

His writings are numerous, but, with one important exception, not of the first order. The exception is his pamphlet published in Berlin in 1827, with the title *Die galvanische Kette mathematisch bearbeitet*. This work, the germs of which had appeared during the two preceding years in the journals of Schweigger and Poggendorff, has exerted most important influence on the whole development of the theory and applications of current electricity. Nowadays "Ohm's Law," as it is called, in which all that is most valuable in the pamphlet is summarized, is as universally known as anything in physics. It may be doubted whether Ohm's investigation could have been made but for the magnificent work of Fourier on the *Conduction of Heat*. In fact, the equation for the propagation of electricity formed on Ohm's principles is identical with that of Fourier for the propagation of heat; and if, in Fourier's solution of any problem of heat-conduction, we change the word "temperature" to "potential" and write "electric current" instead of "flux of heat," we have the solution of a corresponding problem of electric conduction. The basis of Fourier's work, without which even his splendid mathematical powers would have been of no avail, was his clear conception and definition of conductivity. But this involves an assumption, undoubtedly true for small temperaturegradients, but still an assumption, viz., that, all else being the same, the flux of heat is strictly proportional to the gradient of temperature. An exactly similar assumption is made in the statement of Ohm's law, *i.e.*, that, other things being alike, the strength of the current is at each point proportional to the gradient of potential. It happens, however, that with our modern methods it is much more easy to test the accuracy of the assumption in the case of electricity than in that of heat; and it has accordingly been shown by Maxwell and Chrystal that Ohm's law is true, within the limits of experimental error; even when the currents are so powerful as almost to fuse the conducting wire. The value of Ohm's work was but imperfectly recognized until it was stamped by the award of the Copley medal of the Royal Society in 1841.

OIL-CAKE. The solid compressed mass remaining after the expression of oil from the many oil-yielding seeds, nuts, &c., forms a material of considerable commercial importance. It retains after the most perfect treatment by pressure no inconsiderable portion of oil, with practically the whole of the albuminous matter, sugar, mucilage, and the starchy components of the seeds, &c., thus forming in most cases a concentrated nutritious food for cattle and sheep, specially valuable for fattening store animals for the market. The only commercial cakes which are unfit for animal food are such as contain purgative or other active principles, as, for example, the cakes of castor-oil seed, croton seed, purging-nut seed, and mustard seed. The most valuable and at the same time the most abundantly produced feeding-cake is that obtained from ordinary LINSEED (*q.v.*). Next in value is the cake yielded by rape seed, but its wholesomeness is frequently marred by the presence of a large proportion of acrid mustard seed; the best is that yielded by the German green rape seed (*Brassica rapa oleifera*). Cotton-seed cake is also a feeding stuff of considerable importance. It is prepared in two forms, either as decorticated cake, in which the husks of the cotton seed are removed previous to the expression of the oil, or as undecorticated cake, which may contain as much as 40 to 50 per cent. of indigestible woody husk. Among other cakes useful for feeding purposes may be enumerated ground-nut cake from *Arachis hypogæa*, palm-kernel cake from the seeds of the oil palm, sesame or til cake from the seed of *Sesamum orientale*, and hemp cake from the seed of *Cannabis sativa*. The following table indicates the average composition of a few of the principal commercial cakes.

	English Linseed Cake.	German Green Rape Cake.	Decorticated Cotton Cake.	Undecorticated Cotton Cake.	Sesame Cake.	Hemp Cake.	Palm-Kernel Cake.
Water	12·41	10·83	9·28	11·46	8·06	10·00	9·50
Oil	15·64	8·72	16·05	6·07	11·34	8·26	8·48
Albuminous bodies *	27·87	33·81	41·25	22·94	36·87	21·50	30·40
Mucilage, sugar, and digestible fibre	23·79	28·05	16·45	32·52	25·05	48·00	40·95
Woody fibre	14·85	11·49	8·92	20·99	8·14	..	
Mineral matter	5·44	7·10	8·06	6·02	10·54	12·24	10·72
*Containing nitrogen	4·46	5·41	6·58	3·67	5·90	3·30	4·50

Oil-cake should be thoroughly dried by exposure before being packed or stored, otherwise it is apt to heat, and turn sour and mouldy, in which condition it becomes injurious to cattle. The cake also made from rancid seed is frequently deleterious, and so disagreeable in taste as to be refused by animals. Oil-cakes of high value are subject to adulteration; and compounds of varying composition are prepared and sold under commercial brands simply as feeding cake or mixed cake with no indication of their component materials. These are usually largely intermixed with bran, husks, ground rice, and maize siftings, &c.

OIL CITY, a city of the United States, in Venango county, Pennsylvania, at the junction of Oil Creek with the Allegheny river, lies 132 miles north-north-east of Pittsburg by the Allegheny Valley Railroad, in the heart of the Venango petroleum district, and possesses the principal oil exchange of the world, the transactions in 1883 amounting to 1,129,199,500 barrels, valued at $1,209,654,064. The business part of the city is on the low ground north of the river, the residences occupying the south side and the high bluffs on the north side. Besides manufactories connected with the oil industry, the city has machine-shops, foundries, flour-mills, and breweries. Founded in 1860, and partially destroyed by flood in 1865 and by flood and fire in 1866, Oil City was incorporated as a city in 1871. Its population was 7315 in 1880, and now (1884) is estimated at 10,000.

OILS. The term oil is a generic expression under which are included several extensive series of bodies of diverse chemical character and physical properties. In its most comprehensive ordinary acceptation the word embraces the hard solid odourless waxes, tallows, and fats, the viscid fluid fixed oils, the odorous essential oils, and the solid, fluid, and volatile hydrocarbons obtained in nature or by destructive distillation. Further, in former days, when substances were principally classified by obvious physical characteristics, the word applied to various substances which, beyond an oily consistency, possess no other properties in common with ordinary oils. Thus we have still in common use for sulphuric acid the term "oil of vitriol," a substance which, it need hardly be said, is widely different from any oil. Leaving out of account bodies of this nature, the remaining diverse bodies have in common the characters that they are compounds consisting principally, in some cases exclusively, of carbon and hydrogen, that they are mostly insoluble in water, and that they are all readily inflammable. The mineral hydrocarbons obtained either in nature or by destructive distillation do not come within the range of this article (see NAPHTHA, PARAFFIN, PETROLEUM), which is restricted to the series of neutral bodies formed naturally within animal or vegetable organisms. These bodies are divided into two well-defined groups—the fixed oils and fats, and the essential or volatile oils.

FIXED OILS.

The fixed or fatty oils, although varying considerably in external appearance, form in reality a well-defined and homogeneous group of substances having great similarity of chemical composition. They appear to be essential constituents of the most highly-organized forms of animal and vegetable life, being found in plants chiefly in the seed, and in animals chiefly enclosed in the cellular tissue and in special body cavities, but some proportion of fatty matter is found in almost all tissues and organs. Although oils and fats are universally distributed and perform most important functions in animal and vegetable life, those used for technical purposes are not drawn from any very great number of sources; and many bodies might be utilized for the production of oil which at present are not so employed.

As found in commerce, oils possess a faint characteristic taste, a slight odour, and some amount of colour, generally brownish yellow. These characteristics, however, are due to certain impurities; in a really pure condition most oils have scarcely any characteristic taste, odour, colour, or physiological influence. In a few cases only they have special properties which appear to be inseparable characteristics, such as the purgative principle of castor oil, croton oil, and some others. At the ordinary temperatures most vegetable oils are fluid, but a few, produced especially by tropical plants, such as palm oil, cocoa butter, Chinese tallow, &c., are solid fats. Animal fats are for the most part solid, the oils of marine animals and neat's-foot oil being important exceptions. The various solid fats differ greatly in consistency, and the hardness of individual samples is largely affected by the nature of the food and by the health of the animal yielding them, and by some other circumstances. The relative fluidity or solidity of the various oils and fats depends on the proportions of the three principal constituents of all oils—olein, stearin, and palmitin. The fluid oils contain olein in larger proportion, that body being itself liquid at ordinary temperatures, while solid stearin and palmitin predominate in the hard fats. The viscosity of the fluid oils also ranges between wide limits. The rate of flow of an oil, which is a matter of considerable importance in several industrial applications, is estimated by comparison with the standard rate at which water of the same temperature flows through an aperture of fixed dimensions. The most viscid of the fluid oils is castor oil, which at a temperature of 15° C. is more than two hundred times thicker or more slow-flowing than water. Olive oil at the same temperature is more than twenty times thicker, and linseed and hemp oils, though among the most limpid of fixed oils, still flow about ten times as slowly as water.

Oils communicate to paper and like substances a stain which remains an irremovable translucent grease spot. They are almost entirely insoluble in water, and, excepting croton and castor oils, in cold alcohol, but in boiling alcohol they dissolve more freely, and they are perfectly soluble in ether, bisulphide of carbon, chloroform, benzol, and light petroleum spirit. In their pure condition they are neutral bodies, but, on their becoming rancid, free fatty acids are developed which give them an acid reaction. Exposed to air they absorb oxygen freely, and the class containing linoleic acid, known as drying oils, of which linseed oil is the type, thereby harden into a solid translucent semi-elastic caoutchouc-like body, a property of the utmost value in the arts. When they are exposed in thin layers over a great surface the absorption of oxygen proceeds with such energy that heat is evolved sufficient to produce spontaneous combustion, a circumstance frequently exemplified in the heating and igniting of heaps of oily cotton waste. The non-drying oils also on exposure to air thicken and become greasy; they acquire the peculiar disagreeable smell and acrid taste known as rancidity, owing to a kind of fermentation being set up in them through the agency of impurities, whereby the fixed fatty acids they contain are decomposed, and odorous volatile fatty acids formed by oxidation at their expense.

The specific gravity of all oils is lower than that of water, ranging from ·900 in the case of cocoa butter to ·970, the specific gravity of castor oil. Most fluid oils have a specific gravity between ·915 and ·930. The specific gravity of oils varies with the temperature far more than is the case with water. It is found that for each degree Centigrade rise of temperature whale oil increases in volume 1 per 1000, rape oil 0·89, and olive oil 0·83.

When a solid fat is heated slowly till it melts and is allowed gradually to cool, it remains fluid till it falls considerably under the temperature at which it melted, and at the moment of solidification there is a sensible increase in its temperature. Butter, for example, melts at 30° to 31°·5 C., but does not resolidify till it falls to 19° or 20° C. These phenomena have been investigated in the case of the pure fats stearin and palmitin by Duffy (*Chem. Soc. Qu. J.*, v. 197), who finds that these bodies undergo with great readiness three isomeric modifications, each having a distinct melting point widely apart from each other (stearin from beef giving 51°, 63°, and 67°), the solidifying point being slightly under the lowest of the three. The freezing point of the ordinary fluid oils ranges down to from −27° to −28° C. for hemp oil, nut oil, and linseed oil, while olive oil solidifies at +2° to 4° C. Fluid oils heated to from 280° to 300° C., and solid fats to from 300° to 325° C., undergo destructive distillation, resolving into a mixture of rich inflammable gases and a peculiarly irritating acrid vapour, acrolein.

Oils and fats are compounds of carbon, hydrogen, and oxygen, in proportions ranging, as a rule, for carbon between 76 and 80 per cent., hydrogen from 11 to 13 per cent., and oxygen from 10 to 12 per cent. Their proximate constitution was first demonstrated by Chevreul, who indeed, in the great series of classical researches embodied in his *Recherches sur les corps gras d'origine animale* (1823), established the modern chemistry of oils.

The phenomena of saponification, as exemplified on a great scale in the important industry of soap-making, furnished the key for discovering the intimate constitution of oils. Oils and fats treated with alkalis, alkaline earths, and basic metallic oxides in presence of water undergo decomposition and enter new combinations. A soap is formed by the union of the alkaline body with acid constituents of the oil, known as fatty acids, and the sweet body, glycerin, is liberated. The saponification of stearin with sodic hydrate, for example, may be thus represented:—

$$\underset{\text{Stearin.}}{\left.\begin{matrix}(C_{18}H_{35}O)_3\\ C_3H_5'''\end{matrix}\right\}O_3} + \underset{\text{Sodic hydrate.}}{\left.\begin{matrix}3Na\\ H\end{matrix}\right\}O} = \underset{\text{Stearate of sodium (soap).}}{\left.\begin{matrix}3C_{18}H_{35}O\\ Na\end{matrix}\right\}O} + \underset{\text{Glycerin.}}{\left.\begin{matrix}C_3H_5'''\\ H_3\end{matrix}\right\}O_3}.$$

By heating oil with steam under a pressure of from 10 to 12 atmospheres, or with water superheated to about 220° C., the oil is decomposed into free fatty acid and glycerin. Thus, again taking the simple fat stearin, we have:—

$$\underset{\text{Stearin.}}{\left.\begin{matrix}(C_{18}H_{35}O)_3\\ C_3H_5'''\end{matrix}\right\}O_3} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Stearic acid.}}{\left.\begin{matrix}3C_{18}H_{35}O\\ H\end{matrix}\right\}O} + \underset{\text{Glycerin.}}{\left.\begin{matrix}C_3H_5'''\\ H_3\end{matrix}\right\}O_3}.$$

In the above reactions it will be observed that three molecules of water are required for the formation of free stearic acid and glycerin from one molecule of stearin, and to that extent the resulting products are heavier than the original. Reading the equation in the inverse manner we find the formation of stearin takes place by the substitution of the three acid residues of stearic acid $C_{18}H_{35}O$ for the three hydroxyls H . O in the molecule of glycerin. No fat or oil is found in nature consisting of a single chemical fat such as stearin alone. All are mixtures of at least two and for the most part three or more simple fats or glycerides of fatty acids closely allied in nature and constitution. These glycerides or combinations of glycerin and fatty acids are in their chemical relations ethers. Glycerin itself is a triatomic alcohol, and bears to the fatty acids and resulting ethers the same relation which a basic substance bears to an acid and to the salt which results from their combination. In all natural fats glycerin combines, as in stearin, by having substituted for its three replaceable hydrogen atoms three equivalents of fatty acids, whence the natural simple fats are all triacid compounds—tristearin $\left.\begin{matrix}(C_{18}H_{35}O)_3\\ C_3H_5\end{matrix}\right\}O_3$, tripalmitin $\left.\begin{matrix}(C_{16}H_{31}O)_3\\ C_3H_5\end{matrix}\right\}O_3$, triolein $\left.\begin{matrix}(C_{18}H_{33}O)_3\\ C_3H_5\end{matrix}\right\}O_3$, &c., though commonly called stearin, palmitin, and olein, &c. (For further information as to the constitution of glycerides see GLYCERIN, vol. x. p. 697.) The three simple fats above named form by far the largest and most important constituents of all oils and fats, the only others which bulk largely being the glycerides of linoleic acid in drying oils, and of physetoleic acid characteristic of marine oils. The number of fatty acids found combined with glycerin in oils is, however, very considerable. They constitute members of homologous series, the first or stearic series of which possess the common formula $C_nH_{2n}O_2$. Belonging to it are the following:—

		Boiling and Melting point.	Substances in which chiefly found.
Acetic	$C_2H_4O_2$	118° C	Butter fat.
Butyric	$C_4H_8O_2$	156° C.	Butter fat.
Caproic	$C_6H_{12}O_2$	194° C.	Cocoa-nut oil, butter fat.
Caprylic	$C_8H_{16}O_2$	232°	Cocoa-nut oil, butter fat.
Capric	$C_{10}H_{20}O_2$	Melt. pt. 39°	Cocoa-nut oil, butter fat.
Lauric	$C_{12}H_{24}O_2$	" 43°·6	Cocoa-nut oil, bayberry oil.
Myristic	$C_{14}H_{28}O_2$	" 53°·8	Oil of mace, &c.
Palmitic	$C_{16}H_{32}O_2$	" 62°	Lard, palm oil, &c.
Stearic..........	$C_{18}H_{36}O_2$	" 69°·2	Tallow, &c.
Arachidic	$C_{20}H_{40}O_2$	" 75°	Ground nut oil.
Behenic	$C_{22}H_{44}O_2$	" 75°	Ben oil.
Cerotic	$C_{27}H_{54}O_2$	" 78°	Beeswax.
Melissic	$C_{30}H_{60}O_2$	" 88°	Beeswax.

Another, the oleic series, contains two atoms less of hydrogen than the allied stearic series, having the general formula $C_nH_{2n-2}O_2$. To it belong the following:—

		Boiling and Melting point.	Substances in which chiefly found.
Crotonic	$C_4H_6O_2$	Boil. pt. 72°	Croton oil.
Hypogaeic or Physetoleic	$C_{16}H_{30}O_2$	Melt. pt. 34°	Earth-nut oil and whale oils.
Oleic	$C_{18}H_{34}O_2$	....	Most fats and fluid oils.
Brassic	$C_{22}H_{42}O_2$	„ 33°	Rape and mustard oils.

To these there remain to be added, not members of either series, two important fatty acids,—linoleic acid, $C_{16}H_{28}O_2$, characteristic of linseed oil and other drying oils, and ricinoleic acid $C_{18}H_{34}O_3$, the chief product of the saponification of castor oil. Among saponifiable bodies the true waxes are distinguished from other solid fats by containing no glycerin. They are principally ethers of the higher monatomic solid alcohols—cetylic and cerylic alcohol, &c. Thus spermaceti, the solid wax obtained from the head matter of the sperm whale, is a cetyl palmitate $\left.\begin{matrix}C_{16}H_{31}O\\C_{16}H_{33}\end{matrix}\right\}O$. Certain of the vegetable waxes—*e.g.*, Japanese wax—contain some proportion of glycerides.

Extraction of Oil.

The ordinary method for separating vegetable oils and fats from the nuts, seeds, &c., of which they form constituent parts is by pressure, with or without the assistance of heat. They are also obtained by the agency of solvents, principally by the use of bisulphide of carbon and the light petroleum spirit benzin, these being methods of production of comparatively recent introduction. Animal oils and fats are principally isolated by simple melting or "rendering" by heat. The degrees of heat and pressure necessary for separating the several fats vary very much with the fluidity of the oils themselves, the proportion in which they are present in the substances, and the nature and consistence of the associated materials. Sperm oil is indeed obtained direct in its fluid condition from the head of the sperm whale. Virgin olive oil is obtained with the gentlest pressure, and palm oil and several other vegetable fats and waxes are liberated by the agency of boiling water.

Vegetable Oil Pressing.—Pliny describes in detail the apparatus and processes used for obtaining olive oil among his Roman contemporaries, by which it appears that they derived a knowledge of the screw press from the Greeks, and applied it to the pressure of oil from pulped olives. In the East, where vegetable oil forms a most important article for food and for other personal and domestic purposes, various ingenious applications of lever presses and of combined lever and wedge presses have been in use from the earliest times. The Chinese employ the same series of operations which are followed in the most advanced oil mills of modern times, viz., bruising and reducing the seeds to meal under an edge-stone, heating the meal in an open pan, and pressing out the oil in a wedge press in which the wedges are driven home by hand hammers. The apparatus used in Europe in modern times for the extraction of oil by pressure consists of forms of the screw press, the Dutch or stamper press, and the hydraulic press. With the screw press, even of the most improved form, the amount of pressure practically obtainable is limited from the failure of its parts under the severe inelastic strain which can be put on it. It is on this account only used in the pressure of olives and of animal fats, where the power necessary is not great. The Dutch or stamper press, which has played an important part in the oil industry, was invented, as its name indicates, in Holland in the 17th century. The invention of the hydraulic press in 1795 effected the greatest revolution in the oil industry, bringing a new, easily controlled, and almost unlimited source of power into play, and on the great scale that apparatus has practically superseded all other means of pressing.

The sequence of operations in treating oil-seeds for the separation of their contained oils is ordinarily as follows:—(1) the crushing and grinding of the seed or other substance, (2) heating the oleaginous meal so prepared, and (3) expression of the oil by mechanical power.

Grinding.—As a preliminary operation oil-seeds are freed from dust, sand, and other impurities by sifting in an inclined revolving cylinder or screening machine, covered with woven wire having meshes varying according to the size and nature of the seed operated upon. In earlier times the seeds were pounded to meal by means of stamper mills. These consisted of a series of heavy wooden stampers or pestles made to rise and fall by the action of cams or wypers fixed on a revolving shaft, a pair of such stampers falling alternately with heavy force into an egg-shaped mortar about two-thirds filled with seed. As the process proceeded the material became heated, and from time to time had to be sprinkled with water. Stampers are now seen only in small old-fashioned establishments. In a modern oil-mill the screened seed is passed through crushing rollers to bruise or open the husk. The crushing rollers consist of a pair of cast-iron rollers horizontally mounted, commonly of unequal size, the larger being 4 feet in diameter, while the smaller is about 1 foot. The larger roller is revolved by power and the smaller moves by simple friction against the other. Between these rollers the seed is fed by a hopper, and in passing through it is bruised and broken and so prepared for the thorough grinding it receives under the revolving edge-stones to which it next passes. These are a pair of circular stones having a diameter of about 7 feet with a thickness at their running edge of 16 inches, each weighing from 2½ to 3½ tons. They are made of very compact limestone, granite, or fine-grained sandstone, and are mounted on a vertical driving shaft, to which they are attached by a horizontal axle passing through their centre. They revolve on a bed of similar hard compact stone, and the compound rubbing and bruising effect of their rotary motion quickly reduces the bruised seeds to a fine meal. The stones are provided with sweepers, which in their revolution bring the material pressed out towards the side again into their path, and there is a separate sweeper for clearing out the finished meal from the bed of the machine by way of a slide or door provided in the side. The edge-stones revolve about twenty times per minute, and a charge of seed which is slightly moistened during the process is sufficiently ground on an average in about twenty-five minutes.

Heating.—In dealing with certain oils which are easily separated, and especially with oils used in cookery and otherwise consumed, where it is desirable to preserve the pleasant, bland, and faint fruity or nutty taste, the ground oleaginous meal is taken direct to the press and pressed for cold-drawn or virgin oil. The cake from such cold pressing, as it still retains a large proportion of oil, is subsequently broken up, reduced to meal, and heated; after which it is again subjected to pressure to obtain a further flow of oil. Ordinarily, however, the meal is artificially heated previous to any pressure, and it depends greatly on the nature of the seed and the individual manufacturer's method of working whether the material is fully pressed at first or twice submitted to the operation. The warming of the seed meal renders the contained oil more fluid and consequently more readily separable with moderate pressure. It also enables the oil-presser to obtain a larger proportion of the contained oil, coagulates and holds back the albuminous constituents of the seeds, and similarly dries and retains mucilaginous matter. On the other hand, oil from heated meal usually is more highly coloured and harsher to the taste than cold-drawn oil; and the quality is seriously deteriorated if by chance the heat applied should exceed at most 80° C. The heat is applied either in open shallow iron kettles or pans heated over a direct fire or through a sand-bath; but preferably, and now generally, the meal is heated by steam circulating freely between the casings of a jacketed or double-walled pan or pans. Mechanical stirrers are kept in continuous rotation within the pan, to ensure a uniform warming effect throughout the mass. A highly-approved and convenient form of heating apparatus consists of a double steam kettle, one pan being placed above the other, each steam-jacketed and provided with mechanical stirrers. In this machine the heating action is continuous. The meal is first heated for ten or fifteen minutes in the upper pan, which is closed over with a sheet-iron cover, after which a slide in the bottom of the pan is opened and the charge is shot down into the lower pan, where it is raised to the full heat, while the upper pan is again recharged and worked up. When fully heated in the lower pan the charge is swept out at a door in the side of the pan by the action of the mechanical stirrers, and falling into a funnel is passed in measured quantities direct into bags, and without delay prepared for and placed in the press. The kettles are of a capacity sufficient to heat seed for charging three single presses at each operation. A form of heating kettle is also now in use in which the object is effected by direct injection of steam into the mass, whereby the meal is not only heated but a beneficial amount of moisture is distributed throughout the material. In mills of the most recent construction such steam kettles are used in connexion with an improved form of crushing rollers,—employment of edge-mills being dispensed with. These rollers consist of a series of four or five chilled iron or steel cylinders mounted in vertical order like the bowls of a calender. The seeds pass in succession between the first and second rollers in the series, then between the second and third, and so on till they are delivered by the lowest, sufficiently bruised, crushed, and ground.

Pressing.—With the least possible delay the meal is transferred from the heating kettles, so that the oil may be pressed out while the material still retains its heat. Measured quantities, say 10 to 12 ℔ of meal, are filled into woollen bags of strong, thick texture, sufficiently open and porous to allow free flow of the expressed oil, yet having consistency enough to resist rupture by the enormous pressure to which it is subjected. Each bag is further placed within "hairs," thick mats of horse-hair bound with leather. In some methods of working press-cloths—not bags—are used; and the construction of recent presses is such as to dispence altogether with the use of bags or other coverings. The essentials of proper oil-pressing are a slowly accumulating pressure, so that the liberated oil may have time to flow out and escape, a pressure that increases in proportion as the resistance of the materials increases, and that maintains itself as the volume of material decreases through the escape of the oil. These essentials the Dutch or stamper press and the hydraulic press fulfil perfectly, and the prevalence of hydraulic pressure over the other and older method is only due to the greater convenience and ultimate economy of the power. Previous to the early years of the present century the Dutch press was almost exclusively employed in Europe for pressing oil-seeds. It consists of two principal parts, an oblong rectangular box with an arrangement of plates, blocks, and wedges, and over it a framework with heavy stampers, the fall of which produces the pressure. The press box is made either of cast-iron or, according to the older method, of strongly-bound oaken planks. At each extremity of the box there is placed a bag of oil-meal between two perforated iron plates, under which are a perforated bottom and channels for conducting away the expressed oil. Next are inserted filling-up pieces of wood, two of which—the speering-blocks—are oblique or bevelled on one face, forming ways for the two wedges which press against them. Between the speering-blocks, and separated also by a filling piece, are inserted the two wedges, one being the ordinary or driving wedge by which the pressure is applied to the seed-bags, and the other an inverted or spring wedge, which is only driven down to loosen and free the various parts when the pressing operation is complete. The stamper which drives home the ordinary wedge is a heavy log of wood about 16 feet long by 8 inches square, and it falls about fifteen times a minute through a maximum distance of 22 inches by the action of a pair of cams or wypers fixed on a revolving shaft. As soon as the pressure is complete the stamper suspended over the inverted wedge is brought into action, and by a single heavy blow knocking the wedge out of its key-like position it frees the various parts of the apparatus for the removal of the pressed cakes. In a double stamper press about 12 cwt. of finished cake is made per day. Since the introduction of the Bramah press, numerous modifications have been invented with the special object of improving its convenience as an oil-press. The various forms devised for oil-extracting may be comprehended under standing or vertical presses and horizontal or lying presses, with specially-modified seed-boxes and press plates in each instance. The most primitive form of upright press, and one which still recommends itself for simplicity where great pressures are not essential, is a drum or box press, so called because on the platen are placed two circular metal tubs, one within the other, the inner perforated throughout for the escape of the oil. At the top of the press is secured a strong metal plate or table the same diameter as the inner box, and the seed is pressed by the working up of the ram carrying the box against the surface of this table. Within the perforated box the seed-bags are deposited with metal plates between them. Experience, however, has demonstrated that the best presses are those provided with separate trays or seed-boxes for each bag, and the ordinary oil-press of the present day is fitted with four seed-boxes, and presses four separate cakes at one working. A convenient form is the double oil-press of Blundell, which admits of continuous working, one division being under pressure, while the other division is being emptied and recharged. The final pressure applied in ordinary practice on the seed-trays in an hydraulic press is equal to a weight of about 300 tons. This weight is allowed to remain on for seven minutes, and the whole operation of charging, pressing, and emptying a press may be finished in ten minutes. A Blundell double press is capable of working off about 5 cwt. of seed per hour. A form of press of the most recent and improved construction, called the "pack press," dispenses with bags, seed-boxes, and hair-mats. Consolidated cakes of seed enclosed in press-cloths to the number of sixteen for one charge are simply placed between corrugated plates. To enable the press to be charged with sufficient rapidity, and to allow the large number of bags to occupy as small a vertical space as practicable when placed in the press, a moulding or form machine, such as was invented by John Bennie of Glasgow and patented in October 1880, or a similar machine, worked on a modified principle, patented by Francis Virtue, is employed. In these machines, by mechanical contrivances, the measured quantity of heated meal is placed in a trapeziform tray enclosed in a cloth and submitted to a pressure which reduces the thickness of the mass from about 3 inches to a little more than 1 inch and forms it into a solid cake, in which state it packs in small space in the press. The whole time occupied in filling and forming a cake and placing it in the press is not more than a quarter of a minute, and a set of three pack presses in a day of ten hours will work off nearly 9 tons of seed, yielding in the case of linseed about 108 cwt. of cake, and 54 cwt. of oil. It is claimed for the pack press that it extracts a much larger proportion of oil than that worked with seed-boxes.

Horizontal presses are not much in favour in the United Kingdom, but in many Continental mills where two pressings are the rule a set of horizontal presses are kept for the first operation.

The oil, during the process of pressure, works its way from the centre to the edge of the cake, whence it exudes. For this reason an oblong form is the most favourable for the easy separation of the oil, and the trapeziform shape oil-cakes usually present has been selected on account of the wedge-like steadiness the mass has under pressure, and the readiness with which the entire cake frees itself once it is moved the smallest distance from the thin end of the box or tray in which it is pressed. The edges to which the oil is pressed almost invariably retain a considerable proportion of oil. They are pared off, and the parings are returned to the edge-stones to be ground up and again pressed with fresh meal. The oil from the presses flows into the receiver tanks placed under the level of the floor, from which it is pumped into the storage tanks, where it is permitted to settle and clarify. After mechanical impurities and water, &c., have separated themselves, the oil is in some cases ready for the market, but for the most part it has to undergo a process of refining.

Extraction by Solvents.—The only method of obtaining vegetable oils which has come into practical competition with pressing is that in which the solvents bisulphide of carbon (CS_2), the light spirit of petroleum, and common ether are used. In ordinary pressing about 10 per cent. of oil remains in the finished cake, while by means of solvents practically the whole of the oil may be separated. Solvents might therefore be used for extracting that remaining percentage of oil from any oil-cake were such desirable, or they can be employed for treating fresh unpressed seed. As a matter of fact, it is desirable to leave a proportion of oil in the cake which is used for feeding purposes, because its food value depends to no small extent on the oil it contains, and the perfect separation of oil in the solvent process is a drawback, on account of the poverty in fatty matter of the exhausted meal.

Extraction by the agency of bisulphide of carbon was first introduced in 1843 by Jesse Fisher of Birmingham. Twelve years later a patent was secured by E. Deiss of Brunswick, but for several years afterwards the process made little advance. The colour of the oil produced was high, and its taste sharp; it retained traces of sulphur, which showed themselves disagreeably in the smell of soaps made from it, and in the blackening of paints in which it was used; and the meal left by the process was so tainted with evil-smelling carbon bisulphide that cattle would not taste it. These drawbacks have now been perfectly surmounted, and the process appears likely to come into extended use on the Continent.

The seed for treatment with bisulphide of carbon is prepared as for pressing, except that it is not reduced to a fine meal, which would prevent the percolation of the solvent freely through the mass. It is only bruised and placed in a series of four or five upright cylinders, which are hermetically closed and provided with a complicated arrangement of pipes leading to and from each other in various ways,—all being controlled by stop-cocks. Into the first cylinder A bisulphide of carbon is admitted from an overhead reservoir, till the whole mass is saturated with the fluid. After allowing the bisulphide to act on the contents of the cylinder for about fifteen minutes, communication between cylinders A and B is opened, the fluid from A passes into B, and a fresh supply of bisulphide comes from the reservoir into A. Again, after the lapse of fifteen minutes, the pipe leading into cylinder C is opened, and the fluid contents of B enter C. B is filled from A, which again is replenished from the reservoir. The extraction thus goes on, pure bisulphide of carbon always entering the weakest, most nearly exhausted cylinder, and passing on with gradually increasing percentage of oil to cylinders having more and more oil in their contents, till at the end, in the most recently charged cylinder the bisulphide is fully saturated with oil and passes off to the distilling apparatus, where the oil and the bisulphide are separated. When the contents of a cylinder have been fully extracted that vessel is isolated from the others, the remaining bisulphide of carbon is forced out by the admission of compressed air, and thereafter steam is run through the exhausted meal till not a trace of the solvent remains. The bisulphide, boiling at 46° C., is easily separated from the oil by simple distillation, and the last traces of the sulphur compound are removed by blowing steam through the oil in the distilling apparatus. Careful provision is made for the prevention of escape and for the recovery and proper storing of the bisulphide of carbon in use.

In addition to the use of bisulphide of carbon claimed under his patent of 1855 (English patent 1856), E. Deiss enumerates as solvents chloroform, ether, and benzin or benzol. In 1863 an English patent was secured by Messrs Richardson, Lundy, and Irvine for obtaining oil from crushed seeds, or from refuse pressed cake, by the solvent action of "volatile hydrocarbons from petroleum, earth oils, asphaltum oil, coal oil, or shale oil, such hydrocarbons being required to be volatile under 212° Fahr." Since that time the development of the American petroleum industry and improvements in the apparatus employed have raised this system of extraction to the rank of a competing practical method of oil production. The most approved apparatus for this method of extraction at present in use is that of Vohl. In the separation of oil from oil-seeds by means of light petroleum spirit heat is required. Vohl uses a light petroleum spirit boiling at not more than 60° C., which he calls canadol, and by a very ingenious arrangement of extractors, boiling and collecting kettle, and condenser, all brought into connexion by a system of pipes, he percolates the crushed seed in the extractor cylinders with heated canadol, which passes down into the kettle laden with extracted oil. Here the volatile canadol is distilled off by steam heat, and passes into the condenser, whence it again goes into the extractors, still further exhausting the seed and carrying an additional portion of fixed oil into the kettle. In this way the original charge of canadol keeps circulating till it completely exhausts the charge of seed in the extractors. The canadol is then distilled off from the fixed oil collected in the kettle, the condensed spirit going this time into a separate receiver, and finally the oil is perfectly freed from canadol by having steam blown through it. As pure petroleum spirit extracts neither resinous nor gummy matters from the oil-seed, and moreover takes up little or no colouring matter, the oil obtained by this solvent is remarkably pure, and the process is quite adapted for extracting even the oils used for food and for pharmaceutical purposes. The extraction of oils by means of ether, although presenting many advantages, has never been successfully undertaken on a commercial scale, chiefly through the apparently insurmountable waste of the costly menstruum.

Refining.—The refining of vegetable oils is generally carried on as a separate industry. A kind of clarification of an expressed oil takes place by simple settling in oil-tanks, but the action is too tedious and the result too imperfect for practical purposes. The all but universal method of oil-refining now practised was invented and patented by Charles Gower in 1792. It consists of treating the oil with a small percentage of sulphuric acid, which, owing to the avidity with which it takes up water, acts on the suspended impurities by depriving them of the water they contain, and then carbonizes the substances themselves, which precipitate in dark-coloured flocky masses. To a certain extent also the acid influences the oil itself, liberating fatty acids and combining with the freed glycerin; and these new products remain dissolved in the oil. It is thus of great importance to use no more than that proportion of sulphuric acid which is capable of separating the impurities. The ordinary operations of refining are briefly as follows. The oil is placed in a large tank, within which is a coil of pipe for heating by steam. When the oil is sufficiently hot, sulphuric acid is slowly added to the extent of from ½ to 1½ per cent. of commercial acid, according to the nature and impurities of the oil. After the contents of the tank have been in vigorous agitation for about an hour, it is left at rest for about five hours to allow the charred impurities to collect and precipitate. The oil is then conveyed into a washing vat, where it is mixed with about 20 per cent. of boiling water, with the addition of a little soda and kept briskly stirred for an hour. From this the mixture passes to clearing tanks, in which the oil is allowed to rest about a week in order to thoroughly separate the remaining water. The addition of about 5 per cent. of common salt, by increasing the specific gravity of the water, considerably hastens this separation. Finally the oil is passed through a filter composed of alternate layers of tow, dried moss, canvas, and similar porous substances. Numerous modifications of the above sequence and other processes of refining have been introduced, and more or less adopted. One of the best distinct processes is that of Bareswil, which consists in heating the oil and adding to it 2 to 3 per cent. of caustic soda. Thereby a corresponding proportion of soap is formed, which, rising to the surface as a strong frothing scum, brings with it the impurities which are rendered insoluble. The scum is subsequently allowed to precipitate, in doing which it perfectly clarifies the oil. The coagulum so formed is used as a lubricant. Rudolph von Wagner proposed the use of concentrated chloride of zinc, instead of sulphuric acid, in refining; and various other mineral acids as well as salts and tannin have also been suggested and tried. The most recent process of refining, and certainly the simplest and most expeditious if experience demonstrates its sufficiency, is that introduced by Mayer of the Hernalser Actien-Oelfabrik. It consists simply in submitting oil direct from the press to the action of a centrifugal machine. Thereby the albuminoid, mucilaginous, and other impurities are driven against the sides of the drum, on which they deposit as a solid coating, leaving the oil pure and clear. The effect is, of course, due to the difference in density between the oil and its suspended impurities.

Animal Fat Rendering.—The animal fats, butter only excepted, are liberated from the cells in which the fatty matter is enclosed by the agency of heat alone. The heat applied melts the fat, and by thereby causing its expansion as well as by acting on the moisture in the tissue it bursts the cell membrane and allows the liquid fat to flow together. The process is a noxious and disagreeable one owing to the intolerable stench given off by the putrefying animal matter while under the influence of heat; and it is practically impossible to have the fatty matter heated on a large scale in its pure and sweet condition. It becomes an object of importance, therefore, to prevent the escape of such disagreeable fumes into the air, and the apparatus used is principally modified with that view. The simplest method of tallow-rendering consists in cutting the fatty matter by hand or machine into small fragments, which are placed in a copper vessel, with a small quantity of water, over an open fire. While the fire is applied the mass is kept stirring, and gradually the oil exudes and collects as the membraneous matter—greaves or cracklings—becomes shrunken and shrivelled. The fat is then ladled out of the boiler and strained through a sieve or filter, and the greaves, placed in a hair or woollen bag, are submitted to pressure, by which a further portion of tallow is separated. The pressed greaves are useful for dog's food or for feeding swine, &c., or they may be still a source of tallow, which can be obtained by treating them with bisulphide of carbon or with petroleum spirit. An improved method of rendering tallow consists in crushing the suet under a pair of edge-stones, whereby the cells are ruptured, and heating the product over an open fire with about one-fifth part of water acidified with from two to seven parts of strong sulphuric acid added in the boiler. The means, however, of most effectually separating animal fat and at the same time avoiding the pollution of the air consists in the use of air-tight cylinders or kettles heated by steam. According to certain methods of working, superheated steam is forced into the kettle and acts direct on the shred suet, &c.; in other cases the steam circulates in a coiled pipe within the vessel; and a third way consists in the use of steam-jacketed rendering vessels. Strained tallow, however prepared, is further purified or refined before using by melting and thorough washing with hot water, after which it is allowed to cool slowly, so as to throw down impurities with the separating water. The same effect is also produced by blowing steam through molten tallow (comp. LARD, vol. xiv. p. 312).

Classification and Enumeration of Oils and Fats.

There is no strictly systematic plan upon which oils and fats can be satisfactorily classified and arranged. The scheme which follows brings the various commercial products into convenient groups, the distinctions of which are of prominent importance.

- I. *Fluid Oils.*
  - *a.* Non-drying or greasy oils, containing chiefly olein.
  - *b.* Drying oils, containing linolein.
  - *c.* Fish or train oils, containing physetolein.
- II. *Fats and Waxes.*
  - *a.* Solid glycerides, principally palmitin and stearin.
  - *b.* Non-glycerides or waxes.

In a pure condition the non-drying oils undergo little change through the influence of the atmosphere, but by degrees a process of slow fermentation is set up by the agency of the natural impurities they contain, developing an offensive rancid smell, and rendering the oils thick and greasy. Even in very thin layers, however, they never dry. Under the influence of nitrous acid and mercuric nitrate the olein of non-drying oils undergoes a molecular change into elaidin, and the oil becomes solid. Castor oil, the characteristic glyceride of which is ricinolein, occupies an intermediate position between drying and non-drying oils. The influence of nitrous acid on ricinolein changes the molecular constitution of the body forming ricinelaidin, with simultaneous solidification, as in the case of olein. The drying oils are those which contain as principal constituents linolein or analogous glycerides. They absorb oxygen from the atmosphere with much rapidity, giving off at the same time carbonic acid and water, whereby the composition of the oil is modified, the proportion of oxygen much increased, and the physical properties of the oils changed. They do not solidify under the influence of nitrous acid. The fish oils do not dry on exposure to the air, but they thicken and present physical features intermediate between drying and non-drying oils.

The following list embraces the whole of the oils, fats, and waxes ordinarily met with in commerce. Such of them as are of considerable importance are indicated by an asterisk, and notices of these will follow or be found under their own headings, or under the name of the producing material. The oils, &c., of local, limited, or otherwise minor importance are marked with an obelisk.

1. Non-Drying Oils.

Name of Oil.	Source.	Yield per cent.	Specific Gravity.	Principal Use.
*Ground-nut	*Arachis hypogæa*	38-50	0·918	Food; soap.
Ben	*Moringa pterygosperma*	30-35	0·912	Perfumery; personal.
*Almond	*Amygdalus communis*	45-55	0·915	Perfumery; medicine.
†Peach	*Amygdalus persica*	32-35	0·916	
†Plum-kernel	*Prunus domestica*	25-30	0·9127	
†Cherry-kernel	*Prunus Cerasus*	25-30	0·923	Food; burning; soap.
†Apple-seed	*Pyrus Malus*	12-15	..	Food; burning.
†Quince	*Cydonia vulgaris*	15	..	Food.
†Cashew	*Anacardium occidentale*	40-50	0·916	Food.
†Spindle-tree	*Euonymus europæus*	28-29	0·938	Burning; surgery.
†Horse-chestnut	*Æsculus Hippocastanum*	6-8	0·927	Medicine.
*Cotton-seed	*Gossypium* sp.	15-20	0·9306	Soap and lubricant.
Tea-seed	*Camellia theifera*	30-35	0·927	General use in China.
Brazil-nut	*Bertholletia excelsa*	60-67	0·9185	Food.
†Jungle-almond	*Terminalia Catappa*	28	0·918	Food.
*Colza	*Brassica campestris*	35-45	0·9150	Lighting.
*Rape	*Brassica campestris*, var. *Napus*	30-40	0·9139	Lighting and lubricant.
*Mustard	*Brassica* sp.	15-25	0·917	Soap-making.
Radish-seed	*Raphanus sativus*	45-50	0·917	Food.
*Sesame or Gingelly	*Sesamum orientale*	50-56	0·9235	Food; soap-making.
*Olive	*Olea europæa*	30-50	0·91	Food; burning, &c.
Beech-nut	*Fagus sylvatica*	20	0·9225	Food; burning.
Hazel-nut	*Corylus Avellana*	50-60	0·9243	Food; perfumery; burning.
Maize	*Zea Mays* (germ)	15	0·9215	Burning; wool; oiling.
†Cyperus-root	*Cyperus esculentus*	20	0·924	Food.
*Castor	*Ricinus communis*	50-60	0·9667	Medicine; soap; lubricant.
*Croton	*Croton Tiglium*	30-40	0·942	Medicine.
Purging-nut	*Jatropha Curcas*	30-40	0·915	Medicine; soap; lubricant.
Animal Oils—				
*Neat's-foot	....	..	0·915	Fine machinery oil.
Sheep's	....	..	0·9175	
Horse	....	..	0·918	
†Egg	Yellow of eggs	10-18	..	
2. Drying Oils.				
*Candle-nut	*Aleurites triloba*	55-60	0·940	Burning; paint; soap.
Wood	*Aleurites cordata*	35-41	..	Varnish and paint.
†Grape-seed	*Vitis vinifera*	10-20	0·9202	Food; burning; soap.
*Linseed	*Linum usitatissimum*	20-38	0·9350	Paint; varnish; linoleum, &c.
Pumpkin-seed	*Cucurbita Pepo*	20-25	0·9231	Food; burning
Koeme	*Telfairia pedata*	38	..	Food.
*German sesame	*Camelina sativa*	25-28	0·9228	Burning; soap
†Cress-seed	*Lepidium sativum*	50-60	0·924	Burning; soap.
*Poppy	*Papaver somniferum*	50-60	0·9250	Food; paints; soap.
†Mexican poppy	*Argemone mexicana*	25-30	0·919	Burning; medicine.
†Weld-seed	*Reseda Luteola*	30	0·9058	Burning; paints.
†Belladonna	*Atropa Belladonna*	.	0·925	Food; burning.
†Tobacco-seed	*Nicotiana Tabacum*	30-32	0·9232	Burning.
*Sunflower	*Helianthus annuus*	20-30	0·9260	Food; paints; soap.
*Madia	*Madia sativa*	35-40	0·9286	Burning; soap; lubricant.
*Niger	*Guizotia oleifera*	40-45	0·9242	Soap; lubricant.
*Safflower	*Carthamus tinctorius*	30-35	..	Food; burning.
*Hemp	*Cannabis sativa*	30-35	0·9276	Lubricant; varnish.
*Nut	*Juglans regia*	40-50	0·9250	Food; oil-painting.
†Pine-tree	*Pinus sylvestris*	25-30	0·9312	Paints and varnishes.
†Red-pine seed	*Pinus Abies*	25-30	0·9258	Paints and varnishes.
3. Train and Fish Oils.				
Walrus	*Trichecus rosmarus*	..	0·9250	Burning; lubricant; currying leather, &c.
*Seal	Various species	..	..	
*Porpoise	*Delphinus phocæna*	..	0·9220	Burning; lubricant; fibre dressing, &c.
*Bottle-nose	*Globiocephalus globiceps*	..	0·9180	
*Sperm	*Physeter macrocephalus*	..	0·910	Lubricant.
*Whale	Various species	..	..	Burning; lubricant, &c.
*Cod	Livers of *Gadus morrhua*, &c.	..	0·925	Medicinal; currying leather.
Shark	Livers of *Squalus*, various species	..	0·875	
Fish	Various fish	..	..	Burning; lubricant.

4. Vegetable Fats.

Name of Oil.	Source.	Yield per cent.	Specific Gravity.	Principal Use.
†Dika butter	*Irvingia Barteri*	60-65	0·820	Food; candles; soap.
†Java almond oil	*Canarium commune*	40	..	Food.
*Chinese vegetable tallow	*Stillingia sebifera*	20-30	0·918	Candles; soap.
Pekea butter	*Pekea butyrosa*	..	..	Food.
Soap-tree oil	*Sapindus emarginatus*	30	..	Soap-making.
Carapa oil	*Carapa guyanensis*	60-70	..	Soap; medicine.
Piney tallow	*Vateria indica*	..	0·9150	Candles.
Borneo tallow	*Hopea macrophylla*	..	..	....
*Cocoa butter	*Theobroma Cacao*	..	..	....
†Cokum butter	*Garcinia indica*	10	..	....
†Cnaulmoogra oil	*Gynocardia odorata*	50	..	Medicine.
*Oil of mace	*Myristica moschata*	20-28	0·990	Medicine; perfumery.
†Otoba butter	*Myristica Otoba*	..	..	Medicine; candles.
†Becuiba tallow	*Myristica Becuhyba*	..	..	
*Shea butter	*Bassia Parkii*	40	0·958	Candles; medicine.
*Ghee butter	*Bassia butyracea*	..	..	Food; medicine.
†Mahwa butter	*Bassia latifolia*	35-40	0·972	Soap; candles.
†Bayberry oil	*Laurus nobilis*	..	..	Veterinary medicine.
†Avocado oil	*Persea gratissima*	..	..	Soap.
*Palm oil	*Elæis guineensis*	..	0·945	Soap and candles.
*Palm-seed oil	*Elæis guineensis*	45-60	0·952	Soap and candles.
*Cocoa-nut oil	*Cocos nucifera*	..	..	Soap and candles.
5. Animal Fats.				
*Lard	*Sus scrofa domestica*	..	0·940	Food; candles; lubricant.
Horse fat	*Equus caballus*	..	..	Currying; lubricant.
*Butter	Milk of Ruminants	..	..	Food.
*Tallow (ox)	*Bos taurus*	..	0·920	Soap; candles; lubricant.
Beef marrow	*Bos taurus*	..	..	Pomade.
*Tallow (sheep)	*Ovis aries*	..	0·913	Food; soap; candles.
Goose fat	*Anas anser*	..	..	Pomade.
6. Waxes.				
a. Vegetable—				
*Japanese wax	*Rhus succedanea*	..	1·006	Candles.
Ocuba wax	*Myristica Ocuba*	..	0·920	Candles.
Cow-tree wax	*Galactodendron americanum*	..	..	Candles.
Myrtle-berry wax	*Myrica cerifera*	20-25	1·005	Candles.
Carnahuba wax	*Corypha cerifera*	..	0·995	Candles.
Palm-tree wax	*Ceroxylon andicola*	..	0·995	Candles.
b. Animal—				
*Beeswax	*Apis mellifera*, &c.	..	0·963	Candles, &c.
*Insect wax	*Coccus ceriferus*	..	0·970	Candles, &c.
*Spermaceti	*Physeter macrocephalus*	..	0·943	Candles; surgery.

Oil Testing.—The presence of mineral oils in any fixed oil is easily detected by the process of saponification, as well as by a peculiar fluorescence they impart to the mixture. In the saponification test the oil is made into a soap, with either soda or potash, the product mixed with sand, and the whole treated with light solvent petroleum spirit, which extracts the mineral oil. The increase in quantity of solution over the solvent used is the measure of the proportion of adulterants in the oil. Smell, taste, specific gravity, and viscosity, all to a certain extent give indications of the nature of an oil. The elaidin proof—that is, the solidification or non-solidification of an oil under the influence of nitrous acid, and the length of time required for solidifying when such a change ensues—is a valuable indication of the nature of an oil; and similar trustworthy conclusions may be drawn by observing the heat developed by mixing one part of sulphuric acid with three parts of the oil to be tested, a test first suggested by Maumené, and elaborated by Fehling. The colour reactions which result from treatment with acids of different strengths, mixed acids and alkalis, &c., are the most important tests. The following tabular statement of several such tests is extracted from Schaedler's *Technologie der Fette und Oele* (Berlin, 1883). The first column shows the colour reactions produced by nitric acid of sp. gr. 1·18 to 1·20 on equal proportions of oil; the second the effect of fuming nitric acid of sp. gr. 1·40 to 1·45 on four or five times the amount of oil; the third the colour reaction from the use of sulphuric acid of sp. gr. 1·60 to 1·70; and the fourth the effect of a diluted mixture of nitric acid and sulphuric acid on equal volume of oils. In the fifth column is given in hours the time a non-drying oil takes to solidify under the influence of nitrous acid, after which comes the appearance of emulsions formed by treatment with alkaline leys of 1·33 sp. gr. The last two columns are devoted to the effects produced by a solution of chloride of zinc and of hydrochloric acid with the addition of about 2 per cent. of sugar.

Name of Oil.	Nitric Acid.	Fuming Nitric Acid.	Sulphuric Acid.	Nitric Acid and Sulphuric Acid.	Elaidin Test.	Alkaline Leys.	Chloride of Zinc.	Hydrochloric Acid and Sugar.
Almond	Reddish yellow	Reddish	Olive green	Reddish	24	Grey white	White ..	Orange
Castor	Yellowish	Yellow	Red yellow	Yellow	6-7	White ..	White ..	Orange
Cod-liver	..	Blood colour	Violet	Red brown	..	Red	..	Brown
Cotton seed	..	Orange brown	Purple	Red	20-24	Violet ..	Brown	Orange
Ground nut	Reddish yellow	Red yellow	Brown ..	Reddish yellow	24-30	Flesh colour	Brown	Yellow
Hemp ..	Greenish yellow	Dark brown	Green ..	Blackens	..	Greenish yellow	Green yellow	Yellowish green
Linseed	Cadmium yellow	Purple brown	Green ..	Green brown	..	Yellow	..	Yellow
Madia ..	..	Ruddy brown	Dirty green	Dirty brown	..	Yellowish	..	..
Mustard (white)	Yellowish	Cherry red	Greenish brown	Reddish yellow	20	Yellowish	Brownish green	..
Olive ..	Pale green	Dirty brown	Greenish	Greenish	1-2	White ..	Pale rose	Orange
Poppy	..	Yellow red	Green brown	Brick red	..	Yellowish	..	Clear brown
Rape (refined)	..	Brown red	Green brown	Reddish yellow	20	White ..	Yellowish -	Brown
Sesame	Yellow red	Reddish brown	Green ..	Green ..	20-24	Whitish	..	Violet ..
Whale	..	Dark brown	Dark brown	Dirty brown	..	Red	..	Reddish

Commerce.—As regards the United Kingdom it may be said in general terms that Hull is the centre of the linseed and other seed oil trade, Liverpool the headquarters of that in palm oil and palm-nut oil. Tallow and lard and sperm, train, and fish oils are dealt in principally in Dundee, London, and Greenock. In the Mediterranean Marseilles and Trieste are oil-trading centres of great importance, and Hamburg, Rotterdam, Antwerp, and Copenhagen are busy oil marts in northern Europe. Sperm oil, lard, and animal oils come to British markets most largely from the United States, tallow from South America and Russia, castor oil from the East Indies and Italy, olive oil from Italy, the south of France, and Mediterranean ports generally. Palm oil is received exclusively from the west coast of Africa, and cocoa-nut oil from the East Indies and Ceylon. Of seeds imported as sources of oil, linseed is principally derived from the East Indies and Russia, cotton seed from Egypt, and rape from Russia and the East Indies. The following table, from the Board of Trade Returns, gives the imports and exports of oils and fats into the United Kingdom for 1882:—

	IMPORTS.		EXPORTS.	
	Quantities.	Value.	Quantities.	Value.
1. OILS AND FATS.				
Fish, train or blubber	14,808 tuns	£420,466	1,624 tuns	£49,082
Sperm or head matter	1,642 tuns	111,197	119 tuns	9,068
Animal	67,877 cwts.	157,617	9,968 cwts.	25,714
Castor............	168,970 cwts.	264,351	24,288 cwts.	40,067
Cocoa-nut	183,782 cwts.	210,064	184,868 cwts.	205,788
Olive	28,450 tuns	947,154	3,668 tuns	166,698
Palm	818,870 cwts.	1,240,866	428,162 cwts.	642,208
Seed	14,507 tuns	476,807	1,162 tuns	37,279
Unenumerated......	.....	116,229	..	20,175
Lard	667,158 cwts.	1,866,360	48,682 cwts.	127,258
Tallow and stearin	1,116,581 cwts.	2,252,517	212,852 cwts.	428,460
Wax	85,588 cwts.	129,926	16,441 cwts.	56,074
Butter and butterine	2,169,717 cwts.	11,350,909	85,949 cwts.	478,963
Oil (not essential or medicinal)	Produce of the United Kingdom.		14,041,900 galls.	1,444,071
Grease, tallow, and animal fat			239,710 cwts.	872,229
2. OIL SEEDS, &c.				
Linseed	2,433,182 qrs.	5,945,518	6,050 qrs.	13,179
Rape	548,806 qrs.	1,032,829	41,782 qrs.	100,895
Cotton	209,689 tons	1,562,852	64 tons	543
Nuts and kernels ..	57,962 tons	726,426	27,606 tons	330,877
Oil seeds unenumerated	120,968 qrs.	262,029	90,280 qrs.	201,843
Oil-seed cake	190,427 tons	1,460,878	2,946 tons	14,782

Subjoined are notices of various oils and fats of considerable commercial importance to which special articles are not devoted in other parts of this work. In several cases notices of oils will be found under special headings, incorporated with descriptions of other products of the plants and animals whence they are obtained. Here drying and non-drying oils are dealt with together in alphabetical order, after which vegetable fats and animal oils and fats are noticed in groups.

1. *Liquid Vegetable Oils.*—*Almond oil*, the produce of both the sweet and the bitter almond, is a pale straw-coloured oil, having a pleasant nutty taste and sometimes—when pressed from bitter almonds—an odour of the essential oil of bitter almonds. The oil consists almost entirely of olein, remains fluid to −15° C., and solidifies at 20° C. It is used in food, and in medicine is employed as a demulcent and mild laxative; but the readiness with which it becomes rancid interferes with its free use in these capacities. It produces a fine firm soap, and is also largely used by perfumers. The oil is much adulterated with the allied peach-kernel oil, and sesame oil, nut oil, &c. It is chiefly expressed in England from almonds imported from the Mediterranean and the East Indies. *Peach-kernel oil* (from *Amygdalus persica*), *Apricot oil* (from *Prunus armeniaca*), *Plum oil* (from *P. domestica*), and *Cherry oil* (from the kernels of species of *Cerasus*) are a series of oils allied both in sources and properties frequently mixed with or sold as almond oil. *Ben oil* is obtained from the seeds of *Moringa pterygosperma* and *M. aptera*, trees native of Egypt, Syria, and the East Indies, and cultivated in America. The oil, cold-drawn, is clear, bland, and odourless, with little tendency to rancidity, but the product of final hot pressing is coloured, and has a bitter taste and purgative properties. The oil contains, in addition to palmitin, stearin, and olein, the glycerides of behenic acid $C_{22}H_{44}O_2$, and myristic acid $C_{14}H_{28}O_2$. Ben oil is used by perfumers for obtaining essential oils by enfleurage, as a hair oil and ointment, as a salad oil in the West Indies, and as a lubricant for watches and small machinery. It is, however, principally consumed in the regions of its production. *Candle-nut oil* is obtained from the nuts of *Aleurites triloba*, a tree native of the South Sea Islands, but grown also generally throughout tropical countries. The nuts are about the size of a horse-chestnut, with kernels which yield as much as from 60 to 66 per cent. of oil. The name given to these fruits is due to the fact that they are used in the Sandwich Islands, spitted on a stick, as lamps or candles, in which condition they burn with a clear steady light. The oil, cold-pressed, is a clear, almost colourless, rather viscid fluid, with a pleasant taste and smell, and medicinal properties akin to those of castor oil. Hot-pressed, it has a brown colour and a rather disagreeable odour and taste. It contains glycerides of linoleic acid and myristic acid in addition to those of palmitic acid and oleic acid, and possesses strong drying properties which make it useful for varnishes, and otherwise as a substitute for linseed oil; it is also an excellent illuminant and a valuable soap-making material. On account of the cheapness of linseed oil, and the superior value of linseed cake, candle-nut oil does not find a very extensive market in Europe, but it is the basis of an industry of some importance in the South Sea Islands, whence a large quantity of the oil is annually exported to the west coast of America. The nuts of *Aleurites cordata* yield *Wood oil*, a powerfully drying oil, of much importance in China and Japan for use as a natural varnish and in medicine. It does not enter into Western commerce. *Cotton-seed oil*, obtained from the decorticated seed of the varieties of cultivated cotton, is now, on account of the enormous extent of its production, one of the most important of the fluid vegetable oils. Its preparation is quite a recent industry, dating only from 1852, when the first importation of the material was made from Egypt. Since that period the trade has developed with extraordinary rapidity. Egyptian seed, containing about 25 per cent. of oil, is chiefly pressed in European countries (England, France, Germany); the American seed pressed in the United States shows not more than 20 per cent. of oil. The oil as expressed has a dark-brown turbid appearance, owing to the presence of a resin with albuminous impurities, and in the early days of the industry much difficulty was experienced in refining the product sufficiently for commercial purposes. It is now purified by as far as possible coagulating and separating the impurities by treatment with boiling water and steam. After the coagulum so formed has precipitated and been separated, the oil is treated with weak alkaline ley, briskly agitated, and allowed to settle, when the coloured resinous matter goes to the bottom; over that comes a proportion of saponified oil, and the clear refined oil forms the upper portion. The refined oil has a clear straw-yellow colour, a faint earthy odour, and a pleasant nut-like flavour. It consists entirely of a mixture of palmitin and olein, the former beginning to solidify and separate out between 12° C. and 6° C. There is no doubt that cotton-seed oil is very extensively and generally used to adulterate other and more costly oils, especially olive oil. It also is largely used in soap-making, and it constitutes a principal ingredient in compound lubricating oils. The quantity of cotton seed available for pressing annually is estimated to be not less than 800,000 tons, from which about 120,000 tons of oil and 250,000 tons of oil-cake may be produced. *German Sesame* or *Cameline oil* is procured from the small yellow or ruddy seeds of the cruciferous plant called Gold of Pleasure, *Camelina sativa* (*Myagrum sativum*, Linn.). The oil has a golden-yellow colour, a distinctive smell, and a somewhat sharp taste. In addition to other glycerides it contains that of erucasic acid, and of some analogue of linoleic acid. The oil dries

only slowly on exposure to the air, and its chief applications are found in soap-making and for burning in lamps. It is principally produced and consumed in Germany and Russia. *Grape-seed oil* is used in the south of Germany and north of Italy for food and for burning in lamps. The seeds yield from 10 to 20 per cent. of a pleasant brownish-yellow very fluid oil, which dries very slowly on exposure to the air. *Ground-nut oil* (see Ground Nut) is an excellent edible oil, largely used as a substitute for olive oil, and to no small extent passing into consumption either separately or mixed with olive oil under the name of the latter. The inferior hot-pressed qualities are employed in soap-making, being a principal staple of the soap industry of Marseilles, into which city not less than from 700,000 to 800,000 tons of the nuts are annually imported from West Africa. *Madia oil* is obtained from the fruit of *Madia sativa*, a plant native of Chili, but introduced into Europe within this century on account of its oil-yielding properties. The seeds contain from 35 to 40 per cent. of a dark-yellow oil, of peculiar smell and mild taste, which has a tendency to become rancid. It has only faint drying properties, and occupies a place intermediate between drying and non-drying oils. When cold-pressed, madia oil may be used for food purposes, but it is principally consumed in lamps, or employed as a lubricant and in soap-making. *Maize oil* is a product of the seed-germs, which, in the preparation of maize meal and starch and fermented and distilled liquors from maize, have to be removed as carrying in them a disagreeable acrid substance. The germ contains about 15 per cent. of a clear golden-yellow oil, useful for burning, or oiling wool, and for lubricating machinery. *Niger oil* is the produce of the seeds (properly achenes) of *Guizotia oleifera*, a plant native of the east coast of Africa, but cultivated throughout India and to some extent in Germany. The fruits, which are small, tooth-like in form, and shining black in colour, contain from 40 to 45 per cent. of oil, which first came into the English market about 1851. The oil is limpid, clear, pale-yellow in colour, with a pleasant nutty mild flavour. It possesses little drying property, and is not fitted for use either in paints or varnishes. It is much used in India—in the Deccan especially—as a substitute for ghee with the poorer sections of the population, and in other parts of the country both as a culinary oil and for burning. In Western countries niger oil is principally employed in soap-making and as a lubricant. *Nut oil* is the produce in Europe of the nuts of the walnut tree, *Juglans regia*, and in America a similar oil is obtained from hickory nuts, *Carya alba*. The European walnut kernels yield from 40 to 50 per cent. of a fine limpid oil, which when cold-pressed is almost colourless, with a sweet nutty taste and pleasant odour, but the hot-pressed oil has a greenish-yellow colour and a rather sharp taste. Nut oil consists in large proportion of linolein, with olein and the glycerides of myristic and lauric acid. It is one of the most fluid of all oils, and, as it possesses with colourlessness strong drying properties, it is much valued by artists for oil-painting; it also yields a fine transparent varnish. In the hilly districts of northern India and Persia—the native regions of the walnut—the oil is used for culinary purposes and for lighting. Several closely-allied nuts, both in Europe and in America, yield oil similar in quality to that of the walnut. *Para-nut* or *Brazil-nut oil*, yielded by the kernels of *Bertholletia excelsa*, is employed in South America as a food-oil and for soap-making. To a limited extent it is also pressed in England and Germany from nuts which become unfit for table use. The oil becomes rapidly rancid. *Sapucaia oil*, yielded by *Lecythis ollaria*, also a South-American tree, allied to the *Bertholletia*, is analogous in properties and uses. *Pine oils* are got from the seeds of various species of pine and fir trees containing some proportion of resinous matter; they have a turpentine odour and possess powerful drying properties. They are useful for mixing painters' colours, for making varnishes, and for burning in lamps. *Poppy oil* is yielded by the seeds of the opium poppy (see Opium). In the valley of the Ganges, the great region of opium culture, the poppy seed is consumed as an article of food by the native population, and is their principal source of oil. The exceedingly minute seeds contain as much as 60 per cent. of a fine transparent, nearly colourless limpid oil, of pleasant taste and faint characteristic odour. The qualities obtained by cold and hot pressing respectively are distinguished from each other, the former being an esteemed salad oil, while the latter, of yellow colour, sharp taste, and linseed-oil-like odour, is used for soap making, &c. Poppy oil consists principally of the glyceride of linoleic acid, linolein, and has therefore powerful drying properties, on which account it is much used by artists. To some extent the finer qualities are used for adulterating olive oil. *Purging-nut oil* is obtained from the seeds of *Jatropha Curcas*, a small tree native of India, but cultivated in tropical countries. It is a violent purgative, and contains, like castor oil, ricinoleic acid. It is comparatively limpid and odourless, and forms an excellent lamp oil. It is also used in the soap trade and as a lubricant. *Safflower oil* is yielded by the seeds (achenes) of the composite plant *Carthamus tinctorius*, which contain from 30 to 35 per cent. of a light-yellow clear limpid oil. It is extensively used in Egypt, the East Indies, and China (where the plant is cultivated as a source of the dye-stuff safflower), its principal applications being for culinary purposes and burning, and also as an ointment in paralytic affections and ulcers. A thick sticky charred oil is obtained from the seed in India by a process partly of burning and partly of distillation. The dark fluid so obtained is used by the native agriculturist for greasing leather-work exposed to the action of water. *Sesame* or *Gingelly oil*, one of the most highly esteemed of vegetable oils, is the produce of *Sesamum orientale*. The plant is grown especially in India as an annual; it ripens in about three months, and two crops are reaped yearly. The seeds are very small, weighing not more than one-tenth of a grain, and they vary in colour from a dirty white through brown to nearly black. They are highly oleaginous, containing as much as from 50 to 56 per cent. of a clear limpid oil of a pale-yellow colour, inodorous, bland and sweet of taste, and not liable to rancidity. It consists of about three parts of olein to one part of stearin and palmitin, with a small proportion of the glyceride of myristic acid; and it does not solidify till it reaches 5° C. Both seed and oil are of much importance in the East Indies and China as food substances. The seed itself is used directly as food; the oil comes next to cocoa-nut fat in the variety and extent of its applications for food, personal use, and soap-making; and the pressed cake is even an article of food among the poorer classes. As a salad oil the cold-pressed qualities are in every respect equal to the finest olive oil, its mild piquancy of taste causing it to be preferred by many. Indeed sesame oil may be used with advantage for every purpose to which olive oil is applied, excepting, probably, the Turkey-red dyeing, and it is in extensive consumption in food, lighting, soap-making, and as a lubricant. The oil is the subject of much adulteration, especially with the cheaper ground-nut oil. It can by itself, or as an adulterant of olive oil, be readily recognized by a peculiar green coloration it takes when shaken up with mixed sulphuric and nitric acids, a reaction peculiar to sesame oil. Sesame seed is principally crushed at Marseilles and Trieste, to which ports it comes partly from the Levant, but more largely from the East Indies and Java. The quantity of seed imported into France alone yearly is not less than from 70,000 to 80,000 tons. *Sunflower oil* is a clear pale-yellow limpid oil, with scarcely any smell and a mild pleasant characteristic taste, obtained from the so-called seeds (achenes) of the sunflower plant, *Helianthus annuus*, which yield when freed from their husk about 30 per cent. of the oil. It contains glycerides of acids allied to linoleic acid, and possessing certain drying properties. It is of much importance in the east of Russia as an article of food, the sunflower being extensively cultivated in the government of Saratoff solely for its oil seed. *Tea-seed oil* is a commercial product in China, where it is used for food, lighting, and soap-making. It is said to yield a fine hard soap. The oil contains 75 per cent. of olein and 25 parts of stearin, has a yellow colour, and is destitute of taste and smell.

2. *Vegetable Fats.*—Among the numerous solid oils of the vegetable kingdom only a very few occupy a place of great importance in Western commerce. Those which hold a foremost position—palm oil, palm-nut oil, and cocoa-nut oil—are referred to under their proper headings. Of the others the following enter more or less into general commerce. *Dika butter* is a solid fat yielded by the drupes of *Irvingia Barteri*, a tree native of the Gaboon coast of Africa. The kernels are bruised and pounded into a cake, which is used by the natives for food as dika bread, and they contain more than 60 per cent. of solid oil, which can be separated either by boiling or by pressure with heat. It consists principally of glycerides of lauric and myristic acids, with only a little palmitin. Dika fat is used in soap and candle making. *Chinese tallow* is a white hard fat formed on the surface of the seeds of the tallow tree, *Stillingia sebifera*, native of China, but introduced into the North-West Provinces of India. The tallow is in China separated by steaming the seeds till they become soft, beating with stone mallets, and straining the mass through hot sieves. The fat melts at 44°·5 C., and consists principally of palmitin with only a little olein. Chinese tallow has long been valued in China for making candles used in Buddhist worship, and it is now an article in English commerce, being imported for candle and soap making. The seeds themselves, after separation of the fat, yield an oil fluid at ordinary temperatures. *Carapa* (or *Crab-wood*) *oil* is a soft white fat obtained from the seeds of *Carapa guyanensis*, a tree native of Brazil and Guiana and of the west coast of Africa. A similar fat is also expressed from the seeds of the allied *C. moluccensis*, from the coasts of India and Ceylon. The fat has a slightly aromatic odour and a powerfully bitter taste, said to be due to the presence of strychnine. It is imported into the European markets for soap-making, and in its native regions it possesses a great reputation as an ointment in rheumatic affections. *Piney tallow* is a hard solid fat obtained from the seeds of the Indian copal tree, *Vateria indica*. The substance has a feeble but pleasant smell, and a slightly yellow colour; it melts at 36°·5 C., and consists of three parts palmitin and one part olein. It is prized for candle-making on account of the pleasant odour given off by the glowing wick. *Cokum butter* is a solid white or greenish-yellow, pleasant-smelling, rather friable fat obtained from

the seeds of *Garcinia indica*, a tree native of western India. It contains, besides stearin and olein, the glyceride of myristic acid, and various free fatty acids of the volatile class. It is principally used in India to adulterate ghee, and for various medicinal uses; but it is described as forming an excellent substitute for spermaceti and to be applicable for soap-making. The seeds of *Garcinia pictoria* and other allied species yield a similar fat. *Oil of mace* is the solid oil obtained from the NUTMEG (*q.v.*). *Shea butter*, the fat of the seeds of the tropical African tree *Bassia Parkii*, is at ordinary temperatures of a buttery consistency, with a dirty or greenish-white colour and a pleasant aromatic odour and taste. It consists principally of stearin and olein, and is an important article of food in the basin of the Niger and the adjoining regions. In European commerce it is employed for soap and candle making and in the preparation of pomades. *Ghee* or *Indian butter*, the solid fat obtained from the seeds of *Bassia butyracea*, an allied tree native of the sub-Himalayan ranges of northern India, is a most important food substance among the natives of the North-West Provinces, possessing a delicate white colour, the consistency of lard, and a pleasant odour and taste. In the hot climate of India it will keep many months without acquiring bad odour or taste, on which account it is highly valued not only for food but also as an ointment, when perfumed, by the wealthier classes. It makes excellent soap and candles. *Mahwa butter*, obtained from the seeds of *Bassia latifolia*, a tree cultivated generally throughout India, is used as a substitute for or as an adulterant of ghee. It possesses a greenish-yellow tinge, and becomes rancid more readily than genuine ghee. The fat is imported into England for soap and candle making. The seeds of *Bassia longifolia* and *B. elliptica*, natives of India, yield similar fats. *Bayberry oil* is the fat obtained from the seeds of the common bay or sweet laurel. It possesses a buttery granular consistence, a yellowish-green colour, a strong aromatic flavour, and a sharp bitter taste, due to the presence of an aromatic oil. It is pressed from the seeds principally in the south of Europe, Switzerland, and Holland, and finds its chief application in veterinary practice. *Avocado oil* is the produce of the fruit of the avocado pear tree, *Persea gratissima*, an edible fruit, native of the West Indies, but transported to other tropical regions. The fat consists of 30 per cent. of olein and 70 per cent. of lauro-stearin and palmitin, and is largely used in America for soap-making. In addition to the cocoa-nut palm and the oil palm, a large number of trees belonging to the same order, *Palmaceæ*, yield useful fats, which, however, are little known in ordinary commerce.

3. *Animal Oils.*—The only liquid animal oil of considerable importance other than the marine oils is *Neat's-foot oil*, a preparation from the feet of the common ox. For obtaining it the feet are split up and boiled in water over an open fire, or, preferably, treated with superheated steam in a closed cylinder. The oil is skimmed from the surface of the decoction, and after some time it deposits a thick greasy fat, from which the liquid portion is separated. Neat's-foot oil has a brownish colour and a mild animal taste and odour, and does not readily become rancid. It is very valuable for watchmakers' purposes, and for oiling fine machinery generally, and is in great demand in connexion with the tools and machines of engineers. It is much adulterated, generally with fish oils. A large quantity of ox-foot oil is prepared in and exported from the River Plate region in South America. *Sheep's-foot oil* and *Horse-foot oil* are made to a limited extent, and sold as neat's-foot oil. *Egg oil* is obtained as a by-product of the preparation of egg albumen from the yolk or yellow of hens' and ducks' eggs. It is extracted either by pressure or by ether from the hard-boiled yolks, and has a fine brownish-yellow colour and a mild taste, except when extracted by ether, which brings with it a disagreeable fatty constituent. It is now being used to a considerable extent in place of olive oil in the manufacture of chamois or shamoy leather. The *Seal oil* of commerce is obtained from the bodies of nearly thirty species of SEAL (*q.v.*). The blubber or fat consists of a layer of variable thickness lying between the skin and the muscular tissue. Skin and blubber are first removed together from the carcases of the animals, and when the products are landed the fat is removed from the skin and reduced to oil, either by slow maceration and exudation in large vats or by rendering with steam. When heaped up in great wooden vats the mere pressure of the mass causes a flow at first of a fine clear oil, which is saved as a separate commercial quality known as "pale seal." Fermentation and putrefaction meantime progress in the mass, which begins to give off an almost unbearable stench, and the exuding oil gradually assumes a dark-brown colour, with a disagreeable animal odour and taste. By degrees the exudation of oil ceases, and finally the remaining oil is obtained by boiling up the mass with fatty muscular scraps, the product of which also forms a separate class of seal oil. The oil rendered by the action of steam heat on the fat has the advantage of being promptly obtained, free from the disagreeable odour of the greater portion of the seal oil obtained in open vats. According to its quality seal oil varies in specific gravity from 0·915 to 0·930; at a temperature of 5° C. a proportion of stearin solidifies out, and at – 2° to – 3° C. it entirely solidifies. In chemical composition it consists principally of a glyceride of physetoleic acid with proportions of the glycerides of stearic acid, palmitic acid, a little oleic acid, and traces of some of the volatile acids. The oil is only very slightly soluble in alcohol, a circumstance which affords a means of detecting adulterations. It is used for the various purposes to which the allied whale oils are applied; regarding these see WHALE. *Shark oil*, obtained from the liver of various species of shark, is analogous in properties and applications to COD-LIVER OIL (*q.v.*). Shark oil is distinguished from all others by its low specific gravity, which ranges from 0·870 to 0·880. It contains, but in different proportions, the same constituents as cod-liver oil; particularly it is rich in iodine; and it possesses a peculiar, highly-disagreeable odour and a very acrid taste. Under the name of *Fish oil* may be embraced the oil obtainable by boiling from the refuse of various fish as well as from the entire fish which may for any reason be unfit or not applicable for human food. Such oils have a fishy odour and taste, a brownish colour, and a specific gravity ranging from 0·925 to 0·930. The most important of these products is *Menhaden oil*, obtained from the MENHADEN (*q.v.*) on the west coast of North America.

4. *Animal Fats.*—The few solid animal fats which enter into commerce are articles of such importance that they have special articles devoted to them (see LARD, vol. xiv. p. 312, and TALLOW), or of so little consequence that they do not demand special notice. Bear's grease, beef marrow, and goose fat are highly valued for use in pomades for the hair, but comparatively little of what passes under these names is obtained from the sources to which they are attributed.

5. *Waxes.*—The waxes of both animal and vegetable kingdoms will be dealt with under the heading WAX.

ESSENTIAL OILS.

The essential or volatile oils constitute a very extensive class of bodies which possess in a concentrated form the odour characteristic of the plants or vegetable substances whence they are obtained. The oils are usually contained in special cells, glands, cavities, or canals within the plants, either in a separate condition or intermixed with resinous substances, and in the latter case the mixtures form oleo-resins, balsams, or resins, according as the product is viscid or solid and hard. A few do not exist ready formed in the plants whence they are obtained, but result from chemical change of inodorous principles,—examples of this class being oil of bitter almonds and essential oil of mustard. Essential oils are for the most part insoluble, or only with difficulty and sparingly soluble, in water; but in alcohol, ether, the fatty oils, and mineral oils they dissolve freely. They ignite with great ease, and burn with a fierce smoky flame, depositing a large amount of carbon. In many important respects they differ from the fatty oils: they are not oleaginous to the touch, and make no permanent grease spot; they distil at various temperatures unchanged; they have an aromatic smell and hot burning taste; and in chemical constitution they present no relationship to the fats and oils.

Crude essential oils are at ordinary temperatures nearly all limpid liquids, but some are viscid; and the essential oil or otto of roses is solid. Many on exposure to low temperatures separate into two portions, one solid, called "stearoptene," the other liquid, called "elæoptene." The essential oils possess high refractive power. Their influence on the plane of polarized light is various: some rotate to the right, others give left-handed rotation, while with several no effect is visible. In their fresh condition many are colourless, but some are yellow or brown, others become brown by exposure, and in exceptional instances oils are green or blue in colour. They are all powerfully acted on by oxygen, which affects their colour, consistency, odour, and constitution. In specific gravity they range from about 0·850 to 1·142, most of them being specifically lighter than water, and averaging 0·90. In chemical constitution the essential oils are diverse, but they are invariably rich in carbon. They consist, first and principally, of hydrocarbons, associated with which generally are, secondly, oxygenated compounds, sometimes the product of oxidation of the hydrocarbons, although in many instances there is no obvious relation between the bodies. A third class of essential oils, limited in number, consists of those into the composition of which sulphur enters. Of the hydrocarbons which constitute the principal proportion of essential oils terpene, $C_{10}H_{16}$, is the most important. Terpene is the chief constituent of the various kinds of oil of turpentine; and a hydrocarbon of precisely the same composition is contained in the oils of bergamot, orange, and other species of *Citrus*, and in a great number of other essential oils. But although agreeing in chemical formula these terpenes differ considerably in physical properties, such as specific gravity, boiling point, and rotatory influence on the plane of polarization. Under the name of terpenes are also included two series of hydrocarbons, polymeric with the $C_{10}H_{16}$ series, having respectively the formulæ $C_{15}H_{24}$ and $C_{20}H_{32}$. The former of these, $C_{15}H_{24}$, is of comparatively frequent occurrence, being found in the essential oils of cloves, cubebs, patchouli, and several others. The terpenes of formula $C_{10}H_{16}$, by their oxidation in presence of water, give off indirectly peroxide of hydrogen, H_2O_2, and yield cymene, $C_{10}H_{14}$, a hydrocarbon found naturally in the essential oils of cumin, thyme, and some others. The property of evolving peroxide of hydrogen, possessed by cymene in common with terpene, explains the well-known oxidizing and antiseptic influence of common turpentine oil, and has been turned to account in the preparation called "sanitas," a disinfectant and antiseptic agent, consisting of an aqueous solution of oxidized turpentine oil prepared by blowing air into a mixture of turpentine oil and water. The oxygenated bodies in essential oils when formed by direct oxidation of the hydrocarbon generally have feebly acid properties developing through viscid oleo-resins and balsams into solid resins. The oxygenated compounds are very varied in their constitution, some being of the nature of acids or aldehydes, while others exhibit the characters of alcohols or of ethers. The most characteristic oxygenated compounds in essential oils are camphors, the type of which is common or Japan camphor, $C_{10}H_{16}O$. Compounds isomeric with common camphor occur in the volatile oil of *Pyrethrum parthenium*, wormwood, mint, and other labiate plants, and in chamomile and galbanum. Camphors isomeric with Borneo camphor, $C_{10}H_{18}O$, are found in coriander oil, cajeput oil, and Indian geranium oil. Isomeric camphors having the formula $C_{10}H_{20}O$ form the menthol of peppermint and the eucalyptol of *Eucalyptus Globulus*, and patchouli camphor has the composition $C_{15}H_{28}O$. The other oxygenated bodies in crude essential oils mostly ally themselves with compounds of the aromatic series, so called on account of the large proportion of its members that are represented by natural products obtained in essential oils, balsams, and resins. The essential oils which contain sulphur, of which the allyl sulphide, $C_6H_{10}S$, or oil of garlic is a type, have generally a pungent, penetrating, and disagreeable odour.

The essential oils are obtained from their sources in four principal ways,—by distillation, by expression, by enfleurage or absorption, and by maceration. The process of *distillation* is the most important, and is applicable to a large number of substances owing to the ease with which essential oils distil unchanged. Their general insolubility in water is turned to account in the process, the odoriferous materials being placed in a simple still with a small quantity of water, the steam from which carries over with the vapour of the essential oil. In distilling from certain bodies it is necessary to cohobate or return into the still the first distillate, and that operation may require to be repeated more than once before the raw material is quite exhausted. Again, in dealing with some substances, solutions of common salt or of chloride of calcium must be used in place of pure water, and these, by raising the boiling point, send over the vapour more richly laden with essential oil. After condensation and resting a sufficient time, the distillate separates into two portions, the oil floating or sinking according to its specific gravity. The process of *expression* is applicable to the obtaining of the essential oils which reside in the rind of the orange, lemon, and other citric fruits. *Enfleurage* is a method by which the odours of several substances are dealt with. The aroma in such cases is present to a small extent, and is too tender and liable to loss and deterioration to permit of being separated by way of distillation. The process consists of exposing the flowers in contact with purified lard or with fine olive oil in suitable frames, whereby the fatty substances take up and become impregnated with the essential oil. The process is principally employed in preparing pomades and perfumed oils (see PERFUMERY), as is also the analogous method of *maceration*, which consists in extracting the aromatic principles by macerating the raw materials in heated oil or molten fat, whereby the essential oils dissolve out into the fat. By subsequently digesting the impregnated fats and oils prepared either by enfleurage or maceration with spirit 60° over proof the essential oils are obtained as alcoholic essences, in which form they are much used for perfumery and flavouring purposes, &c. Alcoholic solutions of essential oils prepared by macerating the raw materials in alcohol also form a part of the tinctures of pharmacy.

Essential oils have a wide range of uses, of which the principal are their various applications in perfumery. Next to that in many ways they play an important part in connexion with food. The value of flavouring herbs, condiments, and spices is due in largest measure to the essential oils they contain; and, further, the commercial value of tea, coffee, wine, and other beverages is largely dependent on the delicate aroma which they owe to minute quantities of such oils. For the flavouring of liqueurs, of aerated beverages, and of other drinks essential oils are extensively used, and their employment is not less considerable in the manufacture of confectionery and in the preparation of many dietetic articles. In the cheaper kinds of confectionery a large quantity of artificial oils called fruit essences are now employed, although the flavours as such are distinctly crude, and the wholesomeness of the preparations is more than doubtful. The acetate of amyl gives an imitation jargonelle-pear flavour; valerate of amyl yields apple flavour; a mixture of butyrate of ethyl and butyrate of propyl gives the so-called pine-apple flavour. Formic ether has a peach-like odour, and is used for flavouring factitious rum, and there are numerous other artificial compounds used in flavouring and in perfumery. Many of the essential oils form most important medicinal agents. In the arts the cheaper oils, such as oil of turpentine, are used in the manufacture of varnishes; the reducing influence of the oil of cloves is utilized in the silvering of mirror glass; and oils of turpentine, lavender, and spike are used as vehicles for painting, more particularly for the painting of pottery and glass.

The essentials oils are subject to extensive adulteration. The presence of fatty oil is easily detected by the formation of a permanent grease spot on paper on which the suspected mixture is dropped. The admixture of fixed oil may also be demonstrated by distillation, when the volatile portion goes over, leaving the fatty oil, or by treatment of the suspected sample with strong spirit, which dissolves out the essential oil, and leaves the fatty oil as a separate layer. The presence of spirit of wine in an essential oil may be readily proved by shaking up a specimen of the oil with a measured quantity of water in a graduated glass. If the oil is pure there will be little or no change in the volume of the water layer after the complete separation of the oil and water by repose; but if, on the other hand, the oil has been mixed with spirit, the water will have extracted the spirit and decreased the apparent amount of essential oil, and increased the watery layer in proportion to the extent of the falsification. In dealing with very small samples a test by sight is obviously inapplicable, and in such cases the existence of alcohol in the watery solution may be demonstrated by the molybdenum test. This consists of treating a drop or two of water separated from the oil under examination with a solution of molybdic acid in ten parts of sulphuric acid. If the water contains alcohol, a characteristic intense blue reaction at once exhibits itself. The behaviour of essential oils towards alcohol is also made the basis of a test of their purity. The test is effected by mixing the essential oil with two volumes of absolute alcohol, and thereafter observing the volume of diluted alcohol sp. gr. 0·889 required to render the clear solution opalescent. The falsification of a costly essential oil with one of inferior value is a fraud which can only be detected with much difficulty. In practice a fair estimate of the purity of an essential oil and of its individual character may be made by some experience of its smell as rubbed on the hands; colour, boiling point, specific gravity, and other physical properties may also be usefully observed in aiding to form an estimate of the genuineness and value of a sample. Colour tests with various reagents are also used for the identification of the various essential oils. Among these are Fröhde's test (a solution of molybdate of sodium in sulphuric acid), sulphuric acid itself, fuming nitric acid, alcoholic solution of hydrochloric acid and picric acid, &c.

In the following list the essential oils ordinarily met with in commerce, with their sources, general applications whether in medicine, in perfumery, in the arts, or as flavouring materials, and some of their physical properties, are tabulated. The specific gravities and power of turning the plane of polarization, given for a column 10 inches long, are extracted from Dr Gladstone's paper on Essential Oils (*Jour. Chem. Soc.*, new ser., vol. ii., 1864). Such of the oils as are of sufficient importance are separately noticed in their proper places.

Name of Oil.	Source.	Sp. gr.	Rotation for a column 10 inches long.	Principal Application.
Aniseed	*Pimpinella anisatum*	0·9852	− 1°	Med., flavouring.
Australian sassafras	*Atherosperma moschata*	1·0425	+ 7°	Medicine.
Bay	*Laurus nobilis*	·8808	− 6°	Med.
Bergamot	*Citrus Bergamia*	·8825	+ 23°	Med., perf., flav.
Birch-bark	*Betula alba*	·9005	+ 28°	....
Bitter almonds	*Amygdalus communis, var. amara*	..	..	Med., flav.
Buchu leaves	*Barosma species*	..	..	Med.
Cajeput	*Melaleuca Cajuputi*	·9203	0°	Med.
Calamus	*Acorus Calamus*	·9888	+ 45°·5	....
Caraway	*Carum Carui*	·8845	+ 63°	Med., flav.
Cardamoms	*Amomum species*	..	..	Med., flav.
Cascarilla	*Croton Eluteria*	·8956	+ 25°	....
Cassia	*Cinnamomum Cassia*	1·0297	0°	Med., perf., flav.
Cedar	*Juniperus virginiana*	·9622	+ 8°	Perf.
Cedrat	*Citrus medica*	·8584	+156°	Perf.
Chamomile	*Matricaria Chamomilla*	..	..	Med.
Citronella	*Andropogon Nardus*	·8908	− 4°	Perf.
Cloves	*Caryophyllus aromaticus*	1·0475	− 4°	Med., perf., flav., arts.
Copaiba	*Copaifera officinalis*	·878	..	Med.
Coriander	*Coriandrum sativum*	·8775	+ 21°?	Med., flav.
Cubebs	*Piper Cubeba*	·9414	..	Med.
Cumin	*Cuminum Cyminum*	..	..	Med., flav.
Dill	*Anethum graveolens*	·8922	+206°	Med., flav.
Elder	*Sambucus nigra*	·8584	+ 14°·5	....
Ergot	*Claviceps purpurea*	..	..	Med.
Eucalyptus	*Eucalyptus species*	·8812	−136°	Med., flav., arts.
Fennel	*Fœniculum vulgare*	..	..	Med., flav.
Garlic	*Allium sativum*	..	..	Med.
Ginger	*Zingiber officinale*	..	..	Med., flav.
Indian geranium	*Andropogon Schœnanthus*	·9043	− 4°	Med., perf.
Jasmine	*Jasminum species*	..	..	....
Juniper	*Juniperus communis*	..	..	Med.
Lavender	*Lavandula vera*	·8908	− 20°	Med., arts.
Lemon	*Citrus Limonum*	·8498	+164°	Med., perf., flav.
Lemon-grass	*Andropogon citratus*	·8982	− 5°?	....
Limes	*Citrus Limetta*	..	..	Med., flav.
Marjoram	*Origanum Majorana*	..	..	Med., flav.
Melaleuca	*Melaleuca ericifolia*	·9080	+ 26°	Med.
Mint	*Mentha viridis*	·9342	−116°	Med., flav.
Mustard	*Brassica nigra*	..	..	Med.
Myrrh	*Balsamodendron Myrrha*	1·0189	−136°	Med.
Myrtle	*Myrtus communis*	·8911	+ 21°	Med.
Neroli	*Citrus vulgaris*	·8789	+ 15°	Med., perf., flav
Nutmeg	*Myristica moschata*	·8826	+ 44°	Med., flav.
Orange-peel	*Citrus vulgaris*	·8509	+ 33°?	Med., perf., flav.
Orange-peel (Florence)	....	·8864	+216°	....
Parsley	*Apium Petroselinum*	·9926	− 9°	Flav.
Patchouli	*Pogostemon Patchouli*	·9554	..	Perf.
Pennyroyal	*Mentha Pulegium*	..	..	Med.
Peppermint	*Mentha Piperita*	·9028	− 72°	Med., perf., flav.
Petitgrain	*Citrus vulgaris*	·8765	+ 26°	Perf.
Pimento	*Eugenia Pimenta*	1·037	..	Med., flav.
Rose	*Rosa damascena*	·8912	− 7°	Med., perf., flav.
Rosemary	*Rosmarinus officinalis*	·9080	+ 17°	Med., perf.
Rosewood	*Convolvulus scoparius*	·9064	− 16°	Perf.
Rue	*Ruta graveolens*	..	..	Med.
Sage	*Salvia officinalis*	..	..	Med., flav.
Sandalwood	*Santalum album*	·9750	− 50°	Med., perf.
Sassafras	*Sassafras officinalis*	1·090	..	Med., perf., flav.
Savin	*Juniperus Sabina*	..	..	Med.
Spearmint	*Mentha viridis*	·914	..	Med., perf., flav.
Spike	*Lavandula Spica*	..	..	Med., arts.
Star anise	*Illicium anisatum*	..	..	Med., flav.
Thyme	*Thymus vulgaris*	·8818	..	Med., perf.
Turpentine	*Pinus species*	·8727	− 79°	Med., arts.
Valerian	*Valeriana officinalis*	..	..	Med.
Verbena	*Aloysia citriodora*	·8812	− 6°	Perf.
Vetivert	*Andropogon muricatus*	1·007	..	Perf.
Wintergreen	*Gaultheria procumbens*	1·1428	+ 8°	Med.
Wormwood	*Artemisia Absinthium*	·9122	..	Med., flav.

Apart from the oil of turpentine, commerce in essential oils is limited as regards bulk, although the value of the various articles is considerable. The cultivation of plants for their odoriferous principles and the extraction of essential oils are characteristic industries of Grasse, Nice, and Cannes, in the south of France. About Mitcham in Surrey, and in Herefordshire and Bedfordshire, several plants, principally lavender and other labiates, are largely cultivated as sources of essential oils; but the localities whence the greater bulk of oils are drawn are widespread and as numerous as are the materials themselves. (J. PA.)

OISE, a department of northern France, three-fourths of which belonged to Île-de-France, and the rest to Picardy, is situated between 49° 4′ and 49° 46′ N. lat. and 1° 40′ and 3° 10′ E. long., and is bounded on the N. by Somme, on the E. by Aisne, on the S. by Seine-et-Marne and Seine-et-Oise, and on the W. by Eure and Seine-Inférieure. Its greatest length is 75 miles from north-west to south-east, whilst its breadth from north to south varies from 30 to 44 miles. The department is a moderately elevated plateau with pleasant valleys and fine forests, such as those of Compiègne, Ermenonville, Chantilly, and Hallatte, all in the south. It belongs almost entirely to the basin of the Seine,—the Somme and the Bresle, which flow into the English Channel, draining but a small area. The most important river is the Oise, which flows through a broad and fertile valley from north-east to south-west, past the towns of Noyon, Compiègne, Pont St Maxence, and Creil. On its right it receives the Brèche and the Thérain, and on its left the Aisne, which brings down a larger volume of water than the Oise itself, the Authonne, remarkable for the clearness and copiousness of the springs from which it rises, and the Nonette, which irrigates the valley of Senlis and Chantilly. The Ourcq, a tributary of the Marne, in the south-east, and the Epte, a tributary of the Seine, in the west, also in part belong to the department. These streams are separated by ranges of slight elevation or by isolated hills, the highest point (770 feet) being in the ridge of Bray, which stretches from Dieppe to Précy-sur-Oise. The lowest point is at the mouth of the Oise, only 66 feet above sea-level. Although the rainfall is under the average of France, several of the valleys are, owing to their nearness to the sea and the large extent of forests, moist and marshy. The climate is very variable, but the range of temperature is moderate. The population was 404,555 in 1881.

The area of Oise is 2260 square miles, of which four-fifths are arable, one-sixth woods, and one-twentieth pasture-lands. There are 54,000 horses, 5000 asses or mules, 111,000 head of cattle, 517,000 sheep (yielding in 1878 3,700,000 lb of wool), 44,000 pigs, 7000 goats, and 29,000 beehives. In 1882 the produce amounted to 911,835 quarters of wheat, 123,460 of rye, 1,031,700 of oats, with large quantities of beetroot, potatoes, and fodder, besides barley, meslin, buckwheat, colza, hemp, flax, &c. Vegetables, fruits, and milk are supplied to Paris; and wine and cider (6,646,919 gallons in 1882) are made, the latter being the drink principally consumed in the department. Industrial pursuits engage more than 160,000 of the population. A number are employed in quarrying building stone, in digging potter's clay and sand for glass-making, and in cutting turf. There are 697 steam and several hydraulic mills. The forges of Montataire near Creil employ 2000 workmen; but agricultural implements, metal utensils, optical glasses, paper, pasteboard, and various kinds of toys and small wares in bone, horn, mother-of-pearl, and ivory are made in the small workshops which are common everywhere. Chantilly employs 2000 women in making the lace for which it is famous. Beauvais, the chief town, besides its clock-making industry, has a national carpet factory, which rivals that of Gobelins at Paris. There are in the department forty-five woollen-mills with 54,000 spindles, and nine cotton-mills with 28,000; and the making of canvas, woollen fabrics, blankets, hosiery, boots and shoes, revolvers, &c., is also carried on, as well as boatbuilding. Sugar is extensively made from beetroot, and the manufactures of pottery, porcelain, and glass are also considerable. Commerce is greatly facilitated by the Oise and the Aisne, and by the lateral canal of the former. There are more than 400 miles of railway; and the roads are numerous and good. Oise contains four arrondissements—Beauvais, Clermont, Compiègne, Senlis—37 cantons, and 701 communes. It constitutes the diocese of Beauvais. The principal towns are Beauvais (population 17,516), Compiègne (13,567), Senlis (6870), Clermont (5628), Noyon (5780), Creil (7099), an important railway centre, with earthenware manufactures, and Montataire (5385).

OKEN, LORENZ (1779-1851). Under this name the great naturalist of the transcendental or deductive school is commonly known; but his real name was Lorenz Ockenfuss, under which he was baptized at Bohlsbach, Baden, being born in that small Swabian village on the 1st of August 1779. As Ockenfuss he was entered at the natural history and medical classes in the university of Würzburg, whence he proceeded to that of Göttingen, where he became a privat-docent, and abridged his name to Oken. As Lorenz Oken he published in 1802 his small work entitled *Grundriss der Naturphilosophie, der Theorie der Sinne, und der darauf gegründeten Classification der Thiere*, the first of the series of works which placed him at the head of the "natur-philosophie" or physio-philosophical school of Germany. In it he extended to physical science the philosophical principles which Kant had applied to mental and moral science. Oken had, however, in this application been preceded by Fichte, who, acknowledging that the materials for a universal science had been discovered by Kant, declared that nothing more was needed than a systematic co-ordination of these materials; and this task Fichte undertook in his famous *Doctrine of Science* (Wissenschaftslehre), the aim of which was to construct *a priori* all knowledge. In this attempt, however, Fichte did little more than indicate the path; it was reserved for Schelling fairly to enter upon it, and for Oken, following him, to explore its mazes yet farther, and to produce a systematic plan of the country so surveyed.

In the *Grundriss der Naturphilosophie* of 1802 Oken sketched the outlines of the scheme he afterwards devoted himself to perfect. The position he advanced in that remarkable work, and to which he ever after professed adherence, is this,—"that the animal classes are virtually nothing else than a representation of the sense-organs, and that they must be arranged in accordance with them." Agreeably with this idea, Oken contends that there are only five animal classes:—(1) the *Dermatozoa*, or Invertebrates; (2) the *Glossozoa*, or Fishes, as being those animals in which a true tongue makes, for the first time, its appearance; (3) the *Rhinozoa*, or Reptiles, wherein the nose opens for the first time into the mouth and inhales air; (4) the *Otozoa*, or Birds, in which the ear for the first time opens externally; and (5) the *Ophthalmozoa*, or Mammals, in which all the organs of sense are present and complete, the eyes being movable and covered with two lids.

In 1805 Oken made another characteristic advance in the application of the *a priori* principle, by a book on generation (*Die Zeugung*, Frankfort), wherein he maintained the proposition that "all organic beings originate from and consist of *vesicles* or *cells*. These vesicles, when singly detached and regarded in their original process of production, are the infusorial mass or protoplasma (*urschleim*) whence all larger organisms fashion themselves or are evolved. Their production is therefore nothing else than a regular agglomeration of *Infusoria*,—not, of course, of species already elaborated or perfect, but of mucous vesicles or points in general, which first form themselves by their union or combination into particular species." This doctrine is strikingly analogous to the generalized results of the ablest microscopical observations on the development of animal and vegetable tissues which have been prosecuted of late years.

One year after the production of this remarkable treatise, Oken advanced another step in the development of his system, and in a volume published in 1806, in which Kieser assisted him, entitled *Beiträge zur vergleichenden Zoologie, Anatomie, und Physiologie*, he demonstrated that the intestines originate from the umbilical vesicle, and that this corresponds to the vitellus or yolk-bag. Caspar Friedrich Wolff had previously proved this fact in the chick (*Theoria Generationis*, 1774), but he did not see its application as evidence of a general law. Oken showed the importance of the discovery as an illustration of his system. In the same work Oken described and recalled attention to the *corpora Wolffiana*, or "primordial kidneys," as they are now termed and recognized.

The reputation of the young privat-docent of Göttingen had meanwhile reached the ear of Goethe, and in 1807 Oken was invited to fill the office of professor extraordinarius of the medical sciences in the university of Jena. He accepted the call, and selected for the subject of his inaugural discourse his ideas on the "Signification of the Bones of the Skull," based upon a discovery he had made in the previous year. This famous lecture was delivered in the presence of Goethe, as privy-councillor and rector of the university, and was published in the same year, with the title, *Ueber die Bedeutung der Schädelknochen*.

With regard to the origin of the idea, Oken narrates in his *Isis* that, walking one autumn day in 1806 in the Harz forest, he stumbled upon the blanched skull of a deer, picked up the partially dislocated bones, and contemplated them for a while, when the truth flashed across his mind, and he exclaimed, "It is a vertebral column!" At a meeting of the German naturalists held at Jena some years afterwards Professor Kieser gave an account of Oken's discovery in the presence of the grand-duke, which account is printed in the *Tageblatt*, or "proceedings," of that meeting. The professor states that Oken communicated to him his discovery when journeying in 1806 to the island of Wangeroog. On their return to Göttingen Oken explained his ideas by reference to the skull of a turtle in Kieser's collection, which he disarticulated for that purpose with his own hands. "It is with the greatest pleasure," writes Kieser, "that I am able to show here the same skull, after having it thirty years in my collection. The single bones of the skull are marked by Oken's own handwriting, which may be so easily known." There was a cause, as we shall presently see, for this circumstantial testimony.

Oken, having delivered and printed his introductory lecture in 1807, informs us (*Isis*, No. 7) that he presented copies to Goethe and to other members of the grand-duke's Government. "Goethe was so pleased with my discovery as to invite me to stay with him during the Easter week of 1808 in his house at Weimar, which invitation I accepted."

The range of Oken's lectures at Jena was a wide one, and they were highly esteemed. They embraced the subjects of natural philosophy, general natural history, zoology, comparative anatomy, the physiology of man, of animals, and of plants. The spirit with which he grappled with the vast scope of science is characteristically illustrated in his essay *Ueber das Universum als Fortsetzung des Sinnensystems*, 1808. In this work he lays it down that "organism is none other than a combination of all the universe's activities within a single individual body." This doctrine led him to the conviction that "world and organism are one in kind, and do not stand merely in harmony with each other."

In the same year he published his *Erste Ideen zur Theorie des Lichts*, &c., in which he advanced the proposition that "light could be nothing but a polar tension of the ether, evoked by a central body in antagonism with the planets, and heat was none other than a motion of this ether,"—a sort of vague anticipation of the doctrine of the "correlation of physical forces."

In 1809 Oken extended his system to the mineral world, arranging the ores, not according to the metals, but agreeably to their combinations with oxygen, acids, and sulphur. In 1810 he summed up his views on organic and inorganic natures into one compendious system. The first edition of the *Lehrbuch der Naturphilosophie* appeared in that and the following years, in which he sought to bring his different doctrines into mutual connexion, and to "show that the mineral, vegetable, and animal kingdoms are not to be arranged arbitrarily in accordance with single and isolated characters, but to be based upon the cardinal organs or anatomical systems, from which a firmly established number of classes would necessarily be evolved; that each class-moreover, takes its starting-point from below, and consequently that all of them pass parallel to each other;" and that, "as in chemistry, where the combinations follow a definite numerical law, so also in anatomy the organs, in physiology the functions, and in natural history the classes, families, and even genera of minerals, plants, and animals present a similar arithmetical ratio."

The *Lehrbuch* procured for Oken the title of Hofrath, or court-councillor. In 1812 he was appointed ordinary professor of the natural sciences.

In 1816 he commenced the publication of his well-known periodical, entitled *Isis, eine encyclopädische Zeitschrift, vorzüglich für Naturgeschichte, vergleichende Anatomie, und Physiologie.* In this journal appeared essays and notices not only on the natural sciences but on other subjects of interest; poetry, and even comments on the politics of other German states, were occasionally admitted. This led to representations and remonstrances from the Governments criticized or impugned, and the court of Weimar called upon Oken either to suppress the *Isis* or resign his professorship. He chose the latter alternative. The publication of the *Isis* at Weimar was prohibited. Oken made arrangements for its issue at Rudolstadt, and this continued uninterruptedly until the year 1848.

The independent spirit manifested by Oken excited his courtly enemies to harsher measures. An accusation was preferred against him as a member of a forbidden "secret democratic society"; he stood his trial and was acquitted. He thereupon retired for a while into private life, occupying himself with the editorship of the *Isis* and with a series of natural-history manuals in which he considered that he had arranged for the first time the genera and species in accordance with the only true or physio-philosophical principles, stating briefly everything of vital importance respecting them, and maintaining that it was the first attempt to frame a truly scientific history of nature.

In 1821 Oken promulgated in his *Isis* the first idea of the annual general meetings of the German naturalists and medical practitioners, which happy idea was realized in the following year, when the first meeting was held at Leipsic. They have been continued ever since in Germany; and similar annual scientific gatherings have been originated in other countries. The British Association for the Advancement of Science was at the outset avowedly organized after the German or Okenian model.

In 1828 Oken resumed his original humble duties as privat-docent in the newly-established university of Munich, and soon afterwards he was appointed ordinary professor in the same university. In 1832, on the proposal by the Bavarian Government to transfer him to a professorship in a provincial university of the state, he resigned his appointments and left the kingdom.

Switzerland has the honour of affording the final place of refuge, with means of an independent pursuit of science, to this philosophic and patriotic naturalist. Oken was appointed in 1833 to the professorship of natural history in the then recently-established university of Zurich. There he continued to reside, fulfilling his professional duties and promoting the progress of his favourite sciences, until his death in the seventy-second year of his age (11th August 1851).

All Oken's writings are eminently deductive illustrations of a foregone and assumed principle, which, with other philosophers of the transcendental school, he deemed equal to the explanation of all the mysteries of nature. According to him, the head was a repetition of the trunk—a kind of second trunk, with its limbs and other appendages; this sum of his observations and comparisons —few of which he ever gave in detail—ought always to be borne in mind in comparing the share taken by Oken in homological anatomy with the progress made by other cultivators of that philosophical branch of the science.

The idea of the analogy between the skull, or parts of the skull, and the vertebral column had been previously propounded and ventilated in their lectures by Autenreith and Kielmeyer, and in the writings of J. P. Frank. By Oken it was applied chiefly in illustration of the mystical system of Schelling—the "all-in-all" and "all-in-every-part." From the earliest to the latest of Oken's writings on the subject, "the head is a repetition of the whole trunk with all its systems: the brain is the spinal cord; the cranium is the vertebral column; the mouth is intestine and abdomen; the nose is the lungs and thorax; the jaws are the limbs; and the teeth the claws or nails." Spix, in his folio *Cephalogenesis* (1818), richly illustrated comparative craniology, but presented the facts under the same transcendental guise; and Cuvier ably availed himself of the extravagances of these disciples of Schelling to cast ridicule on the whole inquiry into those higher relations of parts to the archetype which Professor Owen has called "general homologies."

The vertebral theory of the skull had practically disappeared from anatomical science when the labours of Cuvier drew to their close. In Owen's *Archetype and Homologies of the Vertebrate Skeleton* the idea was not only revived but worked out for the first time inductively, and the theory rightly stated, as follows:—"The head is not a virtual equivalent of the trunk, but is only a portion, *i.e.*, certain modified segments, of the whole body. The jaws are the 'hæmal arches' of the first two segments; they are not limbs of the head" (p. 176).

Vaguely and strangely, however, as Oken had blended the idea with his *a priori* conception of the nature of the head, the chance of appropriating it seems to have overcome the moral sense of Goethe,—unless indeed the poet deceived himself. Comparative osteology had early attracted Goethe's attention. In 1786 he published at Jena his essay *Ueber den Zwischenkieferknochen des Menschen und der Thiere*, showing that the intermaxillary bone existed in man as well as in brutes. But not a word in this essay gives the remotest hint of his having then possessed the idea of the vertebral analogies of the skull. In 1820, in his *Morphologie*, he first publicly stated that thirty years before the date of that publication he had discovered the secret relationship between the vertebræ and the bones of the head, and that he had always continued to meditate on this subject. The circumstances under which the poet, in 1820, narrates having become inspired with the original idea are suspiciously analogous to those described by Oken in 1807, as producing the same effect on his mind. A bleached skull is accidentally discovered in both instances: in Oken's it was that of a deer in the Harz forest; in Goethe's it was that of a sheep picked up on the shores of the Lido, at Venice.

It may be assumed that Oken, when a privat-docent at Göttingen in 1806, knew nothing of this unpublished idea or discovery of Goethe, and that Goethe first became aware that Oken had the idea of the vertebral relations of the skull when he listened to the introductory discourse in which the young professor, invited by the poet to Jena, selected this very idea for its subject. It is incredible that Oken, had he adopted the idea from Goethe, or been aware of an anticipation by him, should have omitted to acknowledge the source—should not rather have eagerly embraced so appropriate an opportunity of doing graceful homage to the originality and genius of his patron.

The anatomist having lectured for an hour plainly unconscious of any such anticipation, it seems hardly less incredible that the poet should not have mentioned to the young lecturer his previous conception of the vertebro-cranial theory, and the singular coincidence of the accidental circumstance which he subsequently alleged to have produced that discovery. On the contrary, Goethe permits Oken to publish his famous lecture, with the same unconsciousness of any anticipation as when he delivered it; and Oken, in the same state of belief, transmits a copy to Goethe, who thereupon honours the professor with special marks of attention and an invitation to his house. No hint of any claim of the host is given to the guest; no word of reclamation in any shape appears for some years. In Goethe's *Tages- und Jahres-Hefte*, he refers to two friends, Reimer and Voigt, as being cognizant in 1807 of his theory. Why did not one or other of these make known to Oken that he had been so anticipated? "I told my friends to keep quiet," writes Goethe in 1825! Spix, in the meanwhile, in 1815, contributes his share to the development of Oken's idea in his *Cephalogenesis*. Ulrich follows in 1816 with his *Schildkrötenschädel*; next appears the contribution, in 1818, by Bojanus, to the vertebral theory of the skull, amplified in the *Paragon* to that anatomist's admirable *Anatome Testudinis Europææ* (1821). And now for the first time, in 1818, Bojanus, visiting some friends at Weimar, there hears the rumour that his friend Oken had been anticipated by the great poet. He communicates it to Oken, who, like an honest man, at once published the statement made by Goethe's friends in the *Isis* of that year, offering no reflexion on the poet, but restricting himself to a detailed and interesting account of the circumstances under which he himself had been led independently to make his discovery, when wandering in 1806 through the Harz. It was enough for him thus to vindicate his own claims; he abstains from any comment reflecting on Goethe, and maintained the same blameless silence when Goethe ventured for the first time to claim for himself, in 1820, the merit of having entertained the same idea, or made the discovery, thirty years previously.

The German naturalists held their annual meeting at Jena in 1836, and there Kieser publicly bore testimony, from personal knowledge, to the circumstances and dates of Oken's discovery. However, in the edition of Hegel's works by Michelet, Berlin, 1842, there appeared the following paragraph :—"The type-bone is the dorsal vertebra, provided inwards with a hole and outwards with processes, every bone being only a modification of it. This idea originated with Goethe, who worked it out in a treatise written in 1785, and published it in his *Morphologie*, 1820, p. 162. *Oken, to whom the treatise was communicated, has pretended that the idea was his own property, and has reaped the honour of it.*" This accusation again called out Oken, who thoroughly refuted it in an able, circumstantial, and temperate statement, in part vii. of the *Isis*, 1847. Goethe's osteological essay of 1785, the only one he printed in that century, is on a different subject. In the *Morphologie* of 1820-24 Goethe distinctly declares that he had never published his ideas on the vertebral theory of the skull. He could not, therefore, have sent any such essay to Oken before the year 1807. Oken, in reference to his previous endurance of Goethe's pretensions, states that, "being well aware that his fellow-labourers in natural science thoroughly appreciated the true state of the case, he confided in quiet silence in their judgment. Meckel, Spix, Ulrich, Bojanus, Carus, Cuvier, Geoffroy St Hilaire, Albers, Straus-Durckheim, Owen, Kieser, and Lichtenstein had recorded their judgment in his favour and against Goethe. But upon the appearance of the new assault in Michelet's edition of Hegel he could no longer remain silent."

Oken's bold axiom that heat is but a mode of motion of light, and the idea broached in his essay on generation (1805) that "all the parts of higher animals are made up of an aggregate of *Infusoria* or animated globular monads," are both of the same order as his proposition of the head being a repetition of the trunk, with its vertebræ and limbs. Science would have profited no more from the one idea without the subsequent experimental discoveries of Oersted and Faraday, or from the other without the microscopical observations of Brown, Schleiden, and Schwann, than from the third notion without the inductive demonstration of the segmental constitution of the skull by Owen. It is questionable, indeed, whether in either case the discoverers of the true theories were excited to their labours, or in any way influenced, by the *a priori* guesses of Oken; more probable is it that the requisite researches and genuine deductions therefrom were the results of the correlated fitness of the stage of the science and the gifts of its true cultivators at such particular stage.

Oken's real claims to the support and gratitude of naturalists rest on his appreciation of the true relations of natural history to intellectual progress, of its superior teachings to the mere utilitarian applications of observed facts, of its intrinsic dignity as a science.

The following is a list of Oken's principal works :—*Grundriss der Naturphilosophie, der Theorie der Sinne, und der darauf gegründeten Classification der Thiere* (1802); *Die Zeugung* (1805); *Abriss der Biologie* (1806); *Beiträge zur vergleichenden Zoologie, Anatomie, und Physiologie* (along with Kieser, 1806-7); *Ueber die Bedeutung der Schädelknochen* (1807); *Ueber das Universum als Fortsetzung des Sinnensystems* (1808); *Erste Ideen zur Theorie des Lichts, der Finsterniss, der Farben, und der Wärme* (1808); *Grundzeichnung des natürlichen Systems der Erze* (1809); *Ueber den Werth der Naturgeschichte* (1809); *Lehrbuch der Naturphilosophie* (1809-11, 2d ed. 1831, 3d ed. 1843; Eng. tr., *Elements of Physiophilosophy*, 1847); *Lehrbuch der Naturgeschichte* (1813, 1815, 1826); *Handbuch der Naturgeschichte zum Gebrauch bei Vorlesungen* (1816-20); *Naturgeschichte für Schulen* (1821); *Esquisse d'un Système d'Anatomie, de Physiologie, et d'Histoire Naturelle* (1821); *Allgemeine Naturgeschichte* (1833-42, 14 vols.). He also contributed a large number of papers to the *Isis* and other journals. (R. O.)

OKHOTSK. See MARITIME PROVINCE, vol. xv. p. 548.

ÖLAND, or OELAND, next to Gottland, the largest of the islands belonging to Sweden, stretches for 85 miles along the east coast of the southern extremity of that country, from which it is separated by the Calmar Sound, about 5 miles broad at the narrowest point, and not more than 10 fathoms deep in the central portion. Its greatest breadth does not exceed 8 or 9 miles, and its area is estimated at 510 square miles. Consisting for the most part of Silurian limestone, and thus forming a striking contrast to the mainland with its granite and gneiss, Öland is further remarkable on account of the peculiarities of its structure. Down the west side for a considerable distance runs a limestone ridge, rising usually in terraces, but at times in steep cliffs, to an extreme height of 200 feet; and along the east side there is a parallel ridge of sand (resting on limestone), never exceeding 90 feet. These ridges, known as the Western and Eastern Landtborgar, are connected towards the north and the south by belts of sand and heath; and the hollow between them is occupied by a desolate and almost barren tract: the southern portion or Allvar (forming fully half of the southern part of the island) presents a surface of bare red limestone scored by superficial cracks and unfathomed fissures, and calcined by the heat refracted from the surrounding heights; and the northern portion is covered at best with a copse of hazel bushes. Outside the ridges, however, Öland has quite a different aspect,—the hillsides being not unfrequently adorned with clumps of trees, and the narrow strip of alluvial coast-land with its cornfields and villages and church towers presenting an appearance of fruitfulness and prosperity. There are only a few small streams in the island; and only one lake, Hornsjö, about 3 miles long, deserves to be mentioned. Of the fir woods which once clothed a considerable area in the north the Böda crown-park is the only remnant. Grain, sandstone, and alum are exported from the island,—the alum mines at South (Södra) Mockleby being in fact the most extensive in Sweden, and furnishing 7000 tons per annum. The only town is Borgholm, on the west coast, with one of the finest castle-ruins in Sweden. The town was founded only in 1817, and has not more than 800 or 900 inhabitants; but the castle, dating at least from the 13th century, was long one of the strongest fortresses and afterwards one of the most stately palaces in the country. The island, which bears the title of a countship, was joined in 1824 to the province of Calmar. Its inhabitants, formerly styled Öningar, and showing considerable diversity of origin in the matter of speech, local customs, and physical appearance, numbered 22,820 in 1805, 37,270 in 1865, and 37,975 in 1874.

From the raid of Ragnar Lodbrok's sons in 775 Öland is frequently mentioned in Scandinavian history, and especially as a battle-ground in the wars between Denmark and the northern kingdoms. In the Middle Ages it formed a separate legislative and administrative unity. See Linne, *Ölandska och Gothlandska Resa* (1741); Marryat, *One Year in Sweden* (Lond., 1862); Andersson, *Botaniska Resa genom Öland* (1865).

OLAUS MAGNUS or **MAGNI** (Magnus, *i.e.*, Store, being the family name, and not a personal epithet) was born in 1490 and died at Rome in 1558. Like his elder brother, Johannes Magnus, he obtained several ecclesiastical preferments (a canonry at Upsala and at Linköping), and was employed on various diplomatic services; but on the success of the Reformation in Sweden his attachment to the old church led him to accompany his brother into exile. Settling at Rome, he ultimately became his brother's successor in the titular archbishopric of Upsala. Olaus Magnus is best remembered as the author of *Historia de Gentibus Septentrionalibus* (Rome, 1555), a work which long remained for the rest of Europe the chief authority on Swedish matters and is still a valuable repertory of much curious information in regard to Scandinavian customs and folk-lore.

OLBERS, HEINRICH WILHELM MATTHIAS (1758-1840), a distinguished astronomer, was born 11th October 1758 at Arbergen, a village near Bremen, where his father was minister. He studied medicine at Göttingen, 1777-80, attending at the same time Kaestner's mathematical course; and in 1779, while watching by the sick-bed of a fellow-student, he devised a method of calculating cometary orbits which made an epoch in the treatment of the subject, and is still extensively used (see COMET, vol. vi. p. 182). The treatise containing this important invention was made public by Baron von Zach under the title *Ueber die leichteste und bequemste Methode die Bahn eines Cometen zu berechnen* (Weimar, 1797). A table of eighty-seven calculated orbits was appended, enlarged by Encke in the second edition (1847) to 178, and by Galle in the third (1864) to 242. Olbers settled as a physician in Bremen towards the end of 1781, and practised actively for above forty years, finally retiring 1st January 1823. The greater part of each night (he never slept more than four hours) was meantime devoted to astronomy, the upper portion of his house being fitted up as an observatory. He paid special attention to comets, and that of 1815 (period seventy-four years) bears his name in commemoration of its detection by him. He also took a leading part in the discovery of the minor planets, re-identified Ceres on the anniversary of its discovery by Piazzi, 1st January 1802, and detected Pallas on the 28th of March following. His bold hypothesis of their origin by the disruption of a primitive large planet (*Monatliche Correspondenz*, vol. vi. p. 88), although now discarded, received strong confirmation from the finding of Juno by Harding, 2d September 1804, and of Vesta by himself, 29th March 1807, in the precise regions of Cetus and Virgo where the nodes of such supposed planetary fragments should be situated. Olbers was deputed by his fellow-citizens to assist at the baptism of the king of Rome, 9th June 1811, and he was a member of the corps législatif in Paris 1812-13. After some years of suffering from asthma, he died 2d March 1840, at the age of eighty-one. He was twice married, and one son survived him.

Notices of his life and works will be found in *Biographische Skizzen verstorbener Bremischer Aerzte*, by Dr G. Barkhusen (Bremen, 1844); *Allgemeine geographische Ephemeriden*, vol. iv. p. 283, 1799; *Nouvelle Biographie Générale*; *Abstracts Phil. Trans.*, vol. iv. p. 268, 1843; *Astronomische Nachrichten*, vol. xxii. p. 265, also appended to A. Erman's *Briefwechsel zwischen Olbers und Bessel* (2 vols. Leipsic, 1852). A list of Olbers's extremely interesting contributions to scientific periodicals is given at p. xxxv. of the 3d ed. of his *Leichteste Methode*, and his unique collection of works relating to comets now forms part of the Pulkowa library.

OLBIA, Olbiopolis, or Borysthenis, in the south of Russia, on the right bank of the Borysthenes, near its mouth, was a colony of Miletus, 655 B.C. It was the great station for the trade with the interior, and a wealthy city from a very early time. Inscriptions, published in the *Corpus Inscr. Græc.*, vol. ii., especially the famous decree in honour of Protogenes, throw much light on its internal history in the few centuries before and after the Christian era. They show it as a Greek city, maintaining its independence with difficulty against the barbarians who continually threatened it; but the Greek life and the Greek names gradually gave place to Scythian, the city was finally merged in the surrounding tribes, and its civilization and importance disappeared. It is a commonplace among archæologists to speak of the trade-route which led across country to the northern sea from Olbia, and a find of archaic Greek coins in Prussia is appealed to as a proof; but it has recently been proved that this find of coins was an imposture. Though it is probable that such trade-routes did exist at an early time, it is highly improbable that Greek traders used them. The natives brought down their goods to the Greek colonies, and the trade was there conducted, not by money, but rather by barter. The most interesting point about the religion of Olbia is the cult of Achilles Pontarches, the Ruler of the Sea, a deity who was extensively worshipped along the northern coast of the Black Sea. He was evidently a god of the native races, in whom some analogy of name or character made the Greeks recognize their hero Achilles. Hence arose the legend, known already to Pindar, that Achilles lived on in the White Isle in the Black Sea, a god surrounded by the other heroes. Olbia was destroyed by the Getæ about 70-60 B.C., but revived, and was a flourishing city when Dio Chrysostom visited it about 100 A.D.

OLDBURY, a township of Worcestershire, England, comprising the two parishes of Oldbury and Langley, is situated on the Birmingham Canal and on the London and North-Western and Great-Western Railways, 5 miles west of Birmingham and 3 east of Dudley. Coal, iron, and limestone abound in the neighbourhood, and the town possesses chemical works, railway-carriage works, iron, edgetool, nail, and steel works, maltings, corn-mills, brick and tile kilns, and a manufactory of glass shades. There are no public buildings of importance. The population of the urban sanitary district (1678 acres) in 1871 was 16,410, and in 1881 it was 18,841.

OLDCASTLE, Sir John (d. 1417), who had married Johanna, heiress of the noble family of Cobham, and in her right sat in the House of Lords as Lord Cobham, was a nobleman who at once enjoyed the personal friendship of Henry IV. and was a professed follower of Wickliffe and an adherent of Lollardy. His reputation both as soldier and as statesman stood so high that he was selected by the king to command the English auxiliaries sent by Henry to assist the duke of Burgundy in 1411; and his known friendship for the poor preachers and his maintenance of the popular religious cause gained him the title of "the good Lord Cobham." On the death of the earl of Salisbury in one of the revolts against the house of Lancaster, Oldcastle became the recognized leader of the Lollards; his castle of Cowling became their headquarters; he sheltered their preachers, and openly defied the prohibitions and proclamations of the bishops. He publicly professed his faith in the principal Lollard doctrines and refused to believe what the church taught on the eucharist, penance, the power of the keys, image-worship, and pilgrimages. The house of Lancaster had secured the throne by making promises to the people and to the nobles, and had won the support of the church by promising to put down heresy. This had set the Lollards in opposition to the new dynasty, and their discontent was increased by the ecclesiastical measures of the king. See Lollards. In consequence Lollardy remained a constant source of danger during the reign of Henry IV., giving strength to more than one rebellion, and Henry V., on his accession in 1413, determined to extirpate the heresy. While Henry IV. lived Oldcastle was protected, but in the year of the king's death he was accused in convocation of heresy and of harbouring the poor preachers. Henry V. did all in his power to protect him, laboured to make him give up his opinions, but, finding him inflexible, forbade him to appear at court, and permitted the bishops to proceed against him. A citation was served on him. He refused to receive it. It was accordingly posted on the doors of Rochester Castle. He refused to obey it, was excommunicated, seized, and examined, when he boldly confessed his opinions, and was imprisoned in the Tower, forty days being given him to recant. He made his escape, and his freedom was the signal for a Lollard revolt. The preachers and their followers met in St Giles's fields, and only the vigilance of the king prevented a rising. The enactments against Lollardy became even more severe than formerly. Magistrates were directed to seize suspected heretics and to hand them over to the bishops for trial; and a conviction was punished by death and forfeiture of goods. Oldcastle for some years eluded the vigilance of his enemies, but in 1417 he was seized while in hiding in Wales, taken to London, and burned. His execution was peculiarly barbarous. He was suspended from a gallows by an iron chain, a fire was kindled beneath him, and he was slowly burned to death.

In Mr Wright's collection of political songs there are one or two ballads on Sir John Oldcastle, alluding in no very complimentary terms to his Lollardism. Henry's victories had raised the war-spirit of the English people, and it was thought disgraceful that a knight and a gentleman who in his earlier days had gained the reputation of being a skilful soldier should be associated with people many of whom professed to believe that all wars were sinful. This popular contempt has perhaps led to the idea ably advocated by Mr Gairdner that Shakespeare's character of Sir John Falstaff was meant to represent Sir John Oldcastle.

Compare Lechler's *Johann Wiclif*, vol. ii. ch. iii.; Gairdner and Spedding, *Studies in English History*, ch. iii.

OLD CATHOLICS, the self-assumed name of a new party in religious Christendom, which, like the Reformers of the 16th century, has for its avowed aim the restoration of the ancient standard of Christian belief and practice; but, while the Reformers took for their model the supposed doctrines and institutions of the apostolic age, the Old Catholics have agreed to accept the decrees of the first seven general councils (down to the second of Nicæa, 787 A.D.) as authoritative and binding on the church at large. Like the Reformation, Old Catholicism may be said to have had its representatives within the Roman Church long before its formal organization; but the immediate occasion of the movement arose out of the assembling of the œcumenical council at Rome in 1869 by Pope Pius IX. That pontiff had previously given indications of a tendency towards a reactionary policy which contrasted strongly with the liberal measures which characterized his earlier career. Of such indications the dogma of the Immaculate Conception (8th December 1854) and the "Syllabus" of 1864 were the most notable instances. The "Syllabus" was a formal repudiation of the chief doctrines and theories which during the preceding twenty years had been put forward by writers of various schools of thought, but representing opinions unfavourable to the teachings of Catholicism or the claims of the Papacy; and speculations which called in question the existence of a Divine Being were condemned in the same category with views inimical to the temporal power of the Roman curia. It was for the purpose of giving more emphatic recognition and sanction to the tenets of the "Syllabus" that the œcumenical council of 1869 was professedly convened, and the announcement that such a solemn expression of the convictions of the church at large was thus to be invited was hailed by the organs of the Catholic press throughout Europe with unqualified approval. Not until the council was on the eve of assembling did it become vaguely rumoured that among the doctrines which would be brought forward for its acceptance and ratification was that of the Papal Infallibility. The mere report was, however, looked upon as a matter of such grave import that Prince Hohenlohe, the chief minister of Bavaria, was induced to use the most strenuous exertions to prevail upon the Catholic powers to combine to prevent the promulgation of such a dogma, but without success.

The council which assembled at Rome (8th December 1869) was more deserving of the name of "œcumenical" than any which had ever before obeyed the behest of emperor or pope, being attended by delegates from nearly all parts of the world. It included 49 cardinals, 9 patriarchs of the Eastern communion, 4 primates, 121 archbishops, 479 bishops, and 52 abbots and other monastic dignitaries. The total number on the day of opening was 719, increased by the 15th of January to 744. As a representative body it was, however, very unequally composed, the numerous holders of Italian bishoprics (many of which are of but small extent) constituting a large majority of the entire number. A proposal to rectify this practical inequality by dividing the whole council into eight or six sections representing national elements was summarily rejected. On the other hand, the superiority of the minority in learning and reputation was obvious. It included such names as Schwarzenberg, Mathieu, Darboy, Rauscher, Simor, Ginoulhiac, MacHale, Dupanloup, Ketteler, Strossmayer, Clifford, Kenrick, Maret, and Hefele; while in the long list of those who eventually recorded their placets in favour of the new decree scarcely a name of real eminence appears. Dr Döllinger, the foremost scholar of Catholic Germany, was not among the "fathers" of the council, but his disapproval of the new dogma was notorious, as also was that of the Comte de Montalembert in France. After protracted sittings, extending over seven months, and characterized mainly by a series of discreditable manœuvres designed to break the firm phalanx of the minority, who could only record their protests and utter eloquent remonstrances, the *Constitutio* (as it was termed) was finally laid before the council, and carried with eighty-eight dissentients, while ninety-one abstained altogether from recording any vote. The supremacy of the Roman pontiff over even an œcumenical council was thus declared in terms more explicit and emphatic than had ever before been employed (Friedrich, *Documenta*, ii. 316), while the new dogma was enunciated in the following terms:—

> "We teach and define . . . that the Roman pontiff, when he speaks *ex cathedra*, that is, when in discharge of his office of Pastor and Doctor of all Christians he defines, in virtue of his supreme apostolic authority, a doctrine of faith or morals to be held by the Universal Church, is endowed with the divine assistance promised to him in Blessed Peter, with that infallibility with which our divine Redeemer willed that the church should be furnished in defining doctrine of faith or morals, and, therefore, that such definitions of the Roman pontiff are irreformable of themselves and not in virtue of the consent of the church."

When the above dogma was promulgated in its entirety (18th July 1870) in the presence of 535 fathers, only two dissentient votes were recorded. The rest of the minority had decided on quitting Rome before the final event, a resolution confirmed by the oppressive heat of the weather and the threatening aspect of the political horizon. It has since been asserted on good authority that the action of the Papal party was largely influenced by the empress of France and her advisers; and it cannot be doubted that at Rome, not less than in Paris, it was ardently hoped that this bold proclamation of Ultramontanist doctrine would have been followed by the triumph of the French arms over those of Prussia.

The conduct of the different members of the opposition on their return to the isolation of their respective dioceses can only be described as a series of pitiable tergiversations. The "sacrificio dell' intelletto," as it was termed, was the plausible maxim adopted by one and all. Seventeen of the German bishops almost immediately receded from the position they had taken up at Rome and gave in their assent to the dogma, publishing at the same time a pastoral letter in which they sought to justify their change of sentiment on the ground of expediency in relation to the interests of the church (Michelis, *Der neue Fuldaer Hirtenbrief*, 1870). Their example was followed by all the other bishops of Germany as well as by those of Bavaria. Darboy and Dupanloup in France adopted a like course and took with them the entire body of the Gallican clergy. Each bishop demanded in turn the same submission from the clergy of his diocese, the alternative being suspension from pastoral functions, to be followed by deprivation of office. It may be urged as some extenuation of this general abandonment of a great principle, that those who had refused to subscribe to the dogma received but languid support, and in some cases direct discouragement, from their respective Governments. The submission of the illustrious Hefele was generally attributed to the influence exerted by the court of Würtemberg.

The universities, being less directly under the control of the church, were prepared to show a bolder front. Dr von Schulte, professor at Prague, was one of the first to publish a formal protest. A meeting of Catholic professors and distinguished scholars convened at Nuremberg (August 1870) recorded a like dissent, and resolved on the adoption of measures for bringing about the assembling of a really free council north of the Alps. The "Appel aux Evêques Catholiques" of M. Hyacinthe Loyson (better known as "Father Hyacinthe"), after referring to the overthrow of "the two despotisms," "the empire of the Napoleons and the temporal power of the popes," appealed to the Catholic bishops throughout the world to put an end to the schism by declaring whether the recent decrees were or were not binding on the faith of the church. This appeal, on its appearance in *La Libertà* early in 1871, was suppressed by the order of the king of Italy. On the 28th of March Dr Döllinger, in a letter of some length, set forth the reasons which compelled him also to withhold his submission alike as "a Christian, a theologian, an historical student, and a citizen." The publication of this letter was shortly followed by a sentence of excommunication pronounced against Dr Döllinger and Professor Friedrich, and read to the different congregations from the pulpits of Munich. The professors of the university, on the other hand, had shortly before evinced their resolution of affording Dr Döllinger all the moral support in their power by an address (3d April 1871) in which they denounced the Vatican decrees with unsparing severity, declaring that, at the very time when the German people had "won for themselves the post of honour on the battlefield among the nations of the earth," the German bishops had stooped to the dishonouring task of "forcing consciences in the service of an unchristian tyranny, of reducing many pious and upright men to distress and want, and of persecuting those who had but stood steadfast in their allegiance to the ancient faith" (Friedberg, *Aktenstücke z. ersten Vaticanischen Concil*, p. 187). An address to the king, drawn up a few days later, received the signatures of 12,000 Catholics. The refusal of the rites of the church to one of the signataries, Dr Zenger, when on his deathbed, elicited strong expressions of disapproval; and when, shortly after, it became necessary to fill up by election six vacancies in the council of the university, the feeling of the electors was indicated by the return of candidates who were all distinguished by their avowed dissent from the new decrees. In the following September the demand for another and a free council was responded to by the assembling of such a congress at Munich. It was composed of nearly 500 delegates, convened from almost all parts of the world; but the Teutonic element was now as manifestly predominant as the Latin element had been at Rome. The proceedings were presided over by Professor von Schulte, and lasted three days. Among those who took a prominent part in the deliberations were Landammann Keller, Windscheid, Döllinger, Reinkens, Maassen (professor of the canon law at Vienna), Friedrich, and Huber. The arrangements finally agreed upon were mainly provisional; but one of the resolutions plainly declared that it was desirable if possible to effect a reunion with the Oriental Greek and Russian Churches, and also to arrive at an "understanding" with the Protestant and Episcopal communions.

In the following year lectures were delivered at Munich by various supporters of the new movement, and the learning and oratorical powers of Reinkens were displayed with marked effect. In France the adhesion of the abbé Michaud to the cause attracted considerable interest, not only from his reputation as a preacher, but also from the notable step in advance made by his declaration that, inasmuch as the adoption of the stand-point of the Tridentine canons would render reunion with the Lutheran and the Reformed Churches impossible, the wisest course would be to insist on nothing more with respect to doctrinal belief than was embodied in the canons of the first seven œcumenical councils. The approximation which took place in the same year between the Old Catholics, as they now began to be termed, and the historical little Church of Utrecht must not be left unnoticed. Dr Döllinger, in delivering his inaugural address as rector of the university of Munich, expressed his conviction that theology had received a fresh impulse and that the religious history of Europe was entering upon a new phase.

Other circumstances contributed to invest Old Catholicism with additional importance in the eyes of mere observers. It was evident that the relations between the Roman curia and the Prussian Government were becoming extremely strained. In February 1872 appeared the first measures of the Falk ministry, having for their object the control of the influence of the clergy in the schools; and when Cardinal Hohenlohe presented himself at Rome in the following May the world was startled at the refusal of Pius IX. to receive the accredited minister of the Prussian court. In the same year two humble parish priests, Renftle of Mering in Bavaria and Tangermann of Unkel in the Rhineland, set an example of independence by refusing to accept the decrees. The former, driven from his parish church, was followed by the majority of his congregation, who, in spite of every discouragement, continued faithful to him; and for years after, as successive members were removed by death, the crosses over their graves recorded that they had died "true to their ancient belief." Tangermann, the poet, expelled in like manner from his parish by the archbishop of Cologne, before long found himself the minister of a much larger congregation in the episcopal city itself. These examples exercised no little influence, and congregations of Old Catholics were shortly after formed at numerous towns and villages in Bavaria, Baden, Prussia, German Switzerland, and even in Austria. At Warnsdorf in Bohemia a congregation was collected which still represents one of the most important centres of the movement. In September the second congress was held at Cologne. It was attended by some 500 delegates or visitors from all parts of Europe, and the English Church was represented by the bishops of Ely and Lincoln and other distinguished members. The general scope of the proceedings was the formation of a more definite organization; and the question of reunion with other churches was again a prominent topic of discussion. Among those present was the late Dean Stanley, and the striking accounts which he forwarded to *The Times* of the whole congress did much to awaken in England a more widely-extended interest in the movement.

In the month of May in the following year (1873) the celebrated Falk laws were enacted, whereby the articles 15 and 18 of the Prussian constitution were modified, so as to legalize a systematic state supervision over the education of the clergy of all denominations, and also over the appointment and dismissal of all ministers of religion. The measure, which at the time was interpreted as what Prince Bismarck afterwards openly declared it to have been, viz., a direct response to the Vatican decrees, inspired the Old Catholics with a not unreasonable expectation that the moral support of the Government would henceforth be enlisted on their side. On the 11th of August Dr Reinkens, having been duly elected bishop of the new community, received his consecration at Rotterdam, as "missionary-bishop of Germany," at the hands of Bishop Heykamp of Deventer. The archbishop of Utrecht, on whom it would otherwise have devolved to perform the ceremony, had died somewhat suddenly a few days before, and the Ultramontanists did not scruple to interpret the event as a sign of the divine displeasure. In the meantime the extension of the movement in Switzerland had been proceeding rapidly, and it was resolved that Constance should be elected as the centre for the third congress. The proceedings occupied three days (12th to 14th September), and were of an animated and interesting character,—the intelligence that the Prussian Government had resolved on recognizing the election of Bishop Reinkens contributing not a little to inspirit those who were present. English and American theologians, of widely different schools, listened to the discussions with sympathizing appreciation, and even bore a part. The subjects which chiefly occupied the consideration of the assembly were the institution of a synod as the legislative and executive organ of the church, and schemes of reunion with the Greek, the African, and the Protestant communions. The unanimity which prevailed was remarkable, and not less so were the indications that the breach between the Papacy and Old Catholicism had become decisive and final. On the 20th of September the election of Bishop Reinkens was formally recognized by the German Government, and on the 7th of October he took the oath of allegiance to the king.

The following year (1874) was marked by the assembling of both a synod and a conference at Bonn, and of a congress at Freiburg in the Breisgau. The acts of the synod were mainly directed to modifications of the Roman discipline and the removal of prevalent abuses. At the congress Bishop Reinkens spoke in hopeful terms of the results of his observations during a recent missionary tour throughout Germany. The conference, held on the 14th, 15th, and 16th of September, had for its special object the discussion of the early confessions as a basis of agreement, though not necessarily of fusion, between the different communions above-named. The meetings, presided over by Dr Döllinger with an ability and tact which excited general admiration, successively took into consideration the *Filioque*, the sacraments, the canon of Scripture, the episcopal succession in the English Church, the confessional, indulgences, prayers for the dead, and the eucharist. Some divergence of views inevitably disclosed itself in the course of the discussions, but the same conciliatory tone and feeling marked the close as well as the commencement of the proceedings, and by both the English and the Continental religious press the final results were hailed as eminently auspicious. As the direct results of these deliberations it has since been decided to abolish compulsory confession and fasting, to employ the vernacular in public worship, to recognize the marriage of priests as lawful, and to allow them to administer in their churches the communion in both kinds to members of the Anglican persuasion.

Since 1874 Old Catholicism has found new adherents in other lands,—in Austria, in Italy, and in Mexico; but the controversial spirit which in past history has either broken up such organizations or largely impaired their efficiency has also marred the success of this interesting movement. In Switzerland, where important conferences were successively convened (at Solothurn in 1871, at Olten in 1872, 1873, and 1874), the unanimity of the "Christian Catholics," as they preferred to call themselves, seemed at one time in danger of being shipwrecked on the question of episcopacy. It was not until 18th September 1876 that the conflict of opinions was so far composed as to allow of the consecration of Bishop Herzog by Bishop Reinkens. The reforms introduced by M. Hyacinthe Loyson in his church at Geneva have received only a partial assent from the general body. Among the more practical results of his example is to be reckoned, however, the fact that in French Switzerland nearly all the clergy, in German Switzerland about one half, are now married men. But the congregations, which in 1876 had reached the number of fifty-five, have dwindled to thirty-five. The number of children in the different schools is stated to be somewhat under 4000 (Nippold, *Handbuch der neuesten Kirchengeschichte*, ii. 466-478).

In Germany, since the year 1878, the position of the Old Catholics has been one of considerable difficulty. While their representatives have scrupulously abstained from any course of action which could tend to embarrass the Government in its political contests, the most influential organs of that Government have systematically decried the movement and have undisguisedly aimed at its complete extinction. This change of policy is mainly due to the altered relations with the papal court. The present pontiff, skilfully ignoring the original and genuine causes in which Old Catholicism took its rise, has sought to represent its leaders as actuated by revolutionary designs and aiming at the subversion of existing institutions, while the Papacy itself has been described as the chief bulwark against social democracy and nihilistic tendencies. The Prussian Government has responded by a series of concessions to the Roman Catholic clergy, while the favour once shown to the seceding party is at an end. Bishop Reinkens himself, though he still receives a salary from the state, no longer draws it under the head of expenditure for Catholic worship. In Bavaria Professor Friedrich has been constrained to transfer his services from the theological to the philosophical faculty at Munich, and the little Old Catholic congregation has been deprived of its church. Huber's valuable literary powers have been lost to the cause by his premature decease. In France the place of M. Michaud, who has been appointed professor in the university of Bern, is in some measure filled by the return of Father Hyacinthe from Geneva. Under such conditions the continued progress of the party and even its existence are obviously seriously imperilled. But, even if, like the Albigenses, the Lollards, and other similar movements to which the assumptions of the Papacy have at different times given rise, Old Catholicism should be destined to extinction, it will not the less have left on permanent record an example of loyalty to conscientious convictions the influence of which will long survive.

Authorities.—The literature of the subject is now voluminous, but the following are among the best sources of information. (*a*) As regards the proceedings at the Vatican Council and the more immediate results of the decrees: Friedberg (Dr Emil), *Sammlung der Aktenstücke zum ersten Vaticanischen Concil mit einem Grundrisse der Geschichte desselben*, 1872; Friedrich (Dr J.), *Tagebuch während des Vaticanischen Concils geführt*, 2d ed., 1873; Id., *Le Concile du Vatican*, Brussels, 1871; Id., *Gesch. des Vatikanischen Konzils*, vol. i., 1877; Frommann (Theodor), *Gesch. u. Kritik d. Vaticanischen Concils von* 1869 *und* 1870, Gotha, 1872; Janus, *Der Papst und das Concil*, 1869 (a reprint of articles in the *Augsburg Allgem. Zeitung*); *An Inside View of the Vatican Council* (Archbishop Kenrick's Speech, edited by L. W. Bacon), New York; *Catholic Reform*, by Father Hyacinthe, with preface by Dean Stanley, 1874; Quirinus, *Römische Briefe vom Concil*, 1870, of which an English translation has also appeared; Von Schulte (Dr J. F.), *Concilien, Päpste, und Bischöfe*, 1871. (*b*) The proceedings of the successive congresses will be best studied in the *Stenographischer Berichte*, published at Munich, Cologne, Constance, &c.; those of the congress of Constance were summarized in an English form, with other elucidatory matter, by Professor John Mayor. (*c*) For the questions involved in the consecration of Bishop Reinkens: *Rechtsgutachten über die Frage der Anerkennung des altkatholischen Bischofs Dr Reinkens in Bayern*, Munich, 1874; Friedberg (Dr Emil), *Der Staat und d. Bischofswahlen in Deutschland*, Leipsic, 1874; Von Sybel (F.), *Das altkatholische Bisthum und das Vermögen d. römisch-katholischen Kirchengesellschaften in Preussen*, Bonn, 1874. (*d*) Reinkens's own speeches and pastorals, some of which have been translated into English, give his personal views and experiences; the *Life* of Huber has been written and published by Eberhard Stirngiebl; and the persecutions to which the Old Catholic clergy have been exposed have been set forth in a pamphlet by Professor John Mayor, *Facts and Documents*, London, 1875. (*e*) An outline of the whole movement from its first commencement to the year 1875 will be found in *The New Reformation*, by "Theodorus" (J. Bass Mullinger); and an excellent résumé of the main facts in the history of the movement in each European country, as connected with other developments of liberal thought, and with political history, is given in the second volume of Dr F. Nippold's *Handbuch der neuesten Kirchengeschichte*, vol. ii., 1883. (*f*) The recognized organ of the movement, the *Deutscher Merkur* (formerly the *Rheinischer Merkur*), is still published weekly by P. Neusser of Bonn. (J. B. M.)

OLDENBURG, a grand-duchy of Germany, with an area of 2480 square miles, consists of three widely separated portions of territory,—(1) the duchy of Oldenburg, (2) the principality of Lübeck, and (3) the principality of Birkenfeld. It ranks tenth among the states of the German empire and has one vote in the federal council and three members in the reichstag.

I. The duchy of Oldenburg, comprising fully four-fifths of the entire area and population, lies between 52° 29′ and 53° 44′ N. lat. and 7° 37′ and 8° 40′ E. long., and is bounded on the N. by the German Ocean and on the other three sides by Hanover, with the exception of a small strip on the east, where it is conterminous with the territory of the free city of Bremen. It forms part of the north-western German plain defined by the Weser and the Ems, and, except on the south, where the Dammergebirge attain a height of 300 feet, it is almost entirely flat, with a slight inclination towards the sea. In respect of its soil it is divided broadly into two parts,—the higher and inland-lying "Geest," consisting of sandy plains intermixed with extensive heaths and moors, and the "marsh lands" along the coast, consisting of rich but somewhat swampy alluvial soil. The latter, which compose about one-fifth of the duchy, are protected against the inroads of the sea by dykes as in Holland; and beyond these are the so-called "watten," generally covered at high tide, but at many points being gradually reclaimed. The climate is temperate and humid; the mean temperature of the coldest month at the town of Oldenburg is 26° Fahr., of the warmest 66°. Storms are numerous and somewhat violent, owing to the almost entire absence of trees; and fogs and ague are prevalent in the marsh lands. The chief rivers are the Hunte, flowing into the Weser, and the Hase and Leda draining into the Ems. The Weser itself forms the eastern boundary for 42 miles, and internal navigation is greatly facilitated by a new canal, passing through the heart of the duchy and connecting the Hunte and the Ems. On the north there are several small coast streams conducted through the dykes by sluices, the only one of importance being the Jade, which empties itself into the Jadebusen, a deep gulf affording admirable accommodation for shipping. The duchy also contains numerous small lakes, the chief of which is the Dümmer See in the south-east corner, measuring 4 miles in length by 2½ in width. About 30 per cent. of the area of the duchy is under cultivation and 17 per cent. under pasture and meadows, while the rest consists mainly of moor and heath. The forests occupy a very small proportion of the whole, but there are some very fine old oaks. In the Geest the principal crops are rye, oats, potatoes, and buckwheat, for which the heath is sometimes prepared by burning. Large tracts of moorland are, however, useful only as producing an abundant supply of turf and peat for fuel, or as affording a scanty subsistence to the flocks of small coarse-woolled Oldenburg sheep. The rich soil of the marsh lands produces good crops of wheat, oats, rye, hemp, and rape, but is especially adapted for grazing. The fat cattle and horses raised on it are highly esteemed throughout Germany, and the former are exported in large numbers to England. Bee-keeping is also much in vogue on the moors. The live stock of Oldenburg forms a great part of its wealth, and the ratio of cattle, sheep, and horses to the population is one of the highest among the German states. There are few large estates, and the ground is mostly in the hands of small farmers, who enjoy the right of fishing and shooting on their holdings. Game, however, is scarce; but the fishing is fairly productive. The mineral wealth of Oldenburg is very small, and there are no mineral springs.

The industries are comparatively insignificant, though recently somewhat stimulated by the extension of the railway system and other causes. Woollen and cotton fabrics, stockings, jute, and cigars are made at Varel, Delmenhorst, and Lohne; cork-cutting is extensively practised in some districts, and there are a few iron-foundries. Trade is relatively of more importance, chiefly owing to the proximity of Bremen. The agricultural produce of the duchy is exported to Scandinavia, Russia, England, and the United States, in return for colonial goods and manufactures. Varel, Brake, and Elsfleth are the chief commercial harbours. In 1881 the ports of the duchy owned a merchant fleet of 345 vessels of 70,000 tons, and they are entered and cleared annually by from 2000 to 2500 vessels with an aggregate burden of 125,000 tons. Shipbuilding and boat-building are carried on at the above-named seaports and on the tributaries of the Ems. Before 1866 Oldenburg was destitute of railways, but it is now traversed by various lines. The high-roads are good; in the north some of them are laid with "klinkers" like those in Holland.

II. The principality of Lübeck, formed of the old bishopric of that name, has an area of 209 square miles, and shares in the general physical characteristics of East Holstein, within which it lies. On the north-east it extends to the Baltic Sea, and on the south-west it is bounded by the Trave. The chief rivers are the Schwartau, a tributary of the Trave, and the Schwentine, flowing northwards to the Gulf of Kiel. The scenery of Lübeck is often picturesque, especially in the vicinity of the Plöner See and the Eutiner See, the most important of the small lakes with which it is dotted. Agriculture is practised here even more extensively than in the duchy of Oldenburg, about 75 per cent. of the area being cultivated. The population in 1880 was 34,973.

III. The principality of Birkenfeld, 194 square miles in extent, lies in the midst of the Prussian province of the Rhine, about 30 miles to the west of the Rhine at Worms and 150 miles to the south of the duchy of Oldenburg. It is a hilly district, intersected by the spurs of the Hochwald, which attain a height of over 2000 feet; the valleys, however, are fertile and produce wine and grain in considerable abundance. About two-fifths of the surface are covered with forests. Iron-founding, cotton-spinning, and other manufactures are carried on; but the characteristic industry (having its seat in Oberstein) is the polishing of agates, of which great numbers are found within the principality (compare ONYX). Birkenfeld is traversed from end to end, a distance of about 25 miles, by the Nahe, which rises close to its northern frontier. The population in 1880 was 38,685.

The total population of the grand-duchy of Oldenburg in 1880 was 337,478, showing an increase of 1·10 per cent. per annum since the census of 1875, and an average of 136 persons to the square mile. The bulk of the inhabitants are of the Saxon stock, but to the north and west there are numerous descendants of the ancient Frisians. The differences between the two races are still to some extent perceptible, but Low German ("Platt-deutsch") is universally spoken, except in one limited district, where a Frisian dialect has maintained itself. In general characteristics the Oldenburg peasants resemble the Dutch, and the absence of large landowners has contributed to make them sturdy and independent. Oldenburg has the credit of showing almost the lowest average of illegitimate births among the German states, amounting in 1881 to only 5 per cent. This is in significant contrast to the high rate (15 per cent.) among the semi-feudatory peasants of MECKLENBURG (*q.v.*). The population of Oldenburg is somewhat unequally distributed, some parts of the marsh lands containing over 300 persons to the square mile, while in the Geest the number occasionally sinks as low as 40. Nearly 80 per cent. of the inhabitants are returned as belonging to the "rural" population. The only town with more than 10,000 inhabitants is Oldenburg, the capital of the grand-duchy. The war-harbour of Wilhelmshaven, with 12,000 inhabitants, on the shore of the Jadebusen, was built by Prussia on a piece of land bought from Oldenburg. The chief towns of Birkenfeld and Lübeck are Birkenfeld and Eutin, with 2539 and 4674 inhabitants respectively. Oberstein in Birkenfeld has 4808; in the 12th century it was a lordship holding directly of the empire.

Oldenburg is a Protestant country, and the grand-duke is required to be a member of the Lutheran Church. Roman Catholicism, however, preponderates in the south-western provinces, which formerly belonged to the bishopric of Münster. Oldenburg Roman Catholics are under the sway of the bishop of Münster, who is represented by an official at Vechta; and the Catholics of Birkenfeld belong to the diocese of Treves. At the census of 1880 there were in the grand-duchy 260,416 Protestants, 74,254 Roman Catholics, and 1654 Jews. The educational system of Oldenburg is on a similar footing to that of north Germany in general, though the scattered position of the farmhouses interferes to some extent with school attendance. The proportion of Oldenburg recruits in 1882 unable to read or write was only 0·27 per cent., which compares favourably with the average of 1·54 for the whole empire. There is no university in Oldenburg territory, but an ample supply of primary, secondary, and special schools.

The constitution of Oldenburg, based upon a decree of 1849, revised in 1852, is one of the most liberal in Germany. It provides for a single representative chamber, elected indirectly by universal suffrage and exercising concurrent rights of legislation and taxation with the grand-duke. The chamber, which consists of thirty-four members (twenty-six for Oldenburg and four for each of the principalities), meets at regular intervals of three years. The executive consists of three ministers, who are aided by a committee of the landtag, when that body is not in session. The local affairs of Birkenfeld and Lübeck are entrusted to provincial councils. All citizens are alike in the eye of the law, and all exemptions and privileges have been abolished. The municipal communities enjoy an unusual amount of independence.

The finances of each constituent state of the grand-duchy are managed separately, and there is also a fourth budget concerned with the joint administration. The last generally shows a sum of about £50,000 on each side, the expenditure including a matricular contribution of £33,500 to the imperial treasury. In the budget of 1882 the revenues of the duchy of Oldenburg, the principality of Lübeck, and the principality of Birkenfeld were estimated at £289,965, £40,419, and £43.864, while the estimated expenditure was in each case somewhat less. The duchy of Oldenburg has a debt of nearly £2,000,000 and Lübeck one of £2000, while Birkenfeld and the grand-duchy as a whole are free of debt. An annual allowance of about £13,000 is made to the grand-duke, and he is believed to derive as much more from his private estates. The troops of Oldenburg furnish the German army with a regiment of infantry, a regiment of cavalry, and two batteries of artillery.

History.—The earliest recorded inhabitants of this district were the Germanic Chauci, who were afterwards merged in the Frisians. Old chroniclers delight in tracing the genealogy of the counts of Oldenburg up to Wittekind, the stubborn opponent of Charlemagne; but their first historical representative is Elimar I., who flourished at the close of the 11th century. His descendants appear as vassals of the powerful Saxon dukes, but attained the rank of independent princes of the empire on the dissolution of the Saxon power by Frederick Barbarossa (*c.* 1180). The countship of Delmenhorst at this time formed part of the Oldenburg dominions, but was afterwards frequently separated from them, and was not lastingly united under the same ruler till the beginning of the 17th century. The northern and western parts of the present duchy of Oldenburg were in the hands of more or less independent Frisian princes, who had generally remained pagans; and Oldenburg's history for the next two centuries is largely concerned with feuds with these small potentates, and gradual extension of territory at their expense. Bremen and Münster were also frequently at war with the counts of Oldenburg. In 1448 Count Christian VIII. was elected king of Denmark, and, a little later, duke of Holstein and Schleswig, the latter event pregnant with important consequences for future history. Oldenburg was made over to his brother Gerhard, an ambitious prince, whose turbulent disposition resulted in an abdication in favour of his sons, forced on him by a league of Hamburg, Lübeck, and Bremen. Protestantism was introduced by Anton I. (1531-1573), who, however, remained loyal to Charles V. in the Schmalkald war, and was thus enabled to increase his territories. On the accession of Anton Günther in the beginning of the 17th century Oldenburg and Delmenhorst were finally welded into one, and about the same period the last free Frisian states, Jever and Kniphausen, were also absorbed by Oldenburg. Anton Günther proved himself the wisest prince who had ruled in Oldenburg, and by his prudent neutrality in the Thirty Years' War secured for his domains immunity from the devastations to which most other German states were exposed. He also obtained from the emperor the right to levy tolls on vessels passing up the Weser, a lucrative grant, which soon formed one-fifth of his revenues. On his death without issue in 1667 the succession passed to the Danish reigning house, after the claims of the Holstein-Gottorp and Holstein-Sonderburg branches of the family had been compromised. Oldenburg remained under the sway of the Danish monarchs for about a century,—a period, on the whole, of peaceful development. At length, in 1773, the Danish monarch agreed to a family compact, in accordance with which he resigned Oldenburg to the Holstein-Gottorp line in return for a renunciation on their part of all claim to Schleswig and Holstein. The head of the Holstein-Gottorp family at this time was the grand-duke Paul of Russia (afterwards the emperor Paul I.); but he handed over Oldenburg, which was now created a duchy, to his cousin Frederick Augustus, bishop of Lübeck, representative of a younger line. The bishop's son, who followed his father in 1785, was a man of weak intellect; and his cousin, Peter Frederick Louis, who acted as administrator and eventually succeeded to the throne, is the direct progenitor of the present grand-duke. Peter had the task of managing the duchy in the troublous times of the Napoleonic wars, and, though he joined the Confederation of the Rhine, had afterwards to see his domains forcibly annexed to France on his refusal to exchange them for Erfurt. This led him to join the allies, and his services were rewarded at the congress of Vienna by the addition of Birkenfeld to his dominions, which were also raised to the rank of a grand-duchy. The secularised bishopric of Lübeck had been already added to Oldenburg in 1803. Oldenburg did not escape the revolutionary wave that swept over Europe in 1848, but no very serious disturbances took place, and the grand-duke granted a constitution in 1849. This constitution was of an ultra-liberal character, and, as the country had hitherto been ruled in the spirit of an enlightened but absolute despotism, strengthened by the absence of a privileged class of nobles, the unimportance of the towns, and the comparative independence of the peasantry, it was inevitable that it should not work at once without friction. In 1852 it had to submit to some modification, which, however, still left it one of the most liberal constitutions in Germany. In 1864 the grand-duke seemed at first inclined to insist upon his claims to the Schleswig-Holstein succession, but he ultimately resigned them in favour of Prussia. In 1866 he sided with that power against Austria, and in 1871 the grand-duchy became a member of the German empire.

See Halem, *Gesch. d. Herzogth. Oldenburg* (1794-96); Runde, *Oldenburgische Chronik* (3d ed., 1863); Böse, *Das Grossherzogthum Oldenburg* (1863); Kollmann, *Das Herzogthum Oldenburg in seiner wirthschaftlichen Entwickelung während der letzten 25 Jahre* (1879); the publications of the Statistical Bureau of Oldenburg; the annual *Hof- und Staatshandbuch des Grossherzogthums Oldenburg.*

OLDENBURG, the capital of the grand-duchy of that name, is a quiet and pleasant-looking town, situated 24 miles to the west of Bremen, on the Hunte, which is navigable for river-craft up to this point. The inner or old town, with its somewhat narrow streets, is surrounded by avenues laid out on the site of the former ramparts, beyond which are the villas, parks, and gardens of the more modern quarters. Oldenburg has almost nothing to show in the shape of interesting old buildings. The Lambertikirche, though dating from the 13th century, has been so transformed in the present century as to show no trace of its antiquity. The palaces of the grand-duke and the town-house are Renaissance buildings of the 17th and 18th centuries. Among the other prominent buildings—all modern—are the theatre, the law-courts, the gymnasium, the commercial school, the three hospitals, and the new Roman Catholic church. The grand-ducal picture-gallery in the Augusteum includes works by Veronese, Velazquez, Murillo, and Rubens; and there are collections of modern paintings and sculptures in the two palaces. The public library contains 150,000 vols., and the duke's private library has 50,000. There is also a museum with a collection of antiquities and a cabinet of natural history. The industries of Oldenburg, which are of no great importance, include iron-founding and the making of tobacco, soap, and leather. A considerable trade is carried on in grain, and the horse-fairs are largely frequented. The population in 1880 was 20,575, or, including the suburban village of Osternburg on the other side of the Hunte and the Hunte-Ems Canal, 24,678. About four-fifths of these are Protestants.

According to popular tradition Oldenburg was founded by Walbert, grandson of Wittekind, and named after his wife Altburga; but the first historical mention of it occurs in a document of 1108. It was fortified in 1155, and received a municipal charter in 1345. The subsequent history of the town is merged in that of the grand-duchy. (J. F. M.)

OLDHAM, a municipal and parliamentary borough and important manufacturing town of south-east Lancashire, is situated on an eminence near the source of the Medlock, at the junction of several railway lines, 6 miles north-east of Manchester. By the Oldham canal it has water-communication with Manchester, Ashton, Stockport and Rochdale. Although consisting chiefly of monotonous rows of workmen's houses, interspersed with numerous immense factories and workshops, Oldham has some good streets and a number of imposing public buildings. Among these the principal are the town-hall, a fine structure in the Grecian style, with a tetrastyle portico copied from the Ionic temple of Ceres near Athens, enlarged by a new wing erected in 1880 at a cost of £24,000, the nucleus of much more extensive municipal buildings; the lyceum, in the Italian style, erected in 1854 and enlarged in 1880; the public baths, erected in 1854—partly by money raised for a memorial to Sir Robert Peel—and enlarged in 1880; the workmen's hall, erected in 1844 and enlarged in 1854; the Werneth mechanics' institute, 1867; the infirmary, erected in 1870 and enlarged in 1877; and the new post-office, 1877. There is a grammar school, founded in 1611; but a more important educational endowment is the blue-coat school, for which a sum of £40,000 was left in 1808. On account of a legal dispute the money was allowed to accumulate for over twenty years, so that the school started with an endowment of £100,000. The town possesses a commodious general market, opened in 1856, and also a fish market, opened in 1873. Both the gasworks and waterworks have since 1853 been in the hands of the corporation. Additional reservoirs have been added to meet the increasing needs of the town, their total capacity being now 1,233,500,000 gallons. During the cotton famine occupation was given to many of the distressed operatives in laying out 72 acres as a public park, which, under the name of the Alexandra Park, was opened in 1865, at a cost of about £37,000. The town, which is one of the most important seats of the cotton manufacture in the world, owes its prosperity in great part to its situation on the edge of the Lancashire coal-field, where the mineral is very easily wrought. There are many valuable seams of coal in the immediate neighbourhood of the town, those in highest repute being the Black Mine and Bent Mine coals. From entries in the church registers it would appear that linens were manufactured in Oldham as early as 1630. Watermills were introduced in 1770, and with the adoption of Arkwright's inventions the cotton industry spread with great rapidity. After the introduction of steam power the town, owing to its proximity to the coal-beds, soon assumed a leading place in the manufacture of cotton. The total number of persons engaged in the industry is over 30,000, the annual consumption of cotton being over 700,000 bales, or about one-fourth of the whole quantity of cotton imported into the United Kingdom. The principal manufactures are fustians, velvets, cords, hats, shirtings, sheetings, and nankeens. There are also large foundries and mill and cotton machinery works, the most extensive establishment being that of Platt and Co. The gas-meters made at Oldham have a high reputation, and there are also several large manufactories of sewing-machines. The town is divided into eight wards, and is governed by a mayor, eight aldermen, and twenty-four councillors. The area of the township is coextensive with that of the municipal borough and comprehends 4730 acres, of which 13 are water. The parliamentary borough has an area of 12,310 acres, and, in addition to Oldham, includes the townships of Crompton, Royton, and Chadderton, and part of the parish of Ashton-under-Lyne. Within the present century the growth of Oldham has been very rapid. In 1714 the population numbered only 1750, which in 1801 had increased to 12,024, in 1841 to 42,595, in 1861 to 72,333, in 1871 to 82,633, and in 1881 to 111,343. The population of the parliamentary borough in 1871 was 113,100, and in 1881 it was 152,513.

The name Oldham is of Saxon origin. A Roman road, of which some traces are still left, passes through the township, but it does not appear to have been a Roman station. It is not mentioned in Domesday; but in the reign of Henry III. Alwardus de Aldholme is referred to as holding "two bovats of land in Vernet (Werneth)." A daughter and co-heiress of this Alwardus conveyed Werneth Hall and its manor to the Cudworths, a branch of the Yorkshire family, with whom it remained till the early part of last century. From the Oldhams was descended Hugh Oldham, who died bishop of Exeter in 1519. In 1826 the town was placed under the care of a board of commissioners, and in 1849 it received municipal government. Since 1832 it has returned two members to parliament.

OLDHAM, John (1653-1683), a satirist of the Restoration period, achieved notoriety by his *Satires on the Jesuits*, published during the heat of the excitement caused by the revelations of Titus Oates and the murder of Godfrey in 1678. In such a time of national panic and hatred "who peppered the highest was surest to please," and Oldham's satires could hardly be surpassed for energy of invective and copiousness of coarse extravagant irony. They were extravagant enough to pass in a more sober age for burlesques of anti-Popish frenzy. Oldham was at the time a tutor in a judge's family. He was the son of a Nonconformist minister, born at Shipton, near Tedbury in Gloucestershire, in 1653, was a B.A. of Oxford (Edmund Hall), and had been for some three years an usher in a school at Croydon. Before he appeared as a satirist, and while he was still an usher, his verses, circulated in MS., had attracted the attention of Will's Coffee-house, and Rochester with some of his boon companions had sallied down to Croydon to see what the new poet was like. It was probably an extravagantly humorous dithyrambic drunkard's soliloquy that roused their curiosity, and when they found him a tall, thin, consumptive, harsh-featured cynic they apparently left him to his drudgery. After the success of his *Satires on the Jesuits*, Oldham wrote more satires, imitations of Horace and Juvenal, and one of them, a satire on poets, setting forth bitterly their degradation, their poverty, their humiliating adulation of patrons, is often quoted as an index to the condition of men of letters in those days. He died prematurely (1683) at the age of thirty, and was eloquently lamented by Dryden as the "Marcellus of our tongue."

> "Farewell, too little and too lately known,
> Whom I began to think and call my own;
> For sure our souls were near allied, and thine
> Cast in the same poetic mould as mine."

Oldham's verse was rugged, and his rage, as Pope said, "too like Billingsgate"; but "maturing time," as Dryden hoped, might have softened these faults. Donne and Cowley were his literary models, and he poured into their forms great warmth of feeling, wealth of incident, and commanding force of language.

OLDYS, William (1696-1761), a useful bibliographer, was the natural son of Dr Oldys, chancellor of Lincoln, and was born in 1696. He was a good scholar, but of intemperate habits, and never succeeded in freeing himself from the thraldom of Grub Street,—unless, indeed, when he was employed for some years by Harley, earl of Oxford, as librarian. He is best known by his *British Librarian*, an esteemed but unfinished work, which began to appear in 1737 (see Bibliography, vol. iii. p. 652). He was appointed Norroy king-at-arms by the duke of Norfolk. His death took place on 15th April 1761. A MS. collection of notes by Oldys on various bibliographical subjects and a copy of Langbaine's *Lives* copiously annotated by him are preserved in the British Museum.

OLEANDER is the common name for the shrub known to botanists as *Nerium Oleander*. It is a native of the Mediterranean and Levant, and is characterized by its tall shrubby habit and its thick lance-shaped opposite leaves, which exude a milky juice when punctured. The flowers are borne in terminal clusters, and are like those of the common periwinkle (*Vinca*), but are of a rose colour, rarely white, and the throat or upper edge of the tube of the corolla is occupied by outgrowths in the form of lobed and fringed petal-like scales. The hairy anthers adhere to the thickened stigma. The fruit or seed-vessel consists of two long pods, which, bursting along one edge, liberate a number of seeds, each of which is provided with a tuft of silky hairs like thistle down at the upper end. The genus belongs to the family of *Apocynaceæ*, a family that, as is usual where the juice has a milky appearance, is marked by its poisonous properties. Cases are recorded by Lindley of children poisoned by the flowers. The same author also narrates how in the course of the Peninsular War some French soldiers died in consequence of employing skewers made from freshly-cut twigs of oleander for roasting their meat. The oleander was known to the Greeks under three names, viz., *rhododendron*, *nerion*, and *rhododaphne*, and is well described by Pliny (xvi. 20), who mentions its rose-like flowers and poisonous qualities, at the same time stating that it was considered serviceable as a remedy against snake-bite. The modern Greeks still know the plant as ῥοδοδάφνη, although in a figure in the Rinuccini MSS. of Dioscorides a plant is represented under this name, which, however, has rather the appearance of a willow herb, *Epilobium*. The oleander has long been cultivated in greenhouses in England, being, as Gerard says, "a small shrub of a gallant shewe"; and of late numerous varieties, differing in the colour of their flowers and in the mutation of their stamens into petals so as to form double flowers, have been introduced.

Nerium Oleander.

OLEARIUS, Adam, a German traveller whose true name was Oelschläger, was born at Ascherleben near Magdeburg in 1600, and died at Gottorp 22d February 1671. After studying at Leipsic he became librarian and court mathematician to Duke Frederick III. of Holstein-Gottorp, and in 1633 he was appointed secretary to the ambassadors Philip Crusius and Otto Brüggemann or Brugman sent by the duke to Muscovy and Persia in the hope of making arrangements by which his newly-founded city of Frederikstad should become the terminus of an overland silk-trade. It is by his admirable narrative of this legation (*Beschreibung der moskowitischen und persischen Reise*, Schleswig, 1647, and afterwards in several enlarged editions) that Olearius is best known, though he also published a history of Holstein, and a translation of the Gulistan (*Persianisches Rosenthal*, Schleswig, 1654), to which was appended a translation of the fables of Lokman. A French version of the *Beschreibung* was published by Wicquefort (1679), and an English version (1662, 2d ed. 1669) by John Davies of Kidwelly.

The embassy to which Olearius was attached made two different journeys. The first (22d October 1633 to 6th April 1635) was by Hamburg, Lübeck, Riga, Dorpat (five months' stay), Revel, Narva, Ladoga, and Novgorod to Moscow, and back again by a somewhat different route. The second (22d October 1635 to 1st August 1639) was by a similar route to Moscow, thence to the Volga, down the river to Astrakhan, across the Caspian to Nizovaya, and so on, by Shemakha, Ardebil, Sultanieh, Kaswin, &c., to Ispahan, and then back again by Resht and Lenkoran to Astrakhan, Kazan, Moscow, &c. Paul Fleming the poet and Mandelslo, whose travels to the East Indies are usually published with those of Olearius, accompanied the embassy.

OLEO-MARGARINE. The process by which the French chemist Mège-Mouriès sought to convert ordinary animal fat into butter has already been described under Butter (vol. iv. p. 592). The following account of the mode of manufacture as carried on by the "Commercial Manufacturing Company" in New York is abridged from a report by Mr Victor Drummond, secretary to the British Embassy in Washington, in 1880.

Fresh fat from recently killed cattle is soaked in tepid water for one hour, then thoroughly washed with cold water, and, after having been soaked in cold water, assorted, the pieces less rich in "oil" being rejected and put aside for the manufacture of tallow. The fat thus selected is hashed up (almost minced) by machinery and melted down in water-jacketed caldrons, the water being heated by means of steam, so that the fat never becomes hotter than 124° Fahr. Through the action of this heat the fat divides into three parts, namely, shreds of membrane below, a scum of an emulsion of fat and water above, and clear oil between the two. The oil is drawn off and kept for thirty to thirty-six hours at a temperature of 85° Fahr., when a portion of the stearin and palmitin crystallizes out, while the more easily fusible components remain as a mother liquor, which is then squeezed out by hydraulic pressure. This oil, which on cooling freezes into a semi-solid fat, constitutes *oleo-margarine*, and is recommended as an excellent substitute for melted butter. Of the oil considerable quantities are worked up into imitation butter. For this purpose it is violently churned up with milk for about twenty minutes, a little arnotto being added to produce a yellow colour. The emulsion is run direct on a mass of pounded ice to cause it to solidify without crystallization. After having been again churned up with fresh milk, it is kneaded to remove the excess of water, salted (in short, manipulated as genuine churned butter is), and sent out into the market.

The report includes a comparative analysis of real and of the Commercial Company's imitation butter, of which the following is a somewhat condensed copy:—

		Real Butter.	Imitation.
1.	Glycerides of non-volatile fatty acids	51·4	56·3
2.	Glycerides of butyric and other volatile acids	7·4	1·3
3.	Casseine	0·2	0·6
	Salt	5·1	5·1
	Water	23·3	24·9

Oleo-margarine,—that is, ordinary fat minus part of the palmitin and stearin—is necessarily somewhat richer in those components (2) which are characteristically predominant in butter, but still falls far short of what real butter naturally contains. The physiological action of these butter-glycerides, as we may call them, has never been made out; possibly they may account to some extent for butter being more easily digestible than ordinary fat.

Hehner and Angell have the merit of being the first to work out an easy and straightforward method for detecting (considerable) admixtures of ordinary animal fat, and consequently also of such things as oleo-margarine, with real butter. It consists in determining the percentage of insoluble and non-volatile acids contained in the previously dehydrated and filtered article. By their *modus operandi* all ordinary animal fats yield close upon 95 per cent., while genuine butter yields only 86·5 to 87·5, at most 89 per cent., of fixed fatty acids. Easier and more decisive is the method of Reichert, who saponifies 2·5 grammes of the dry filtered article with 1 gramme of caustic potash dissolved in alcohol, expels the alcohol, decomposes the soap, after addition of 50 cubic centimetres of water, with 20 c.c. of dilute sulphuric acid (1 vol. of vitriol, 10 vol. of water), and distils off (exactly) 50 c.c., to determine therein the volatile acids by ascertaining the volume of a dilute standard solution of caustic alkali which is required to neutralize them. Real butter (per 2·5 grammes) yields 12 to 13 milligrammes, ordinary fats only 1·8 to 2·7, of volatile acids, calculated as butyric, $C_4H_8O_2$.

OLERON, an island lying off the west coast of France, opposite the mouths of the Charente and Seudre, and included in the department of the Charente-Inférieure, has an area of 59 square miles. It is about 18 miles in length from north-west to south-east, and 7 in extreme breadth; the width of the strait separating it from the mainland is at one point less than a mile. The greater part of the island is very fertile, but there are also some extensive salt marshes, from which a considerable quantity of salt is made. The chief products are corn, wine, fruit, and vegetables. The population of the island, which is mostly Protestant and supplies excellent sailors, numbered 18,244 in 1881; that of the chief town, Château d'Oleron, on the south-east coast, was 1727. Other towns are Saint-Georges d'Oleron (4943) and Saint-Pierre d'Oleron (1535). Oleron, the Uliarus Insula of Pliny, gave its name to a mediæval code of maritime laws, for the origin and history of which see Sea Laws.

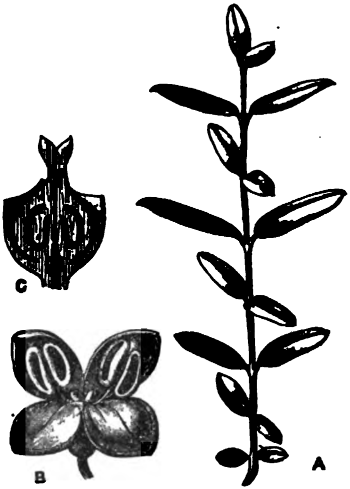
OLGA, wife of Igor, prince of Kieff, and afterwards (from 945) regent for Sviatoslaf her son, was baptized at Constantinople about 955 and died about 969. She was afterwards canonized in the Russian church, and is now commemorated on 11th July. See Russia.

OLIVA, Fernan Perez de, Spanish man of letters, one of the earliest writers of didactic prose in that language, was born at Cordova about 1492, and, after studying at Salamanca, Alcalá, Paris, and Rome, was appointed to the chair of moral philosophy at Salamanca, where he died in 1530. His principal work, a *Dialogue on the Dignity of Man*, which he did not live to complete, was finished by Francisco Cervantes de Salazar, and published in 1546. His metrical translations from Euripides and Plautus are unimportant.

OLIVARES, Gaspard de Guzman, Conde Duque de (1587-1645), Spanish statesman, was born at Rome on 6th January 1587, where his father, Count Enrique, who afterwards became viceroy successively of Sicily and Naples, was at the time ambassador to Pope Sixtus V. His grandfather, Count Pedro (1502-1562), had been a prominent figure at the courts both of Charles V. and of Philip II. After studying at Salamanca Olivares received, through the influence of his uncle the duke of Uceda, the appointment of gentleman of the bedchamber to the prince of Asturias. By his winning manners and valued, if not always very creditable, services he so ingratiated himself with the heir-apparent that the latter, on his accession as Philip IV. in 1621, forthwith made him his prime minister, conferring on him the title of Duque de San Lucar de Barrameda. It was the ambition of Olivares to regain for his country by arms and intrigue the influence it had formerly possessed in Europe, but his abilities, great as they were, were very unequally matched with those of Richelieu, his rival in policy, and twenty-two years of almost autocratic power accordingly had no other result than deep national humiliation as well as personal disgrace (see Spain). The expedients to which he was compelled to resort in order to raise money for his long and unsuccessful war with the Dutch and for the support of his armies in Germany and Italy raised throughout the Spanish peninsula a spirit of discontent, which came to a crisis in 1640, when Catalonia rebelled, calling in the aid of the French, and Portugal declared its independence, electing the duke of Braganza as king. All his attempts at pacification having failed, the enemies of Olivares succeeded in supplanting him in the king's favour in 1643. He was banished to Toro (Zamora) where he died in 1645.

See De la Rocca, *Hist. du ministère du Comte-duc d'Olivares* (Cologne, 1673).

OLIVE (*Olea europæa*), the well-known plant that yields the olive oil of commerce, belongs to a section of the natural order *Oleaceæ*, of which it has been taken as the type. The genus *Olea* includes about thirty-five species, very widely scattered, chiefly over the Old World, from the basin of the Mediterranean to South Africa and New Zealand. The wild olive, or oleaster, is a small tree or bush of rather straggling growth, with thorny branches and opposite oblong pointed leaves, dark greyish-green above and, in the young state, hoary beneath with whitish scales; the small white flowers, with four-cleft calyx and corolla, two stamens, and bifid stigma, are borne on the last year's wood, in racemes springing from the axils of the leaves; the drupaceous fruit is small in the wild plant, and the fleshy pericarp, which gives the garden olive its economic value, is hard and comparatively thin. In the cultivated forms the tree acquires a more compact habit, the branches lose their spinous character, while the young shoots become more or less angular; the leaves are always hoary on the under-side, and are generally lanceolate in shape, though varying much in breadth and size in the different kinds. The fruit is subject to still greater alterations of form and colour; usually oval or nearly globular, in some sorts it is egg-shaped, in others much elongated; while the dark hue that it commonly assumes when ripe is exchanged in many varieties for violet, green, or almost white. At present the wild olive is found in most of the countries around the Mediterranean, extending its range on the west to Portugal, and eastward to the vicinity of the Caspian, while, locally, it occurs even in Afghanistan. An undoubted native of Syria and the maritime parts of Asia Minor, its abundance in Greece and the islands of the Archipelago, and the frequent allusions to it by the earliest poets, seem to indicate that it was there also indigenous; but in localities remote from the Levant it may have escaped from cultivation, reverting more or less to its primitive type. It shows a marked preference for calcareous soils and a partiality for the sea-breeze, flourishing with especial luxuriance on the limestone slopes and crags that often form the shores of the Greek peninsula and adjacent islands.



A, *Olea europæa* (from nature). B, opened flower; C, vertical section (after Luerssen, *Med.-Pharm. Botanik*, 1883).

The varieties of olive known to the modern cultivator are extremely numerous,—according to some authorities, equalling or exceeding in number those of the vine. In France and Italy at least thirty kinds have been enumerated, but comparatively few are grown to any large extent. None of these can be safely identified with ancient descriptions, though it is not unlikely that some of the narrow-leaved sorts that are most esteemed may be descendants of the famed "Licinian" (see below). Italy retains its old pre-eminence in olive cultivation; and, though its ancient Gallic province now excels it in the production of the finer oils, its fast-improving culture may restore the old prestige. The broad-leaved olive trees of Spain bear a larger fruit, but the pericarp is of more bitter flavour and the oil of ranker quality. The olive tree, even when free increase is unchecked by pruning, is of very slow growth; but, where allowed for ages its natural development, the trunk sometimes attains a considerable diameter. De Candolle records one exceeding 23 feet in girth, the age being supposed to amount to seven centuries. Some old Italian olives have been credited with an antiquity reaching back to the first years of the empire, or even to the days of republican Rome; but the age of such ancient trees is always doubtful during growth, and their identity with old descriptions still more difficult to establish. The tree in cultivation rarely exceeds 30 feet in height, and in France and Italy is generally confined to much more limited dimensions by frequent pruning. The wood, of a yellow or light greenish-brown hue, is often finely veined with a darker tint, and, being very hard and close-grained, is valued by the cabinetmaker and ornamental turner.

The olive is propagated in various ways, but cuttings or layers are generally preferred; the tree roots in favourable soil almost as easily as the willow, and throws up suckers from the stump when cut down. Branches of various thickness are cut into lengths of several feet each, and, planted rather deeply in manured ground, soon vegetate; shorter pieces are sometimes laid horizontally in shallow trenches, when, covered with a few inches of soil, they rapidly throw up sucker-like shoots. In Greece and the islands grafting the cultivated tree on the oleaster is a common practice. In Italy embryonic buds, which form small swellings on the stems, are carefully excised and planted beneath the surface, where they grow readily, these "uovoli" soon forming a vigorous shoot. Occasionally the larger boughs are inarched, and young trees thus soon obtained. The olive is also sometimes raised from seed, the oily pericarp being first softened by slight rotting, or soaking in hot water or in an alkaline solution, to facilitate germination. The olives in the East often receive little attention from the husbandman, the branches being allowed to grow freely and without curtailment by the pruning-knife; water, however, must be supplied in long droughts to ensure a crop; with this neglectful culture the trees bear abundantly only at intervals of three or four years; thus, although wild growth is favourable to the picturesque aspect of the plantation, it is not to be recommended on economic grounds. Where the olive is carefully cultivated, as in Languedoc and Provence, it is planted in rows at regular intervals, the distance between the trees varying in different "olivettes," according to the variety grown. Careful pruning is practised, the object being to preserve the flower-bearing shoots of the preceding year, while keeping the head of the tree low, so as to allow the easy gathering of the fruit; a dome or rounded form is generally the aim of the pruner. The spaces between the trees are occasionally manured with rotten dung, or other nitrogenous matter; in France woollen rags are in high esteem for this purpose. Various annual crops are sometimes raised between the rows, and in Calabria wheat even is grown in this way; but the trees are better without any intermediate cropping. Latterly a dwarf variety, very prolific, and with green fruit, has come into favour in certain localities, especially in America, where it is said to have produced a crop two or three seasons after planting. The ordinary kinds do not become profitable to the grower until from five to seven years after the cuttings are placed in the olive-ground. Apart from occasional damage by weather or organic foes, the olive crop is somewhat precarious even with the most careful cultivation, and the large untended trees so often seen in Spain and Italy do not yield that certain income to the peasant proprietor that some authors have attributed to them; the crop from these old trees is often enormous, but they seldom bear well two years in succession, and in many instances a luxuriant harvest can only be reckoned upon every sixth or seventh season. The fruit when ripe is, by the careful grower, picked by hand and deposited in cloths or baskets for conveyance to the mill; but in many parts of Spain and Greece, and generally in Asia, the olives are beaten down by poles, or by shaking the boughs, or even allowed to drop naturally, often lying on the ground until the convenience of the owner admits of their removal; much of the inferior oil owes its bad quality to the carelessness of the proprietor of the trees. In southern Europe the olive harvest is in the winter months, continuing for several weeks; but the time varies in each country, and also with the season and the kinds cultivated. The amount of oil contained in the fruit differs much in the various sorts; the pericarp usually yields from 60 to 70 per cent. The ancient agriculturists believed that the olive would not succeed if planted more than a few leagues from the sea (Theophrastus gives 300 stadia as the limit), but modern experience does not confirm the idea, and, though showing a preference for the coast, it has long been grown far inland. A calcareous soil, however dry or poor, seems best adapted to its healthy development, though the tree will grow in any light soil, and even on clay if well drained; but, as remarked by Pliny, the plant is more liable to disease on rich soils, and the oil is inferior to the produce of the poorer and more rocky ground the species naturally affects. The olive suffers greatly in some years from the attacks of various enemies. A fungoid growth has at times infested the trees for several successive seasons, to the great damage of the plantations. A species of coccus, *C. oleæ*, attaches itself to the shoots, and certain lepidopterous caterpillars feed on the leaves, while the "olive-fly" attacks the fruit. In France the olivettes suffer occasionally from frost; in the early part of the last century many trees were cut to the ground by a winter of exceptional severity. Gales and long-continued rains during the gathering season also cause mischief.

The unripe fruit of the olive is largely used in modern as in ancient times as an article of dessert, to enhance the flavour of wine, and to renew the sensitiveness of the palate for other viands. For this purpose the fruit is picked while green, soaked for a few hours in an alkaline ley, washed well in clean water, and then placed in bottles or jars filled with brine; the Romans added *amurca* to the salt to increase the bitter flavour of the olives, and at the present day spices are sometimes used.

The leaves and bark of the tree are employed in the south, as a tonic medicine, in intermittent fever. A resinous matter called "olive gum," or Lucca gum, formed by the exuding juice in hot seasons, was anciently in medical esteem, and in modern Italy is used as a perfume.

In England the olive is not hardy, though in the southern counties it will stand ordinary winters with only the protection of a wall, and will bear fruit in such situations; but the leaves are generally shed in the autumn, and the olives rarely ripen.

The genus *Olea* includes several other species of some economic importance. The olive of America, *O. americana*, a rather small tree, growing in the southern parts of the United States, with broadly-lanceolate leaves and compound racemes of small white fragrant flowers, is remarkable for the extreme hardness of its wood, which, resisting ordinary tools, is called devil-wood by the southern lumberers and squatters. *O. paniculata* is a larger tree, attaining a height of 50 or 60 feet in the forests of Queensland, and yielding a hard and tough timber. The yet harder wood of *O. laurifolia*, an inhabitant of Natal, is the black ironwood of the South African colonist. The white or yellowish sweet-scented flowers of *O. fragrans*, a Chinese species, are employed to communicate their aroma to some of the finer teas; the oblong serrated leaves are said to be used for the adulteration of inferior kinds. Some other species of olive furnish hard and close-grained wood, but are not yet of much general interest.

At what remote period of human progress the wild oleaster passed under the care of the husbandman and became the fruitful garden olive it is impossible to conjecture;—history and tradition are alike silent regarding the origin of most of the more valued plants of cultivation, and we know little more of the later evolution of the olive than of the remoter genealogies of our present wheat and maize. The frequent reference in the Bible to the plant and its produce, its implied abundance in the land of Canaan, the important place it has always held in the economy of the inhabitants of Syria, lead us to consider that country the birthplace of the cultivated olive. An improved variety, possessed at first by some small Semitic sept, it was probably slowly distributed to adjacent tribes; and, yielding profusely, with little labour, that oily matter so essential to healthy life in the dry hot climates of the East, the gift of the fruitful tree became in that primitive age a symbol of peace and goodwill among the warlike barbarians. At a later period, with the development of maritime enterprise, the oil was conveyed, as an article of trade, to the neighbouring Pelasgic and Ionian nations, and the plant, doubtless, soon followed.

Hehn remarks that in the Homeric world, as depicted in the *Iliad*, olive oil is known only as a luxury of the wealthy,—an exotic product, prized chiefly for its value in the heroic toilet; the warriors anoint themselves with it after the bath, and the body of Patroclus is similarly sprinkled; but no mention of the culture of the plant is made, nor does it find any place on the Achillean shield, on which a vineyard is represented. But, although no reference to the cultivation of the olive occurs in the *Iliad*, the presence of the tree in the garden of Alcinous and other familiar allusions show it to have been known when the *Odyssey* was written. Whenever the introduction may have taken place, all tradition points to the limestone hills of Attica as the seat of its first cultivation on the Hellenic peninsula. When Poseidon and Athene contended for the future city, an olive sprang from the barren rock at the bidding of the goddess, the patron of those arts that were to bring undying influence to the rising state. That this myth has some relation to the first planting of the olive in Greece seems certain from the remarkable story told by Herodotus of the Epidaurians, who, on their crops failing, applied for counsel to the Delphic oracle, and were enjoined to erect statues to Damia and Auxesia (symbols of fertility) carved from the wood of the true garden olive, then possessed only by the Athenians, who granted their request for a tree on condition of their making an annual sacrifice to Athene, its patron; they thus obeyed the command of the Pythian, and their lands became again fertile. The sacred tree of the goddess long stood on the Acropolis, and, though destroyed in the Persian invasion, sprouted again from the root,—some suckers of which were said to have produced those olive trees of the Academy in an after age no less revered. By the time of Solon the olive had so spread that he found it necessary to enact laws to regulate the cultivation of the tree in Attica, from which country it was probably distributed gradually to all the Athenian allies and tributary states. To the Ionian coast, where it abounded in the time of Thales, it may have been in an earlier age brought by Phœnician vessels; some of the Sporades may have received it from the same source; the olives of Rhodes and Crete had perhaps a similar origin. Samos, if we may judge from the epithet of Æschylus (ἐλαιόφυτος), must have had the fruitful plant long before the Persian wars. It is not unlikely that the valued tree was taken to Magna Græcia by the first Achæan colonists, and the assertion of Pliny (quoted from Fenestella), that no olives existed in Italy in the reign of Tarquinius Priscus, must be received with the caution due to many statements of that industrious compiler. In Latin Italy the cultivation seems to have spread slowly, for it was not until the consulship of Pompey that the production of oil became sufficient to permit of its exportation. In Pliny's time it was already grown abundantly in the two Gallic provinces and in Spain; indeed, in the earlier days of Strabo the Ligurians supplied the Alpine barbarians with oil, in exchange for the wild produce of their mountains; the plant may have been introduced into those districts by Greek settlers in a previous age. Africa was indebted for the olive mainly to Semitic agencies. In Egypt the culture never seems to have made much progress; the oil found in Theban tombs was probably imported from Syria. Along the southern shore of the great inland sea the tree was carried by the Phœnicians, at a remote period, to their numerous colonies in Africa,—though the abundant olives of Cyrene, to which allusion is made by Theophrastus, and the glaucous foliage of whose descendants still clothes the rocks of the deserted Cyrenaica, may have been the offspring of Greek plants brought by the first settlers. The tree was most likely introduced into southern Spain, and perhaps into Sardinia and the Balearic Islands, by Phœnician merchants; and, if it be true that old olive trees were found in the Canaries on their rediscovery by mediæval navigators, the venerable trees probably owed their origin to the same enterprising pioneers of the ancient world. De Candolle says that the means by which the olive was distributed to the two opposite shores of the Mediterranean are indicated by the names given to the plant by their respective inhabitants,—the Greek ἐλαία passing into the Latin *olea* and *oliva*, that in its turn becoming the *ulivo* of the modern Italian, the *olivo* of the Spaniard, and the *olive*, *olivier*, of the French, while in Africa and southern Spain the olive retains appellatives derived from the Semitic *zait* or *zeit*; but the complete subjugation of Barbary by the Saracens sufficiently accounts for the prevalence of Semitic forms in that region; and *aceytuno* (Arab. *zeitûn*), the Andalusian name of the fruit, locally given to the tree itself, is but a vestige of the Moorish conquest. Yielding a grateful substitute for the butter and animal fats consumed by the races of the north, the olive, among the southern nations of antiquity, became an emblem not only of peace but of national wealth and domestic plenty; the branches borne in the Panathenæa, the wild olive spray of the Olympic victor, the olive crown of the Roman conqueror at ovation, and those of the equites at their imperial review alike typified gifts of peace that, in a barbarous age, could be secured by victory alone. Among the Greeks the oil was valued as an important article of diet, as well as for its external use. The Roman people employed it largely in food and cookery,—the wealthy as an indispensable adjunct to the toilet; and in the luxurious days of the later empire it became a favourite axiom that long and pleasant life depended on two fluids, "wine within and oil without." Pliny vaguely describes fifteen varieties of olive cultivated in his day,—that called the "Licinian" being held in most esteem, and the oil obtained from it at Venafrum in Campania the finest known to Roman connoisseurs; the produce of Istria and Bætica was regarded as second only to that of the Italian peninsula. The *gourmet* of the empire valued the unripe fruit, steeped in brine, as a provocative to the palate, no less than his modern representative; and pickled olives, retaining their characteristic flavour, have been found among the buried stores of Pompeii. The bitter juice or refuse deposited during expression of the oil (called *amurca*), and the astringent leaves of the tree have many virtues attributed to them by ancient authors. The oil of the bitter wild olive was employed by the Roman physicians in medicine, but does not appear ever to have been used as food or in the culinary art.

In modern times the olive has been spread widely over the world; and, though the Mediterranean lands that were its ancient home still yield the chief supply of the oil, the tree is now cultivated successfully in many regions unknown to its early distributors. Soon after the discovery of the American continent it was conveyed thither by the Spanish settlers. In Chili it flourishes as luxuriantly as in its native land, the trunk sometimes becoming of large girth, while oil of fair quality is yielded by the fruit. To Peru it was carried at a later date, but has not there been equally successful. Introduced into Mexico by the Jesuit missionaries of the 17th century, it was planted by similar agency in Upper California, where it has prospered latterly under the more careful management of the Anglo-Saxon conqueror. Its cultivation has also been attempted in the south-eastern States, especially in Carolina, Florida, and Mississippi. In the eastern hemisphere the olive has been established in many inland districts, which would have been anciently considered ill adapted for its culture. To Armenia and Persia it was known at a comparatively early period of history, and many olive-yards now exist in Upper Egypt, where the cultivation is said to be increasing. The tree has lately been introduced into Chinese agriculture, while in the present generation it promises to become an important addition to the resources of the Australian planter. In Queensland the olive has found a climate specially suited to its wants; in South Australia, near Adelaide, it also grows vigorously; and there are probably few coast districts of the vast island-continent where the tree would not flourish. It has likewise been successfully introduced into some parts of the Cape Colony. (C. P. J.)

OLIVES, MOUNT OF, or **MOUNT OLIVET** (ὄρος ἐλαιῶνος or τῶν ἐλαιῶν, in Mishna and Midrash הַר הַזֵּיתִים or הַר הַמִּשְׁחָה, now Jebel al-Ṭûr), is the hill facing the Temple Mount on the east, and separated from it by the Kidron (see vol. xiii. p. 636 *sq.*). Here our Lord sat when He delivered His great eschatological address (Mark xiii. 3). That the ascension took place from the summit of the Mount of Olives is not necessarily implied in Acts i. 12, and appears to be excluded by Luke xxiv. 50, for Bethany lies at the back of the hill and almost a mile from the top. But since Constantine erected the basilica of the ascension on the spot marked by a certain sacred cave (Euseb., *V. Const.*, iii. 41) the site of the ascension has been placed here and marked by a succession of churches. The present building is quite modern. Close to the chapel of the ascension is the vault of St Pelagia, and a little way down the hill is the labyrinth of rock-hewn sepulchral chambers now called the "Tombs of the Prophets." A chapel bearing the name of 'Omar, and said to occupy the place where he encamped when Jerusalem surrendered to the Moslems, formerly stood beside the church of the ascension (Moḳaddasí).

OLIVETANS, a monastic order, that of Our Lady of Monte Oliveto, following the Benedictine rule, was founded about the year 1313 by Bernardo Tolomei of Siena (see Monachism). The mother-house at Monte Oliveto Maggiore, about 19 miles to the south of Siena, is a favourable specimen of a great Benedictine monastery; the church and library contain some fine inlaid work by Fra Giovanni da Verona (1502-1505), and the court has celebrated frescos by Luca Signorelli and Ant. Bazzi (Soddoma).

OLMSTED, Denison (1791-1859), man of science, was born at East Hartford, Connecticut, U.S.A., on 18th June 1791, and became a student of Yale, where he graduated in 1813, and acted as college tutor from 1815 to 1817. In the latter year he was appointed to the chair of chemistry, mineralogy, and geology in the university of North Carolina. This chair he exchanged for that of mathematics and physics at Yale in 1825; in 1836, when this professorship was divided, he retained that of astronomy and natural philosophy. He died at New Haven, Connecticut, on 13th May 1859.

His first publication (1824-25) was the *Report* of his geological survey of the State of North Carolina. It was followed by various text-books on natural philosophy and astronomy, but he is chiefly known to the scientific world for his observations on hail (1830), on meteors, and on the aurora borealis. For his conclusions on the last-named subject see vol. viii. of the *Smithsonian Contributions*.

OLMÜTZ (Slavonic, *Olomouc* or *Holomauc*), the second city and the ecclesiastical metropolis of Moravia, and one of the strongest fortresses in the Austrian empire, is situated on the March, about 110 miles to the north of Vienna. Like most Slavonic towns, it contains several large squares, the chief of which is adorned with a trinity column, 115 feet high. The most prominent church is the cathedral, a Gothic building of the 14th century, containing the tomb of King Wenceslaus III., who was murdered here in 1306. The principal secular buildings are the archbishop's palace, the town-house, the arsenal, the barracks, and the various schools, convents, and hospitals. The old university is now represented by a theological faculty attended by about a hundred students. Its library formerly possessed an important collection of Slavonic works, which was carried off by the Swedes during the Thirty Years' War. There is also an industrial museum. The manufactures of Olmütz itself are comparatively insignificant, but it is important as the emporium of a busy mining and industrial district and as a mart for Russian and Moldavian cattle. The population in 1880 was 20,176, besides which there is a garrison of about 6000 men. German is the predominant language. The chief part of the fortifications, which were originally constructed in the time of the wars with Frederick the Great, consists of a girdle of about twenty outlying forts. In case of attack the adjacent district can be flooded with the water of the March.

Olmütz is said to occupy the site of a Roman fort founded in the imperial period, the original name of which, *Mons Julii*, has been gradually corrupted to the present form. At a later period Olmütz was long the capital of the Slavonic kingdom of Moravia, but it ceded that position to Brünn in 1640. During the Thirty Years' War it was occupied by the Swedes for eight years, and in 1758 it successfully resisted Frederick the Great during a siege of seven weeks. In 1848 Olmütz was the scene of the emperor Ferdinand's abdication, and in 1850 of an important conference, for an account of which see Germany and Austria. The bishopric of Olmütz was founded in 1073, and raised to the rank of an archbishopric in 1777. The bishops were created princes of the empire in 1588. The archbishop is the only one in the Austrian empire who is elected by the cathedral chapter.

OLONETZ, a government of north-western Russia, extending from Lake Ladoga almost to the White Sea, is bounded on the W. by Finland, on the N. and E. by Archangel and Vologda, and on the S. by Novgorod. The area is 57,440 square miles. Its north-western portion belongs orographically and geologically to the Finland region; it is covered with hills reaching 1000 feet in height, and with numberless smaller ridges and hollows running from north-west to south-east. The rest of the government is a flat plateau sloping towards the marshy lowlands of the south. The geological structure is very varied. Granites, syenites, and diorites, covered with Laurentian metamorphic slates, occur extensively in the north-west. Near Lake Onega they are covered with Devonian sandstones and limestones, yielding marble and sandstone for building; to the south of that lake the Carboniferous limestones and clays make their appearance. The whole is covered by vast beds of boulder-clay,—the bottom moraine of the great ice-sheet of the Glacial period. The entire region bears traces of glaciation, either in the shape of scratching and elongated grooves on the rocks, or of eskers (*åsar*, *selgas*) running parallel to the glacial striation. Numberless lakes, more than 2000 being already laid down on the maps, still occupy the depressions of the surface, while a great many more have left evidence of their past existence in the shape of extensive marshes. Lake Onega covers 3765 square miles and reaches a depth of 125 fathoms. Lakes Seg, Vyg, Lache, and Vodlo cover from 140 to 480 square miles each, and their crustacean fauna shows a former connexion with the Arctic Ocean. The south-eastern part of Lake Ladoga belongs also to the government of Olonetz. Altogether, the area covered by lakes, marshes, and rivers reaches one-fifth of the whole surface. The rivers belong to the Baltic and White Sea basins. To the former system belong Lakes Ladoga and Onega, which are connected by the Svir and receive numerous streams; of these the Vytegra, which communicates with the Mariinsk canal-system, and the Oyat, an affluent of Lake Ladoga, are important for navigation. No less than 4,000,000 cwts. of timber, fire-wood, stone, metal, and flour are annually shipped on waters belonging to this government. The Onega river, which has its source in the south-eastern parts of the government and flows into the White Sea, is of minor importance. Seventy per cent. of the area of Olonetz is occupied by forests; those of the crown, maintained for shipbuilding purposes, cover more than 800,000 acres.

The climate is harsh and moist, the average yearly temperature at Petrozavodsk (61° 8′ N. lat.) being 33°·6 Fahr. (12°·0 in January, 57°·4 in July); the thermometer rarely falls under − 30° Fahr. The population, which numbered 321,250 in 1881 (296,400 in 1873), is made up of Great Russians and Finns; Karelians and Tchudis are estimated at about 52,000 each. The people mostly belong to the Greek Church, or are Nonconformists. Sparse though it is, the population is still too dense in certain places when the smallness of the area available for agriculture (only the summits of the *selgas*, or elongated ridges separated by marshes) is taken into account. The villages are mostly small, and in several parts of the government are still aggregated into federations of communes. Only 765,000 acres were under crops in 1877. Cattle and horse breeding, which are much interfered with by plague, are insignificant. The chief source of wealth is the timber-trade, next to which come fishing and hunting. Mushrooms and berries are exported to St Petersburg. There are also quarries and iron-mines, and some 1600 men find employment in saw-mills, tanneries, iron-works, distilleries, and flour-mills. More than one-fifth of the entire male population leave their homes every year in search of employment. The government is divided into seven districts, the chief towns of which are the capital Petrozavodsk (12,000 inhabitants), Kargopol, Olonetz, Povyenets, Vytegra, and Pudozh. Olonetz includes the "Olonetz Mining District," a territory belonging to the crown, which covers 432 square miles and extends partly into the Serdobol district of Finland. The iron-works were begun by Peter I. in 1701-14. There is a population of about 60,000, who were, until 1864, serfs to the crown.

Olonetz was colonized by Novgorod in the 11th century, and though it suffered much from Swedish invasion its towns soon became wealthy trading centres. Ivan III. annexed it to the principality of Moscow.

OLORON-SAINTE-MARIE, the chief town of an arrondissement in the department of Basses-Pyrénées, France, lies about 21 miles south-west of Pau, at the confluence of the mountain torrents (locally known as "gaves") Aspe and Ossau, which unite to form the Oloron, a tributary of the Pau. The united population of Oloron and of Sainte-Marie, on the opposite bank of the Aspe, is 7746. Oloron, curiously clustered on the summit and slopes of a steep hill, has remains of old ramparts and pleasant promenades with beautiful views. The only building of interest, the church of the Sainte-Croix, belongs mainly to the 11th century; it contains a large altar of gilded wood, constructed in the Spanish style of the 17th century. The church of Sainte-Marie, which formerly served as the cathedral of Oloron, is a medley of various styles from the 11th to the 15th century, and its sculptures are more antique than tasteful. The fairs and markets of Oloron for cattle, horses, wool, and hams are much frequented. It manufactures woollen goods, textile fabrics, and caps (bérets), and has also tanyards and flour-mills.

Oloron, formerly Iluro, an ancient episcopal town, was destroyed by the Saracens, and afterwards by the Normans, and was rebuilt in 1080 by the viscount of Béarn. At the Reformation the place became a centre of Catholic reaction. In the 17th century it carried on a considerable trade with Aragon, until the Spaniards, jealous of its prosperity, pillaged the establishments of the Oloron merchants at Saragossa in 1694,—a disaster from which it only slowly recovered. The bishopric was suppressed in 1790.

OLYBRIUS, Roman emperor from 11th July to 23d October 472, was a member of the Anician family and a native of Rome, where he lived until the sack of Genseric in 455. He then went to Constantinople, where in 464 he was made consul, and about the same time married Placidia, daughter of Valentinian III. In 472 he was sent to Italy by the emperor Zeno to assist Anthemius against Ricimer, but, having entered into negotiations with the latter, was himself proclaimed emperor, and, on the murder of his rival, ascended the throne unopposed. His reign was as uneventful as it was brief. He died from natural causes.

OLYMPIA. The purpose of this article is to give a short but clear summary for English readers of the principal results obtained by the German exploration of Olympia in 1875-81, and recorded in the five volumes of the *Ausgrabungen* published at Berlin. While the sketch is necessarily confined to salient features and essential points, two aims have been kept in view:—first, to omit nothing that is important to the general study of antiquity; secondly, to make the outlines, however slight, sufficiently precise and consecutive to serve as an introduction to a more special archæological study. Having enjoyed the advantage of seeing the excavations, under the courteous guidance of Dr. Treu (then at the head of the German archæological mission), at the close of the third campaign in June 1878, the writer is able to speak of the ground not from a book-knowledge alone. A few words must be premised on the geography and history of Olympia, so far as an acquaintance with the broader aspects of these must be presupposed in an intelligent survey of the topography.

On the western side of the Peloponnesus, the Alpheus, the chief river of the peninsula, issues from the central highlands of Arcadia. Increased by the tributary streams of the Ladon and the Erymanthus, it then flows, in a broad bed, between hills which gradually subside, until it enters on the sandy levels of the coast, and reaches the sea between two long lagoons. The district traversed by its lower course is that which was anciently called *Pisatis*, extending from the mouth of the Alpheus to the Erymanthus, between Elis on the north and Triphylia on the south. The alpine character of Arcadia has here entirely disappeared. There are few steep cliffs or rocks; the banks of the river are generally covered with alluvial earth; and rich vegetation prevails, with abundance of evergreen trees and bushes. Cornfields, vines, and currants are plentiful; even the sandy tracts, coated with a rich mud, prove fertile. Cattle-breeding prospers on the higher ground of Mount Pholoe; and the lagoons yield fish. The stay-at-home character of the inhabitants which the historian Polybius notices was a natural result of their environment. While the region was ill-suited to the secure development of a strong state, it was eminently favourable to a life of quiet industry, and was open on every side to peaceful intercourse with the neighbouring country. The ancient landing-place was at the mouth of the Alpheus,—about 3000 metres above the present mouth. The site of the modern town of Pyrgos—then much nearer the sea—may be that of the ancient Dyspontium. The only modern landing-place is at Catácolo, where a mole has been constructed by French engineers. It is visited by coasting steamers, being one of the export-stations of the currant-trade. In the valley of the Alpheus, a few miles east of the point at which it enters on the flat seaboard, there existed a primitive shrine of the Pelasgian Zeus. As in other places associated with his worship, the low range bounding the Alpheus on the north was called *Olympus*, while the name of *Ossa* was given to the hill-boundary of the valley on the south. When the worship of the Hellenic Zeus had been established on this spot, the place acquired the name of *Olympia*.

Olympia is on the right or north bank of the Alpheus (now the Ruphia), about 16 kilometres east in a straight line from the modern Pyrgos. The course of the river is here from east to west, and the average breadth of the valley is about 1000 metres. At this point a small stream, the ancient Cladeus, flows from the north into the Alpheus. The area known as Olympia is bounded on the west by the Cladeus, on the south by the Alpheus, on the north by the low heights which shut in the Alpheus valley, and on the east by the ancient race-courses. One group of these heights terminates in a conical hill, about 122 metres high, which is cut off from the rest by a deep cleft, and descends abruptly on Olympia. This hill is the famous *Cronion* (Κρόνιον), sacred to Cronus, the father of Zeus.

The natural situation of Olympia is, in one sense, of great beauty. When Lysias, in his *Olympiacus* (spoken here), calls it "the fairest spot of Greece," he was doubtless thinking also—or perhaps chiefly—of the masterpieces which art, in all its forms, had contributed to the embellishment of this national sanctuary. But even now the praise seems hardly excessive to a visitor who, looking eastward up the valley of Olympia, sees the snow-crowned chains of Erymanthus and Cyllene rising in the distance. The valley, at once spacious and definite, is a natural *temenos*. Nowhere could the Greek Zeus be more fitly honoured by the display of human gifts, physical or mental; nowhere could the divided communities of Hellas find a more convenient or attractive place of peaceful re-union.

The importance of Olympia in the history of Greece has, in fact, this twofold character: it is at once religious and political. The religious associations of the place date from the prehistoric age, when, before the states of Elis and Pisa had been founded, predecessors—perhaps ancestors—of the Hellenes worshipped the "heaven-father" in this valley. The political associations may be said to date from the time when the Achæans founded Pisa, and combined the Pelasgian worship of the god Zeus with a local cult of their own ancestor, the hero Pelops. It was then, and in honour of Pelops, that games were probably instituted for the first time at Olympia. The addition of Hera and of the mother of the gods to the specially honoured deities must have come early in the Hellenic period. Elis and

Pisa were at first associated, as equal states, in the control of the Olympian festival. Sixteen women, representing eight towns of Elis and eight of Pisatis, wove the festal peplus for the Olympian Hera. Olympia thus became the centre of an ἀμφικτυονία, or federal league under religious sanction, for the west coast of the Peloponnesus, as Delphi was for its neighbours in northern Greece. It suited the interests of Sparta to join this amphictyony; and, before the regular catalogue of Olympic victors begins in 776 B.C., Sparta had formed an alliance with Elis. Aristotle saw in the temple of Hera at Olympia a bronze disk, recording the traditional laws of the festival, on which the name of Lycurgus stood next to that of Iphitus, king of Elis. Whatever may have been the age of the disk itself, the relation which it indicates is well attested. Elis had from the first been stronger than Pisa. Elis and Sparta, making common cause, had no difficulty in excluding the Pisatans from their proper share in the management of the Olympian sanctuary. Pisa had, indeed, a brief moment of better fortune. The ascendency of Pheidon of Argos enabled him to reassert the old Achæan claim by celebrating the 28th Olympiad under the presidency of the Pisatans. This festival, from which the Eleans and Spartans were excluded, was afterwards struck out of the official register, as having no proper existence. At last, about 570 B.C., the destruction of Pisa by the combined forces of Sparta and Elis put an end to the long rivalry. Not only Pisatis, but also the district of Triphylia to the south of it, now became dependent on Elis. So far as the religious side of the festival was concerned, the Eleans had now an unquestioned supremacy. It was at Elis, in the gymnasium of the city, that candidates from all parts of Greece were tested, before they were admitted to the athletic competitions at Olympia. To have passed through the training (usually of ten months) at Elis was regarded as the most valuable preparation. Elean officials, who not only adjudged the prizes at Olympia, but decided who should be admitted to compete, marked the national aspect of their functions by assuming the title of *Hellanodicæ*.

Long before the overthrow of Pisa the list of contests at Olympia had been so enlarged and diversified as to invest the celebration with a Panhellenic character. Exercises of a Spartan type—testing endurance and strength with an especial view to war—had almost exclusively formed the earlier programme. But as early as the 25th Olympiad —*i.e.*, several years before the interference of Pheidon on behalf of Pisa—the four-horse chariot-race was added. This was an invitation to wealthy competitors from every part of the Hellenic world, and was also the recognition of a popular or spectacular element, as distinct from the skill which had a merely athletic or military interest. Horse-races were added later. For such contests the *hippodrome* was set apart. Meanwhile the list of contests on the old racecourse, the *stadion*, had been enlarged. Besides the foot-race in which the course was traversed once only, there were now the *diaulos* or double course, and the "long" foot-race (*dolichos*). Wrestling and boxing were combined in the *pancration*. Leaping, quoit-throwing, javelin-throwing, running, and wrestling were combined in the *pentathlon*.

After the conquest of Messenia Spartan ambition had turned towards Arcadia. The aim of the Spartans was nothing less than the subjugation of the entire Peloponnesus. But the decided check which the aggressors experienced in their new attempt produced a change of design. It became evident that a policy of forcible annexation could be pushed no further. Yet Sparta might at least aspire to the hegemony of the peninsula. The other states of the Peloponnesus, while remaining independent, might be virtually under Spartan control. And for the establishment of such a hegemony what agency could be more suitable than that of Olympia? In the Olympian amphictyony, Sparta, closely allied with Elis, already held a commanding position. The rising popularity of the festival was constantly tending to make Olympia the religious and social centre of Peloponnesian life—indeed, in some sense, of the Hellenic world. As the Eleans, therefore, were now the religious supervisors of Olympia, so the Spartans aimed at constituting themselves its political protectors. Their military strength—greatly superior at the time to that of any single Hellenic state—readily enabled them to do this in the most effectual manner. Spartan arms could enforce the sanction which the Olympian Zeus gave to the oaths of the amphictyones, whose federal bond was symbolized by common worship at his shrine. Spartan arms could punish any violation of that "sacred truce" which was indispensable if Hellenes from all cities were to have peaceable access to the Olympian festival. And in the eyes of all Dorians the assured dignity thus added to Olympia would be enhanced by the fact that the protectors were the Spartan Heraclidæ.

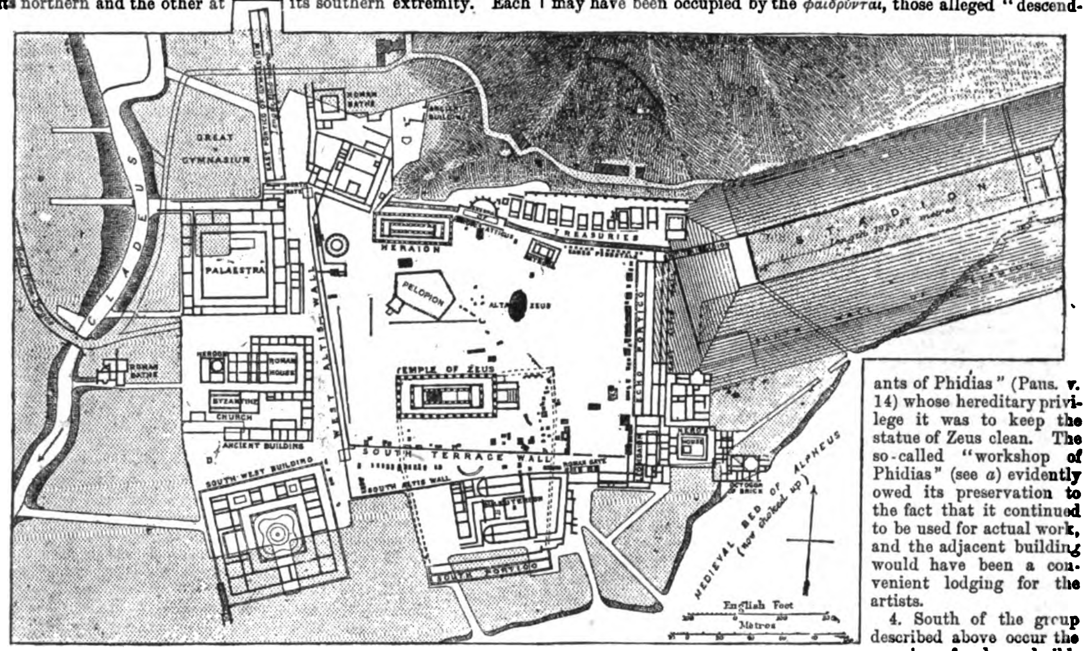
Thus, under the permanent guarantee of the strongest military power, and at the same time under auspices which, for a large part of the Greek world, were the most illustrious possible, Olympia entered on a new phase of brilliant and secure existence as a recognized Panhellenic institution. This phase may be considered as beginning after the destruction of Pisa, about 570 B.C. And so it continued to be to the last. While the details of the scene and of the festival were the subjects of endless modification or change, Olympia always remained a central expression of the Greek ideas that the body of man has a glory as well as his intellect and spirit, that body and mind should alike be disciplined, and that it is by the harmonious discipline of both that men best honour Zeus. The significance of Olympia was larger and higher than the political fortunes of the Greeks who met there, and it survived the overthrow of Greek independence. In the Macedonian and Roman ages the temples and contests of Olympia still interpreted the ideal at which free Greece had aimed. Philip of Macedon and Nero are, as we shall see, among those whose names have a record in the Altis. Such names are typical of long series of visitors who paid homage to Olympia. Even those who were least in sympathy with the old spirit of the festival could still feel that the place was representative and unique. According to Cedrenus, a Greek writer of the 11th century (*Σύνοψις Ἱστοριῶν*, i. 326), the Olympian festival ceased to be held after 393 A.D., the first year of the 293d Olympiad. The list of Olympian victors, which begins in 776 B.C. with Corœbus of Elis, closes with the name of an Armenian, Varastad, who is said to have belonged to the race of the Arsacidæ. In the 5th century the desolation of Olympia had set in. The chryselephantine statue of the Olympian Zeus, by Phidias, was carried to Constantinople, and perished in a great fire, 476 A.D. The Olympian temple of Zeus is said to have been destroyed, either by the Goths or by Christian zeal, in the reign of Theodosius II. (402-450 A.D.).

The German excavations at Olympia were begun in 1875. After six campaigns, of which the first five lasted from September to June, they were completed on the 20th of March 1881. The result of these six years' labours was, first, to strip off a thick covering of earth from the *Altis*, the consecrated precinct of the Olympian Zeus. This covering had been formed, during some twelve centuries, partly by clay swept down from the Cronion, partly by deposit from the overflowings of the Cladeus. The task presented to the German explorers may be judged by the fact that the coating of earth over the Altis had an average depth of no less than five metres.

Their work could not, however, be restricted to the Altis. It was necessary to dig beyond it, especially on the west, the south, and the east, where several ancient buildings existed, not included within the sacred precinct itself. The complexity of the task was further increased by the fact that in many places early Greek work had later Greek on top of it, or late Greek work had been overlaid with Roman. In a concise survey of the results obtained, it will be best to begin with the remains external to the precinct of Zeus.[1]

I.—Remains outside the Altis.

A. *West Side.*—The materials and the technical character of the wall bounding the Altis on the west are the same as those which belong to the western portion of the south Altis wall. Both belong to the earlier part of the Macedonian age, and to a time at which the Altis received its largest traceable extension to west, north-west, and south-west. In the west wall were two gates, one at its northern and the other at its southern extremity. Each gate was *προστυλος*, having before it on the west a colonnade consisting of a double row of four columns. A third and smaller gate, at about the middle point of the west wall, and nearly opposite the Pelopion in the Altis, was probably of a later age.



Plan of Olympia.

West of the west Altis wall, on the strip of ground between the Altis and the river Cladeus (of which the course is roughly parallel to the west Altis wall), the following buildings were traced. The order in which they are placed here is that in which they succeed each other from north to south.

1. Just outside the Altis at its north-west corner was a *Gymnasium*. A large open space, not regularly rectangular, was enclosed on two sides—possibly on three—by Doric colonnades. On the south it was bordered by a portico with a single row of columns in front; on the east by a longer portico, with a similar colonnade in front, and a second row, parallel to the first, traversing the interior of the portico itself. At the south-east corner of the gymnasium, in the angle between the south and the east portico, was a Corinthian doorway, which a double row of columns divided into three passages. Immediately to the east of this doorway was the gate giving access to the Altis at its north-west corner. The gymnasium was used for practice in the first four exercises of the pentathlon—leaping, quoit-throwing, javelin-throwing, running. The great length of the east portico is thus explained.

2. Immediately adjoining the gymnasium on the south was a *Palaestra*, the place of exercise for wrestlers and boxers. It was in the form of a square, of which each side was about 64 metres long, enclosing an inner building surrounded by a Doric colonnade. Facing this inner building on north, east, and west were rooms of different sizes, to which doors or colonnades gave access. The chief entrances to the palaestra were at south-west and south-east, separated by a long Ionic porch which extended along the south side.

3. Near the palaestra on the south a Byzantine church forms the central point in a complex group of remains. (*a*) The church itself occupies the site of an older brick building, which is perhaps a remnant of the "workshop of Phidias" seen by Pausanias. (*b*) North of the church is a square fountain-house, of the Hellenic age. (*c*) West of this is a small circular structure, enclosed by square walls. An altar found (*in situ*) on the south side of the circular enclosure shows by an inscription that this was the *Heroon*, where worship of the heroes was practised down to a late period. (*d*) East of the fountain-house stood a large building, of Roman age at latest, arranged round an inner hall with colonnades. Its particular destination is uncertain. (*e*) So, too, is that of a long and narrow building on the south of the Byzantine church. It may have been the priests' house mentioned by Pausanias, or it may have been occupied by the *φαιδρύνται*, those alleged "descendants of Phidias" (Paus. v. 14) whose hereditary privilege it was to keep the statue of Zeus clean. The so-called "workshop of Phidias" (see *a*) evidently owed its preservation to the fact that it continued to be used for actual work, and the adjacent building would have been a convenient lodging for the artists.

4. South of the group described above occur the remains of a large building, dating from the late Hellenic or early Macedonian age. It is an oblong, of which the north and south sides measure about 80 metres, the east and west about 73. Its orientation differs from that of all the other buildings above mentioned, being not from north to south, but from west-south-west to east-north-east; and there are signs that it was built before the west Altis wall. Externally it is an Ionic peripteros, enclosing suites of rooms, large and small, grouped round a small interior Doric peristyle. In Roman times it was altered in such a way as to distribute the rooms into (apparently) four quarters, each having an atrium with six or four columns. The most probable conjecture is that it was used as a lodging for distinguished visitors during the games, such as the heads of the special missions from the various Greek cities (*ἀρχιθέωροι*), or Roman officials. Traces existing within the exterior porticos on north, west, and east indicate much carriage traffic.

B. *South Side.*—Although the limits of the Altis on the south (*i.e.*, on the side towards the Alpheus) can be traced with approximate accuracy, the precise line of the south wall becomes doubtful after we have advanced a little more than one-third of the distance from the west to the east end of the south side. The middle and eastern portions of the south side were places at which architectural changes, large or small, were numerous down to the latest times, and where the older buildings met with scant mercy. The westernmost and best-defined part of the south-wall line is, as already stated, coeval with the west wall, belonging to the early Macedonian age.

1. The *Council Hall* (*βουλευτήριον*, Paus. v. 23) was just outside the Altis, nearly at the middle of its south wall. It comprised

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[1] Permission to use the accompanying plan of Olympia has kindly been given by the publisher, Herr Weidmann of Berlin.

two separate Doric buildings of identical form, viz., oblong, having a single row of columns dividing the length into two naves, and terminating to the east in a semicircular apse. The orientation of each was from west-south-west to east-north-east, one being south-south-east of the other. In the space between stood a small square building. In front, on the east, was a portico extending along the front of all three buildings; and east of this again a large trapeze-shaped vestibule or fore-hall, enclosed by a colonnade. This bouleuterion would have been available on all occasions when Olympia became the scene of conference or debate between the representatives of different states,—whether the subject was properly political, as concerning the amphictyonic treaties, or related more directly to the administration of the sanctuary and festival. Two smaller Hellenic buildings stood immediately west of the bouleuterion. The more northerly of the two opened on the Altis. Their purpose is uncertain.

2. Close to the bouleuterion on the south, and running parallel with it from south-west by west to north-east by east, was the *South Portico*, a late but handsome structure, closed on the north side, open on the south and at the east and west ends The external colonnade (on south, east, and west) was Doric; the interior row of columns Corinthian. It was used as a promenade, and as a place from which to view the festal processions as they passed towards the Altis.

3. East of the bouleuterion was a gateway of Roman age, with triple entrance, the central being the widest, opening on the Altis from the south. North of this gateway, but at a somewhat greater depth, traces of a pavement were found in the Altis. This was manifestly the gateway by which the sacred processions entered the Altis in Roman times. The older processional route, however, probably struck the south boundary of the Altis at a point somewhat to the west of the Roman gate, proceeding past the front of the bouleuterion and the eastern end of the south portico.

C. *East Side.*—The line of the east wall, running due north and south, can be traced from the north-east corner of the Altis down about three-fifths of the east side, when it breaks off at the remains known as "Nero's house." These are the first which claim attention on the east side.

1. Pausanias mentions a building called the *Leonidaion*, erected by the Elean Leonidas "*outside* the Altis, and near the Processional Gate." This Leonidaion was the point from which he set out on many of his walks in the Altis. Its original form is traceable in Hellenic remains at the south-east angle of the Altis, which show that the Leonidaion—an oblong structure with colonnade on north, west, and south—stood *within* the Altis. But the Greek Leonidaion was afterwards absorbed into a Roman house which projected beyond the Altis on the east, the south part of the east Altis wall being destroyed to admit of this. A piece of leaden water-pipe found in the house bears NER. AVG. Only a Roman master could have dealt thus with the Altis, and with a building which, like the Leonidaion, stood within its sacred precinct. It cannot be doubted that the Roman house—from which three doors gave access to the Altis—was that occupied by Nero when he visited Olympia. Later Roman hands again enlarged and altered the building, which may perhaps have been used for the reception of Roman governors. But Pausanias, who speaks only of a Leonidaion, shows that the old Greek name was retained, even when the building of Nero's time had placed the new Leonidaion beyond the limits of the Altis.

2. Following northwards the line of the east wall, we reach at the north-east corner of the Altis the entrance to the *Stadion*, which extends east of the Altis in a direction from west-south-west to east-north-east. The apparently strange and inconvenient position of the Stadion relatively to the Altis was due simply to the necessity of obeying the conditions of the ground, here determined by the curve of the lower slopes which bound the valley on the north. The German explorers excavated the Stadion so far as was necessary for the ascertainment of all essential points. Weak walls had originally been built on west, east, and south, the north boundary being formed by the natural slope of the hill. The walls were afterwards thickened and raised. The space thus defined was a large oblong, about 214 metres in length by 32 in breadth. There were no artificial seats. It is computed that from 40,000 to 45,000 spectators could have found sitting-room, though it is hardly probable that such a number was ever reached. The exact length of the Stadion itself—which was primarily the course for the foot-race—was 192·27 metres,—an important result, as it determines the Olympian foot to be 0·3204 metre. In the Heraion at Olympia, it may be remarked, the unit adopted was not this Olympian foot, but an older one of 0·297 metre. The starting-point and the goal in the Stadion were marked by limestone thresholds. Provision for drainage was made by a channel running round the enclosure. The Stadion was used not only for foot-races but for boxing, wrestling, leaping, quoit-throwing, and javelin-throwing.

The entrance to the Stadion from the north-east corner of the Altis was a privileged one, reserved for the judges of the games, the competitors, and the heralds. Its form was that of a vaulted tunnel, 100 Olympian feet in length. Dating from about 350-300 B.C., it is one of the oldest examples of vaulted work in cut stone. To the west was a vestibule, from which the Altis was entered by a handsome gateway.

3. The *Hippodrome*, in which the chariot-races and horse-races were held, can no longer be accurately traced. The overflowings of the Alpheus have washed away all certain indications of its limits. But it is clear that it extended south and south-east of the Stadion, and roughly parallel with it, though stretching far beyond it to the east. From the state of the ground the German explorers inferred that the length of the hippodrome was 770 metres or 4 Olympic stadia.

D. *North Side.*—If the northern limit of the Altis, like the west, south, and east, had been traced by a boundary wall, this would have had the effect of excluding from the precinct a spot so sacred as the Cronion, the hill inseparably associated with the oldest worship of Zeus at Olympia. It seems therefore unlikely that any such northern boundary wall ever existed. But the line which such a boundary would have followed is partly represented by the remains of a wall running from east to west immediately north of the treasure-houses (see below), which it was designed to protect against the descent of earth from the Cronion just above. This was the wall along which, about 157 A.D., the main water-channel constructed by Herodes Atticus was carried.

Having now surveyed the chief remains external to the sacred precinct on west, south, east, and north, we proceed to notice those which have been traced within it.

II.—REMAINS WITHIN THE ALTIS.

The form of the Altis, as indicated by the existing traces, is not regularly rectangular. The length of the west side, where the line of direction is from south-south-east to north-north-west, is about 195 metres. The south side, running nearly due east and west, is about equally long, if measured from the end of the west wall to the point which the east wall would touch when produced due south in a straight line from the place at which it was demolished to make way for "Nero's house." The east side, measured to a point just behind the treasure-houses, is the shortest, about 180 metres. The north side is the longest. A line drawn eastward behind the treasure-houses, from the Prytaneion at the north-west angle, would give about 250 metres.

The remains or sites within the Altis may conveniently be classed in three main groups, viz.—(A) the chief centres of religious worship; (B) votive buildings; (C) buildings, &c., connected with the administration of Olympia or the reception of visitors.

A. *Chief Centres of Religious Worship.*—1. The earliest Hellenic phase of the sanctuary, when a pre-Hellenic worship of Zeus was combined with a cult of the hero Pelops, is recalled by the *Altar of Zeus*. This, the central object of the older temenos, stood a little east of the Pelopion, and after the Altis had been enlarged was still nearly at its centre. The basis was of elliptic form, the length of the lozenge being directed from south-south-west to north-north-east, in such a manner that the axis would pass through the Cronion. The upper structure imposed on this basis was in two tiers, and also, probably, lozenge-shaped. This was the famous "ash-altar" at which the Iamidæ, the hereditary gens of *μάντεις*, practised those rites of divination by fire (*μαντικὴ δι' ἐμπύρων*) in virtue of which more especially Olympia is saluted by Pindar as "mistress of truth" (*δέσποιν' ἀλαθείας*). The steps by which the priests mounted the altar seem to have been at north and south.

2. The *Pelopion*, to the west of the Altar of Zeus, was a small precinct in which, from the time when Pisa was founded by the Achæans, sacrifices were offered to the Achæan *ἥρως* Pelops. The traces agree with the account of Pausanias. Walls, inclined to each other at obtuse angles, enclosed a plot of ground having in the middle a low tumulus of elliptic form, about 35 metres from east to west by 20 from north to south. A Doric propylaion with three doors gave access on the south-west side.

The three temples of the Altis were those of Zeus, Hera, and the Mother of the gods. All were Doric. All, too, were completely surrounded by a colonnade, *i.e.*, were "peripteral."

3. The *Temple of Zeus*, south of the Pelopion, stood on a high substructure with three steps. The colonnades at the east and west side were of six columns each; those at the north and south sides (counting the corner columns again) of thirteen each. The cella had a prodomos on the east and an opisthodomos on the west. The cella itself was divided longitudinally (*i.e.*, from east to west) into three partitions by a double row of columns. The central partition, which was the widest, consisted of three sections. The west section was shut off; it contained the throne and image of the Olympian Zeus. The middle section, next to the east, contained a table and stelæ. Here, probably, the wreaths were presented to the victors. The third or easternmost section, which had side porticos, was open to the public. This temple was most richly adorned with statues and reliefs. On the east front Pæonius had represented in twenty-one colossal figures the moment before the contest between Œnomaus and Pelops. The west front exhibited the fight of the

Lapithæ and Centaurs, and was connected with the name of Alcamenes. The Twelve Labours of Heracles were depicted on the metopes of the prodomos and opisthodomos; and of these reliefs much the greater part was found,—enough to determine with certainty all the essential features of the composition. It was near this temple, at a point about 35 metres east-south-east from the south-east angle, that the explorers found the fragment of a flying goddess of victory—the Nice of Pæonius.

4. The *Temple of Hera* (Heraion), north of the Pelopion, was raised on two steps. It was originally built as a temple *in antis*, and afterwards converted into a peripteros, having colonnades of six columns each at east and west, and of sixteen each (counting the corner columns again) at north and south. It was smaller than the temple of Zeus, and, while resembling it in general plan, differed from it by its singular length relatively to its breadth. When Pausanias saw it, one of the two columns of the opisthodomos (at the west end of the cella) was of wood; and for a long period all the columns of this temple had probably been of the same material. A good deal of patch-work in the restoration of particular parts seems to have been done at various periods. The cella—divided, like that of Zeus, into three partitions by a double row of columns—had four "tongue-walls," or small screens, projecting at right angles from its north wall, and as many from the south wall. Five niches were thus formed on the north side and five on the south. In the third niche from the east, on the north side of the cella, was found one of the greatest of all the treasures which rewarded the German explorers,—the Hermes of Praxiteles (1878).

5. The *Temple of the Mother of the Gods* (Metroon) was again considerably smaller than the Heraion. It stood to the east of the latter, and had a different orientation, viz., not west to east, but west-north-west to east-south-east. It was raised on three steps, and had a peripteros of six columns (east and west) by eleven (north and south), having thus a slightly smaller length relatively to its breadth than either of the other two temples. Here also the cella had prodomos and opisthodomos. The adornment and painting of this temple had once been very rich and varied. There are indications that in Roman times it underwent a restoration, conducted, apparently, with little taste or skill.

B. *Votive Edifices.*—Under this head are placed buildings erected, either by states or by individuals, as offerings to the Olympian god.

1. The twelve *Treasure-houses* on the north side of the Altis, immediately under the Cronion, belong to this class. We have seen that on the north side the limit of the Altis does not seem to have been defined by a wall, as on the other three sides. Here, then, we cannot distinguish with the same precision between objects within or without the precinct. The row of treasure-houses is, however, so situated that they are most naturally regarded as standing *within* the Altis, with a single exception. This is the easternmost of the twelve, the treasure-house dedicated by the state of Gela, which projected on the east beyond the line of the east Altis wall. It was evidently the oldest of the series. Originally planned as a small Doric temple *in antis*, of which the longer sides were the north and south, it was afterwards adorned on the south side with a colonnade, having six columns in front. Doric cut stone-work, overlaid with coloured terra-cotta plates, occurred here, as in monuments found at Gela itself, at Selinus, and elsewhere in Sicily. The same general character—that of a Doric temple *in antis*, facing south—is traceable in all its younger neighbours on the west. In the cases of six of these the fragments are sufficient to aid a reconstruction. Two—viz., the 2d and 3d counting from the west—had been dismantled at an early date, and their site was traversed by a roadway winding upward towards the Cronion. This roadway seems to have been older at least than 157 A.D., since it caused a deflexion in the watercourse along the base of the Cronion constructed by Herodes Atticus. Pausanias, therefore, would not have seen treasure-houses Nos. 2 and 3. This explains the fact that, though we can trace twelve, he names only ten.

As the temples of ancient Greece partly served the purposes of banks, in which precious objects could be securely deposited, so the form of a small Doric chapel was a natural one for the "treasure-house" to assume. Each of these treasure-houses was erected by a Greek state, either as a thank-offering for Olympian victories gained by its citizens, or as a general mark of homage to the Olympian Zeus. The treasure-houses were designed to contain the various ἀναθήματα or dedicated gifts (such as gold and silver plate, &c.), in which the wealth of the sanctuary partly consisted. The temple inventories recently discovered at Delos illustrate the great quantity of such possessions which were apt to accumulate at a shrine of Panhellenic celebrity. Taken in order from the west, the treasure-houses were founded by the following states:—1, Sicyon; 2, 3, unknown; 4, Syracuse (referred by Pausanias to Carthage); 5, Epidamnus; 6, Byzantium; 7, Sybaris; 8, Cyrene; 9, Selinus; 10, Metapontum; 11, Megara; 12, Gela. It is interesting to remark how this list represents the Greek colonies, from Libya to Sicily, from the Euxine to the Adriatic. Greece proper, on the other hand, is represented only by Megara and Sicyon. The dates of the foundations cannot be fixed.

2. The *Philippeion* stood near the north-west corner of the Altis, a short space west-south-west of the Heraion. It was dedicated by Philip of Macedon, after his victory at Chæronea (338 B.C.). As a thank-offering for the overthrow of Greek freedom, it might seem strangely placed in the Olympian Altis. But it is, in fact, only another illustration of the manner in which Philip's position and power enabled him to place a decent disguise on the real nature of the change. Without risking any revolt of Hellenic feeling, the new "captain-general" of Greece could erect a monument of his triumph in the very heart of the Panhellenic sanctuary. The building consisted of a circular Ionic colonnade (of eighteen columns), about 15 metres in diameter, raised on three steps, and enclosing a small circular cella, probably adorned with fourteen Corinthian half-columns.

3. The *Exedra of Herodes Atticus* stood at the north limit of the Altis, close to the north-east angle of the Heraion, and immediately west of the westernmost treasure-house (that of Sicyon). It consisted of a half-dome of brick, 16·6 metres in diameter, with south-south-west aspect. Under the half-dome were placed twenty-one marble statues, representing the family of Antoninus Pius, of Marcus Aurelius, and of the founder, Herodes Atticus. In front of the half-dome on the south, and extending slightly beyond it, was a basin of water for drinking, 22 metres long. The ends of the basin at north-north-west and south-south-east were adorned by very small open temples, each with a circular colonnade of eight pillars. A marble bull, in front of the basin, bore an inscription saying that Herodes dedicates the whole to Zeus, in the name of his wife, Annia Regilla. The exedra must have been seen by Pausanias, but he does not mention it.

C. It remains to notice those features of the Altis which were connected with the management of the sanctuary or with the accommodation of its guests.

1. Olympia, besides its religious character, originally possessed also a political character, as the centre of an amphictyony. It was, in fact, a sacred πόλις. We have seen that it had a bouleuterion for purposes of public debate or conference. So also it was needful that, like a Greek city, it should have a public hearth or prytaneion, where fire should always burn on the altar of the Olympian Hestia, and where the controllers of Olympia should exercise public hospitality. The *Prytaneion* was at the north-west corner of the Altis, in such a position that its south-east angle was close to the north-west angle of the Heraion. It was apparently a square building, of which each side measured 100 Olympian feet with a south-west aspect. It contained a chapel of Hestia at the front or south-west side, before which a portico was afterwards built. The dining-hall was at the back (north-east), the kitchen on the north-west side. On the same side with the kitchen, and also on the opposite side (south-east), there were some smaller rooms.

2. The *Porch of Echo*, also called the "Painted Porch" (στοὰ ποικίλη), extended to a length of 96 metres along the east Altis wall. Raised on three steps, and formed by a single Doric colonnade, open towards the Altis, it afforded a place from which spectators could conveniently view the passage of processions and the sacrifices at the great altar of Zeus.

3. Before the Porch of Echo, and east of the Altar of Zeus, was the *Proedria*, a structure 20 metres long, containing places of honour for officials and visitors of distinction. A flight of steps, curved inwards in a semicircle, gave access from the west. At either end of the Proedria (north and south) stood a colossal Ionic column. These columns, as the inscriptions show, once supported statues of Ptolemy and Berenice.

4. The *Agora* was the name given to that part of the Altis which had the Porch of Echo and Proedria on the east, the Altar of Zeus on the west, the Metroon on the north, and the precinct of the Temple of Zeus on the south-west. In this part stood the altars of Zeus Agoraios and Artemis Agoraia.

5. The *Zanes* (Ζᾶνες) were brazen images of Zeus, the cost of making which was defrayed by the fines exacted from competitors who had infringed the rules of the contests at Olympia. These images stood at the northern side of the Agora, in a row, which extended from the north-east angle of the Metroon to the gate of the private entrance from the Altis into the stadion. Sixteen pedestals were here discovered *in situ*. A lesson of loyalty was thus impressed on aspirants to renown by the last objects which met their eyes as they passed from the sacred enclosure to the scene of their trial.

6. *Arrangements for Water-supply.*—A copious supply of water was required for the service of the altars and temples, for the private dwellings of priests and officials, for the use of the gymnasium, palæstra, &c., and for the thermæ which arose in Roman times. In the Hellenic age the water was derived wholly from the Cladeus and from the small lateral tributaries of its valley. A basin, to serve as a chief reservoir, was built at the north-west corner of the Altis; and a supplementary reservoir was afterwards constructed a little to the north-east of this, on the slope of the Cronion. A new source of supply was for the first time made available by Herodes Atticus, c. 157 A.D. At a short distance

east of Olympia, near the village of Miraka, small streams flow from comparatively high ground through the side-valleys which descend towards the right or northern bank of the Alpheus. From these side-valleys water was now conducted to Olympia, entering the Altis at its north-east corner by an arched canal which passed behind the treasure-houses to the reservoir at the back of the exedra. The large basin of drinking-water in front of the exedra was fed thence, and served to associate the name of Herodes with a benefit of the highest practical value. Olympia further possessed several fountains, enclosed by round or square walls, chiefly in connexion with the buildings outside the Altis. The drainage of the Altis followed two main lines. One, for the west part, passed from the south-west angle of the Heraion to the south portico outside the south Altis wall. The other, which served for the treasure-houses, passed in front of the Porch of Echo parallel with the line of the east Altis wall. The whole subject of the water-works of Olympia was exhaustively investigated by Herr Gräber, and has been explained by him in vol. v. of the *Excavations*, pp. 26 *sq.*

Such, in brief outline, are the more important results of the German exploration of Olympia, an enterprise alike honourable to the Government which undertook it and to the eminent men by whom it was conducted. The work of excavation was from the outset guided by scientific knowledge, and the results were at no point confused or obscured by rash and unsound theories. The general outcome of the undertaking is certainly greater than could have reasonably been anticipated at its commencement. In the Olympia seen by Pausanias there was, of course, very much of which not the slightest trace has been found,—such, for instance, as the temples of Eileithyia, of Aphrodite Urania, and of Demeter Chameune. In regard to particular works of art, many hopes of discovery have been disappointed, nor can "the survival of the fittest" be always acknowledged in the salvage from so many centuries of ruin. On the other hand, the German campaigns had their welcome surprises and their strokes of good fortune, such as the finding of the Hermes and the Nice. Above all, they have their reward in this, that the topography of Olympia is now thoroughly ascertained. We now know with certainty the exact position of the principal buildings, the plan of the Altis and its relation to its whole environment, and all the main local conditions of the festival. In reading an Olympian ode of Pindar, the modern student can now call up the scene with adequate fulness of detail. Precious as are the particular works of ancient art which have been discovered, and valuable as are the results of the study of art and architecture, the largest gain of all consists in the vivid and suggestive light thus shed on a great centre of Hellenic history and life. (R. C. J.)

OLYMPIAS, the ambitious and energetic wife of Philip II., king of Macedonia, and the mother of Alexander III., commonly called The Great, was daughter of Neoptolemus I., king of Epirus, who claimed to be descended from Pyrrhus, son of Achilles. Plutarch tells us that it was while being initiated in the Samothracian mysteries, in which she was an enthusiastic participant, that Philip, still very young, fell in love with her. The marriage took place in 359 B.C., shortly after his accession, and Alexander was born in 356. There was also a daughter, named Cleopatra. The fickleness of Philip and the vehement and jealous temper of Olympias led to a growing estrangement, which became complete when Philip married a second wife, Cleopatra, in 337. Alexander, who strongly sided with his mother, withdrew, along with her, into Epirus, whence they both returned in the following year, after the assassination of Philip, which Olympias is said to have countenanced. During the absence of Alexander, with whom she had regular correspondence on public as well as domestic affairs, she had great influence in Macedonia, and by her arrogance and ambition gave great trouble to Antipater,—so great, indeed, that on the death of her son (323) she found it prudent to withdraw into Epirus. Here she remained until 317, when, allying herself with Polysperchon, by whom her old enemy had been succeeded in 319, she took the field with an Epirote army; the opposing troops at once declared in her favour, and for a short period Olympias was mistress of Macedonia. Cassander, Antipater's son, speedily, however, returned from the Peloponnesus, and, after an obstinate siege, compelled the surrender of Pydna, where she had taken refuge. One of the terms of the capitulation had been that her life should be spared; but this did not protect her against trial for numerous and cruel executions (including that of Nicanor, Cassander's brother) of which she had been guilty during her short lease of power. Condemned without a hearing, she was put to death tumultuously by the friends of those whom she had slain, and Cassander is said to have denied her remains the rites of burial (316).

OLYMPUS, the name of many mountains in Greece and Asia Minor, and of the fabled home of the gods, and also a city name and a personal name.

I. Of the mountains bearing the name the most famous is the lofty ridge on the borders of Thessaly and Macedonia. The river Peneus, which drains Thessaly, finds its way to the sea through the great gorge of Tempe, which is close below the south-eastern end of Olympus and separates it from Mount Ossa. The highest peak of Olympus is over 9000 feet high; it is covered with snow for great part of the year. Olympus is a mountain of massive appearance, in many places rising in tremendous precipices broken by vast ravines, above which is the broad summit. The lower parts are densely wooded; the summit is naked rock. Homer calls the mountain *ἀγάννιφος*, *μακρός*, *πολυδειράς*; the epithets *νιφόεις*, *πολύδενδρος*, *frondosus*, and *opacus* are used by other poets. The modern name is Ἔλυμπο, a dialectic form of the ancient word.

The peak of Mount Lycæus in the south-west of Arcadia was called Olympus. East of Olympia, on the north bank of the Alpheus, was a hill bearing this name; beside Sellasia in Laconia another. The name was even commoner in Asia Minor: a lofty chain in Mysia (Keshish Dagh), a ridge east of Smyrna (Nif Dagh), other mountains in Lycia, in Galatia, in Cilicia, in Cyprus, &c., were all called Olympus.

II. A lofty peak, rising high above the clouds of the lower atmosphere into the clear ether, seemed to be the chosen seat of the deity. Homer distinguishes between Olympus, which is the mountain, and the heaven or ether; but later poets use the terms as practically equivalent. In the elaborate mythology of Greek literature Olympus was the common home of the multitude of gods. Each deity had his special haunts, but all had a residence at the court of Zeus on Olympus; here were held the assemblies and the common feasts of the gods.

III. There was a city in Lycia named Olympus; it was a bishopric in the Byzantine time.

IV. A semi-historical musician, named Olympus, was connected with the development of flute music about 700 B.C. It is probable that he introduced the double flute, and increased the number of holes in the instrument and the tones of which it was capable: on the right flute were three holes for the low notes, on the left four for the high notes. He also brought into use compositions for the flute without words (*κρούματα*). It is said that he was an elegiac poet, but this is apparently a misconception. It is difficult to say whether Olympus is an actual historical person, or whether he merely represents in an individualized form the influence which Phrygian music, used in the Phrygian religion, began to exert on the Ionian cities about 700 B.C. The growth of intercourse between Phrygia and Ionia at this time is certain (see PHRYGIA). In any case, the musical innovations associated with the name of Olympus were the beginning of a richer and more varied school of lyric poetry, as well as of music, in the Greek world.

On the musician see, besides the general works on Greek literature, Ritschl, "Olympos der Aulet," in *Opusc.*, i.; Flach, *Gesch. d. griech. Lyrik*, 1883; Westphal, *Metrik*, &c.

OLYNTHUS was an important city of Chalcidice (see vol. xv. p. 137), situated in a fertile plain at the head of the Toronaic gulf between the peninsulas of Sithonia and Pallene, at some little distance from the sea, and about 60 stadia from Potidæa. The district belonged originally to a Thracian people, the Bottiæi; and it is said that it was given over to the Greek colonists of Chalcidice at the Persian invasion. It fell under Athenian influence during the 5th century, but regained its freedom during the invasion of Brasidas (424 B.C.). It became the head of a great confederacy, and its power excited the jealousy of Sparta. A war broke out 383-379, and Olynthus was compelled to become a member of the Spartan confederacy. No long time afterwards the Athenians made themselves masters of several towns which had previously been under the influence of Olynthus, and then a new and more dangerous enemy appeared on the northern frontier. Philip of Macedon found the city his most powerful rival, and directed all his strength against it. The Athenians made an alliance with Olynthus, but did not give any active aid, though Demosthenes tried hard to induce them to oppose Philip before he grew too strong. The famous series of Olynthiac orations was delivered by him at this crisis. After a long siege the city was captured by treachery in 347 B.C.; it was razed to the ground, and the people sold as slaves.

OMAHA, the largest city in Nebraska, U.S., is situated on the west bank of the Missouri, 600 miles from its confluence with the Mississippi, in 41° 15′ 43″ N. lat. and 95° 56′ 47″ W. long. (time $1^h 16^m$ after that of Washington). The lower part, situated mainly on a terrace, is principally devoted to business; the upper part, on the bluffs, to the finer residences, parks, and churches. It was founded in 1854, and in 1855 it became the capital of Nebraska Territory, when its inhabitants numbered little over 100; Lincoln, however, is the capital of the State. The population (1883 in 1860, 16,083 in 1870) was 30,518 in 1880, and in 1883 had risen to 49,710, its present growth surpassing that of any former period. Omaha contains the most extensive smelting and refining works in the Union. The number of men employed is 300, and the production of metals in 1882 was—lead, 43,711,921 ℔; gold, 16,272 oz. fine; silver, 4,853,851 oz. fine; sulphate of copper, 152,041 ℔. Other manufactures amount to over $7,000,000 annually. The educational institutions include Creighton College, Brownell Hall for young ladies, a medical college, and a business college. The high school building, erected at a cost of $250,000, is one of the finest in the country. There are besides ten free schoolhouses, containing seventy-four schoolrooms. Among the public buildings are the post-office and court-house, an opera-house seating 1700 people, many hotels, and numerous churches. The streets are wide and cross at right angles, and the business portions are in process of being paved. The city is lighted by gas and the electric light. Street railways penetrate in all directions. Omaha is also an important railroad centre.

OMAN, or 'OMÁN. See ARABIA.

'OMAR. See MOHAMMEDANISM, vol. xvi. pp. 563, 574.

'OMAR KHAYYÁM. The great Persian mathematician, astronomer, freethinker, and epigrammatist, Ghiyáthuddín Abulfath 'Omar bin Ibráhím al-Khayyámí, who derived the epithet Khayyám (the tentmaker) most likely from his father's trade, was born in or close by Níshápúr, and is stated to have died there in 517 A.H. (1123 A.D.). This date is accepted by most Eastern and Western writers, but the renowned vizier of the Seljúk sultáns Alp Arslan and Maliksháh, Nizám-ulmulk of Tús, whose birth is fixed in 408 A.H. (1017 A.D.), expressly states in one of his writings that 'Omar was of the same age as himself, and attended with him the lectures of the imám Muwaffak in the college of Níshápúr. However that may be, there cannot be the slightest doubt that at an early age 'Omar entered into a close friendship both with Nizám-ulmulk and his schoolfellow Hasan ibn Sabbáh, who founded afterwards the terrible sect of the Isma'ílís or Assassins. The three friends pledged themselves by a solemn promise that he who should first gain an influential position in the world would lend a helping hand to the other two and promote their success in life. When Nizám-ulmulk was raised to the rank of vizier by Alp Arslan (1063-1073 A.D.) he remembered this covenant and bestowed upon Hasan ibn Sabbáh the dignity of a chamberlain, whilst offering a similar court office to 'Omar Khayyám. But the latter contented himself with an annual stipend which would enable him to devote all his time to his favourite studies of mathematics and astronomy, and he soon proved his gratitude for the liberality of his patron and friend by the publication of his standard work on algebra, written in Arabic. This and other treatises of a similar character—for instance, on the extraction of cube roots and on the explanation of difficult definitions in Euclid—raised him at once to the foremost rank among the mathematicians of that age, and induced Sultán Malikshâh to summon him in 467 A.H. (1074 A.D.) to institute astronomical observations on a larger scale, and to aid him in his great enterprise of a thorough reform of the calendar. A twofold fruit resulted from 'Omar's elaborate research in the sultan's observatory,—a revised edition of the Zíj or astronomical tables, and the introduction of the Ta'ríkh-i-Maliksh※hí or Jalálí, that is, the so-called Jalálian or Seljúk era, which commences in 471 A.H. (1079 A.D., 15th March).

Great, however, as 'Omar's scientific fame has always been throughout the East, it is nearly eclipsed by his still greater poetical renown, which he owes to his *rubá'ís* or quatrains, a collection of about 500 epigrams, unequalled by any of his predecessors or followers. The peculiar form of the rubá'í—viz., four lines, the first, second, and fourth of which have the same rhyme, while the third usually (but not always) remains rhymeless—was first successfully introduced into Persian literature as the exclusive vehicle for subtle thoughts on the various topics of Súfic mysticism by the sheikh Abú Sa'íd bin Abulkhair,[1] but 'Omar differs in its treatment considerably from Abú Sa'íd. Although some of his quatrains are purely mystic and pantheistic, most of them bear quite another stamp; they are the breviary of a radical freethinker, who protests in the most forcible manner both against the narrowness, bigotry, and uncompromising austerity of the orthodox ulemá and the eccentricity, hypocrisy, and wild ravings of advanced Súfís, whom he successfully combats with their own weapons, using the whole mystic terminology simply to ridicule mysticism itself. There is in this respect a great resemblance between him and Háfiz, but 'Omar is decidedly superior, not so much on account of his priority as for his more concise, more simple, and yet infinitely more energetic style. He has often been called the Voltaire of the East, and cried down as materialist and atheist. As far as purity of diction, fine wit, crushing satire against a debased and ignorant clergy, and a general sympathy with suffering humanity are concerned, 'Omar certainly reminds us of the great Frenchman; but there the comparison ceases. Voltaire never wrote anything equal to

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[1] Died Jan. 1049. Comp. Ethé's edition of his rubá'ís in *Sitzungsberichte der bayr. Akademie*, 1875, pp. 145 *sq.*, and 1878, pp. 38 *sq.*

'Omar's fascinating rhapsodies in praise of wine, love, and all earthly joys, to the fervent effusions of his heart so full of the most tender feelings and affections, and his passionate denunciations of a malevolent and inexorable fate which dooms to slow decay or sudden death and to eternal oblivion all that is great, good, and beautiful in this world. There is a touch of Byron, Swinburne, and even of Schopenhauer in many of his rubá'is, which clearly proves that the modern pessimist is by no means a novel creature in the realm of philosophic thought and poetical imagination.

The Leyden copy of 'Omar Khayyám's work on algebra was noticed as far back as 1742 by Gerald Meerman in the preface to his *Specimen calculi fluxionalis*; further notices of the same work by Sédillot appeared in the *Nouv. Jour. As.*, 1834, and in vol. xiii. of the *Notices et Extraits des MSS. de la Bibl. roy.* The complete text, together with a French translation (on the basis of the Leyden and Paris copies, the latter first discovered by M. Libri, see his *Histoire des sciences mathématiques en Italie*, i. 300), was edited by F. Woepcke, *L'algèbre d'Omar Alkhayyámí*, Paris, 1851. Articles on 'Omar's life and works are found in Reinaud's *Géographie d'Aboulféda*, pref., p. 101; *Notices et Extraits*, ix. 143 *sq.*; Garcin de Tassy, *Note sur les Rubá'iyát de 'Omar Khaiyám*, Paris, 1857; and Rieu, *Cat. Pers. MSS. in the Br. Mus.*, ii. p. 546. The quatrains have been edited at Calcutta, 1836, and Teheran, 1857 and 1862; text and French translation by J. B. Nicolas, Paris, 1867 (very incorrect and misleading); a portion of the same, rendered in English verse, by E. Fitzgerald, London, 1859, 1872, and 1879. A new English version was published in Trübner's "Oriental Series," 1882, by E. H. Whinfield, and the first critical edition of the text, with translation, by the same, 1883. (H. E.)

OMAYYADS. See Mohammedanism.

OMEN. See Augurs, Divination, and Magic.

OMSK, the chief town of the government of Akmolinsk and capital of western Siberia, stands at the junction of the Om with the Irtish, on the great highway of Siberia, 1795 miles east of Moscow. Distant as it is from the great line of steamboat communication leading to Tomsk, the true commercial capital of western Siberia, Omsk has a purely administrative importance; its "fortress," or old earthwork, is now almost entirely abandoned. The town, situated in a wide steppe, broken only by the gently-sloping hill occupied by the fort, is almost entirely of wood. It has a military school, a lyceum, several lower schools, and a small public library. A "West Siberian branch of the Russian Geographical Society," opened in 1877, issues valuable publications. Its industries (candlemaking, tanning, and the like) are insignificant; but the trade, chiefly in cattle, skins, and furs imported from the Kirghiz Steppe, and partly also in tea, is of some importance. The population, which is entirely Russian, numbers about 31,000, of whom about 5000 are military.

The "fort" of Omsk was erected in 1716 to protect the series of block-houses on the Russian frontier, and, as two lines of block-houses—that of the Ishim and that of the Irtish—met at this point, it became a military centre. In consequence of frequent incursions of the Kirghiz about the end of the last century, a stronger earthwork, with bastions and a stone gate, was erected on the right bank of the Om. From being a district town of the government of Tobolsk, Omsk became in 1839 the seat of the administration of western Siberia in anticipation of a further advance of the Russians towards the south. Since the conquest of Turkestan it has lost even this strategic importance.

ON, or Heliopolis. See Egypt, vol. vii. p. 769.

ONEGA, next to Ladoga the largest lake in Europe, having according to Strelbitskiy an area of 3763 square miles, is situated in the heart of the government of Olonetz in European Russia, and, discharging its waters by the Svir into Lake Ladoga, belongs to the system of the Neva. The lake basin lies north-west and south-east, the same direction which is common to the lakes of Finland and to the line of glacier-scoring observed in this region. A straight line drawn from the village of Lumbuzha at the head of Povyenets Bay on the north to Oshta in the south measures 145 miles, but a considerable portion of it lies across the Zaonezhe peninsula. The greatest width is 50 miles. Between the northern and southern divisions of the lake there is a considerable difference: while the latter has a comparatively regular outline, and contains hardly any islands, the former splits up into a number of inlets and is full of islands and submerged rocks. It is thus the northern division which brings the coast-line up to 860 miles and causes the navigation of the lake to be so dangerous that previous to 1874, when additional buoys and beacons were laid down, the loss of life from shipwreck was about eighty persons per annum. The north-western shore between Petrozavodsk and the mouth of the river Lumbuzha consists of dark clay slates generally in horizontal strata and broken by raised parallel bands of diorite. These bands extend far into the lake and are locally known as "hogs' backs." The eastern shore (as far as the mouth of the Andoma) is for the most part alluvial, with outcroppings of red granite and in one place (the mouth of the Pyalma) diorite and dolomite. To the south-east are sedimentary Devonian rocks, and the general level of the coast is broken by Mount Andoma and Cape Petropavlovskii (160 feet above the lake); to the south-west a quartzy sandstone (well known as a building and monumental stone in St Petersburg) forms a fairly bold rim. Onega lies 236 feet above the sea. Towards the centre of the southern section a considerable area is upwards of 165 feet deep, and at one place a depth of 738 feet has been reached. The most important affluents, the Vodla, the Andoma, and the Vuiterga, come from the east. The Kumsa, a northern tributary, is sometimes represented in maps as if it connected the lake with Lake Seg, but the latter drains to the White Sea, and proposals to restore by means of a canal the communication which formerly existed here between the Arctic and Baltic basins have not yet been carried out. Lake Onega remains free from ice for 209 days in the year (middle of May to second week of December). The water is at its lowest level in the beginning of March; by June it has risen 2 feet. A considerable population is scattered along the shores of the lake, mainly occupied in the timber trade, fisheries, and mining industries. Salmon, palya (a kind of trout), burbot, pike, perchpike, and perch are among the fish caught in the lake. Steamboats were introduced in 1832.

It is to be noted that the river Onega, which after a course of about 260 miles reaches the Gulf of Onega, an inlet of the White Sea, has no connexion with Lake Onega. At the mouth of this river (on the right bank) stands the district town and port of Onega (2275), which dates from settlements made by the people of Novgorod in the 15th century, and known in history as the Ustenskaya or Ustyanskaya volost. It has a cathedral (St Michael and the Holy Trinity), erected in 1796.

ONEIDA COMMUNITY, in Madison co., New York, is a society which has attracted wide interest on account of its pecuniary success and its peculiar religious and social principles. Its founder, organizer, and controlling mind was John H. Noyes, who in 1834, while a student and licentiate of the theological seminary of Yale College, was led by his study of the New Testament to believe that the gospel of Christ, when fully accepted, secures present salvation from sin, and that the second coming of Christ, instead of being a future event, took place, according to promise, within a single generation of His first coming. Other religious doctrines at variance with popular theology were developed by Mr Noyes, such as that God is a dual being, Father and Son; that God is in no sense responsible for the existence of evil, but that the author of evil, as the author of good, was uncreated; that, the second coming of Christ being past, we are now living in a new dispensation of grace; that personal spiritual communication with Christ and His risen church is possible, and when perfected secures salvation from all evil, including disease and death itself.

These doctrines found their practical expression in a social system of pure communism. In the Oneida Community, founded in 1848, "not one said that aught of the things which he possessed was his own, but they had all things in common." The Community was a large family or brotherhood, numbering at one time over three hundred members, the common bond being paramount. The children were regarded as belonging primarily to the Community; and it was a favourite theory, which they made some attempts to realize, that children should be begotten and reared only under the best conditions. So far as their experiments in this direction extended, the results, they claimed, justified their theories, and they adduced in confirmation the testimony of critical observers like Professor Goldwin Smith, who wrote after a visit to the Community as follows:—

> "Undeniably, they are a fine, healthy-looking, merry set of children. They are reared under conditions of exceptional advantage, which could not fail to secure health to the offspring of any but positively diseased parents. The nurseries, with everything about them, are beautiful. Large playrooms are provided for exercise in winter. The nurses are not hirelings, but members of the Community who voluntarily undertake the office. Every precaution is taken against the danger of infection. A simple and wholesome dietary is enforced, and no mother or grandmother is permitted to ruin digestion and temper by administering first a poison from the confectioner's and then another poison from the druggist's."

But, while the Oneida Communists extended the pentecostal principle to all social relations, they yet maintained strict order among themselves. The thousands of visitors who annually inspected their dwellings and factories, and admired their lawns and gardens, discovered none of the usual signs of lax social morality. Credit for this is unquestionably due in part to the strong personal influence of Mr Noyes, but credit is also due to the members for voluntarily subjecting themselves to a system of self-control in the intercourse of the sexes called "male continence," and to "mutual criticism," which last was in fact exalted into their principal means of government. The system is one of plain truth-telling, and was termed "mutual" because it was expected that all, or nearly all, would alternate as critic and subject. Sometimes persons were criticized by a standing committee selected for the purpose by the Community, sometimes by committees of their own selection, sometimes by the whole Community. The critics were expected in all cases to speak the truth without fear or favour, that the subject might see himself, whatever his faults or virtues, as others saw him.

Radical as its theories and practices were, the Oneida Community was able to conduct its experiment with much success for thirty years. About that time public opinion, aroused by the clergy of the surrounding region, demanded that its social practices should be abandoned; and this was accordingly done in 1879, under the counsel of its founder and president, Mr Noyes, who had many times previously expressed his willingness to conform to the wishes of the public respecting the practical assertion of his social principles. This important change led to other changes in the society, including the introduction of marriage and family life; and in 1880 communism of property gave place to joint-stock, and the Community was legally incorporated as the Oneida Community, Limited. Each member now has a separate individual interest represented by shares of stock, in place of the undivided interest he formerly had in the common property. These changes were so wisely managed that the complex manufacturing and commercial businesses of the society were not seriously disturbed. In the division of the property of the Community, prior to its reorganization into a joint-stock company, a guarantee of support was first offered to all elderly and infirm persons in lieu of stock; second'y, a guarantee was pledged for the support and education of the children of the Community till sixteen years of age; thirdly, labour in the new company was guaranteed to all members of the old society; fourthly, some co-operative features were preserved, such as common dwellings and lawns, a common laundry, library, reading-room, &c.

Although the Oneida Community was started with very limited capital (the inventoried valuation of its property in 1857 being only $67,000), and hard work and poor fare were the lot of its members for many years, yet industry and business integrity brought their usual rewards, and upon the reorganization the members were able to divide $600,000. The last annual report of the Oneida Community, Limited, filed with the secretary of state at Albany, New York, shows that its assets, 1st January 1884, were $785,656,—a sum covering, not only its capital stock of $600,000, but a surplus fund of $24,050, and all liabilities against the company.

The Oneida Community, Limited, owns water-powers and factories at Wallingford, Connecticut, and Niagara Falls, New York, as well as at Community, New York; but its business is principally carried on at the two places last named. At Wallingford there existed, previous to the reorganization, a branch community, varying from thirty to sixty members, and having a common interest in the parent society,—both men and means being transferred from one society to the other as occasion required.

The Oneida Community has been often described by writers not connected with the society, the most noteworthy being Colonel T. W. Higginson, Professor Goldwin Smith, Charles Nordhoff in *Communistic Societies of the United States*, and William H. Dixon in *New America*. The Community also published many pamphlets and larger works in exposition of its principles and social life, and a newspaper during its entire career of thirty years. These may be consulted in several of the public libraries of the United States, and also in the British Museum, which has a complete set of the publications of the Oneida Community. The following list includes the more important books and pamphlets:—*History of American Socialisms*, by John H. Noyes, 1870; *Berean*, *Home-Talks*, *Salvation from Sin*, *Male Continence*, *Scientific Propagation*, *Dixon and his Copyists*, all by the same author; *Report on the Health of the Children of the Oneida Community*, by Dr T. R. Noyes; *Foot-Notes*, by Alfred Barron; *Mutual Criticism*, and *American Communities*, by William Alfred Hinds. (W. A. H.)

'ONEIZA, or 'ANEYSA, a town in the Nefúd or sand country of Al-Ḳasím and, after Riáḍ, the most considerable place in Nejd or highland Arabía, appears to have been founded about 500 years ago,[1] near the now ruined village of Jennaḥ (settled some centuries before by colonists of the Baní Khálid). These new places were in the circuit of the old Baní Tamím towns destroyed by the sword of Khálid b. Walíd, whose sites are now named Al-'Eyaría (Manzil 'Eyas) and Al-Owshazía. Colonists of the Ḳaisite stock of Sbeya Arabs were the first builders of 'Oneiza, and the emirs of the township are still of this blood. After them came in colonists of the Tamím, who now form the chief element in the population. The old faction warfare between the villages Jennaḥ and 'Oneiza was incessant, and the Baní Khálid had the greatest name in Nejd till the rise of the Wahhábite power. Jennaḥ then made alliance with the Montefiḳ Arabs in the north; 'Oneiza sided with the Wahhábites, and, these soon overrunning all, a part of the Jennaḥ villagers abandoned their country, and went to live in Mesopotamia, and the rest came in to inhabit 'Oneiza. The site of their old village is now in the orchards of 'Oneiza, enclosed by the common town-wall.

'Oneiza is built upon an old *seil* (freshet) strand (2600 feet above sea-level), and has been sometimes damaged by floods; the houses are of clay; the population, greatly increased, as Mr Doughty was told, in the fifteen years preceding his visit, was computed by him at nearly 7000. The site is near the great Wádi al-Romma (comp. Yáḳút,

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[1] The name belonged to the site before there was a town (see Bekri and Yáḳút), and the same place is probably meant by the dual 'Oneizatein in 'Antara's *Mo'allaḳa*.

iii. 738), and beyond the wádi, at 11 miles' distance, is the other great township of Middle Nejd, Boreida less than 'Oneiza, with a population probably of 5000.

The people of these and the neighbouring towns, as Al-Russ,[1] are in great part caravaners and merchants; they are the Lombards of Arabia, and are called in the Mecca country "the easterlings," and in the Syrian and Mesopotamian border-lands the 'Azeil. These world-wandering men are commonly of easy, liberal mind in doctrines of religion, whilst the large half of their home-dwelling fellow-citizens are sour Wahhábites. In these upper parts of the peninsula we see yet some remains of the ancient Arabian civilization. Here is found the art, elsewhere lost, of stone-cutting and well-building; and at 'Oneiza are goldsmiths whose work is among the best seen in the bazaars of Mecca. 'Oneiza has an appearance of commercial prosperity, but the poor farmers are much indebted to the money-lenders. The townsmen are among the greatest coffee-drinkers in Arabia. The horse-dealers of 'Oneiza procure young horses from the nomads round the town, even as far as Yemen, and ship these (known in India as "'Oneiza horses") at Koweyt for Bombay.

When Ibráhím Pasha marched to Nejd against the Wahhábite power this town was held by a resident for Ibn Sa'úd. Ibráhím shelled the clay fortress, but allowed the governor to depart with arms and baggage. After the building of Al-Riád 'Oneiza fell again to the Wahhábites. Jellowwy, a brother of the Wahhábite prince Feysel ibn Sa'úd, was resident, but, bearing himself oppressively, he was expelled, as had been determined in a secret council of the sheikhs. This brought Ibn Sa'úd with all Nejd under arms, and the Shammar prince Ibn Rashíd, to recover the rebellious town. He encamped upon the borders of the Wádi al-Romma, and lay there till the second year (1853-54), but attempted nothing (since Arabs cannot be commanded or led to storm a clay town-wall even if, as in this case, it is no more than 18 inches thick), and then departed, making peace with the townsmen upon their own terms. A second war followed after eight years. Abdullah al-Azíz al-Mohammed, the natural prince of Boreida, worsted by the Wahhábite faction, fled to 'Oneiza; and a little later, when he was going to take refuge with the sherif of Mecca, the Wahhábites lay in wait for him in the desert and killed him. Word being carried to 'Oneiza, the townsmen sent out armed men, who overtook and fought with them because they had killed the guest of 'Oneiza, thus drawing a new conflict on the town. Mohammed, another brother of the prince Ibn Sa'úd, came against 'Oneiza, and all subject Arabia in arms with him; and to meet this multitude 'Oneiza had little more than 1000 men. The Wahhábites had cannon, but could not handle them; the 'Oneizians, in their walled township, followed their daily labours at leisure. The citizens made one sally in force, but after heavy fighting were driven back with a loss of 200 men. There were two slighter skirmishes in long months of warfare. At length the besiegers, impatient of the time vainly spent, drew homeward, and Ibn Sa'úd returned to Al-Riád.

ONKELOS. See TARGUM.

ONOMACRITUS was a seer, priest, and poet of Attica about 530-480 B.C. His importance lies in his connexion with the religious movements in Attica during the 6th century. He had great influence on the development of the Orphic religion and mysteries; and the works of Musæus, the legendary founder of Orphism in Attica, are said to have been reduced to order by him (see ORPHEUS). He was in high favour at the court of the Pisistratidæ till he was detected by Lasus of Hermione making an interpolation in an oracle of Musæus, and was banished by Hipparchus. When the Pisistratidæ were themselves expelled and were living in Persia, Onomacritus is said to have furnished them with oracles encouraging Xerxes to invade Greece and restore the tyrants in Athens. He is also said to have interpolated Homer, and has in modern times been considered by some critics to have remodelled the Homeric poems.

ONTARIO is the name given under the confederation of the provinces of British North America to what was previously known as Upper Canada (see CANADA). The river Ottawa, through a considerable part of its course, forms the eastern boundary separating it from the province of Quebec. Its southern and south-western boundaries are the Lakes Ontario, Erie, St Clair, Huron, and Superior, with the St Lawrence, Niagara, St Clair, Detroit, and St Mary rivers. The northern and western boundaries, which had remained without precise determination so long as the region beyond was the hunting-ground of the Hudson's Bay Company, were defined in 1878 by arbitrators named by the Dominion and provincial Governments. By this award the boundary line is traced from a point determined by a line produced due north from the head of Lake Temiscaming to James Bay, along the south shore of Hudson's Bay westerly to the mouth of the Albany river, and so by the river and lakes to the head of Lake Joseph, and by Lac Seul and the English river to a point of intersection with the meridian line drawn from the north-western angle of the Lake of the Woods on the United States boundary. The legislature of Ontario accepted this award as determining the limits, and defining the boundary line between the provinces of Ontario and Manitoba, but the Dominion Government withheld its assent, and the final decision is now referred to the privy council. The area of the province within the limits thus defined would be 197,000 square miles. Its area as given in the census returns of 1881 is 101,733 square miles.

Geology and Minerals.—The shores of Lakes Erie and Ontario belong to the great plain of Canada, underlaid by Silurian and Devonian limestone and shales, above which rest beds of clay and gravel. Its average breadth is about 70 miles, and, though technically a plain, it is not merely undulating, but is broken by shelving rocks and precipices. To the north of the province a spur from the Laurentian chain in Quebec forms an extensive hilly region, and runs southwards to the coasts of Lake Huron and the Georgian Bay. Within the province there is a great variety of mineral wealth yet only partially developed. Iron, of which, according to the census returns, the annual yield is about 92,000 tons, is found in large quantities to the north of Lake Ontario, between the Georgian Bay and the Ottawa river. Magnetic iron is obtained in various beds, red hematite in the Bruce copper-mines near Lake Huron, and bog iron in the sandy tracks which flank the Laurentian hills. Copper is found in the same region as iron, the Bruce mines yielding ore to the annual value of £50,000. Silver abounds on the shores of Lake Superior, especially in the neighbourhood of Thunder Bay,—Silver Islet, where the ore is dug 500 feet below Lake Superior, containing one of the richest veins in the world. Gold is obtained in the same region, but the yield is so uncertain as to discourage regular enterprise. There are petroleum wells of immense value in the western districts of the province, the annual yield being nearly 16,000,000 gallons of crude petroleum. Salt brine is drawn up from deep wells at Goderich and the neighbourhood, the annual yield being about 500,000 gallons. Mica is extensively worked. Marble equal to that of Carrara is quarried in several districts. The principal other minerals are galena, plumbago, antimony, arsenic, manganese, calc-spar, and gypsum.

Agriculture and Trade.—The oldest settled districts of the province on the shores of Lakes Ontario and Erie, and on the intervening peninsula of Niagara, are favoured in many respects by geographical position, soil, and climate. The fertile area stretching westward between Lake Erie and the Georgian Bay is often styled the "Garden of Canada." The settled portions include upwards of 9,000,000 acres, much of which has been long cleared and brought into a high state of cultivation. Thousands of acres are planted as orchards; and the apple crop is a

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[1] Near Al-Russ is Al-Ethella, the site, probably, of Járada, the ancient metropolis of Kasím.

profitable branch of farm produce. In the still earlier settled district of Niagara, which lies between the two great lakes, the extremes alike of summer heat and winter cold are tempered by those large bodies of water. There accordingly the peach, grape, and plum flourish; orchards of apple and pear trees cover large areas; and, as seen from Queenston heights, the landscape looks like a garden. The vine is indigenous, and grows luxuriantly in the woods, as do all the smaller fruits.

But the energy of more recent settlers has greatly extended cultivation. Bands of pioneers, lumber-men, and free-grant settlers have carried the axe and the plough into the Muskoka, Nipissing, and other northern districts; and those regions are now accessible by steamboat and railway. The rich mineral regions of Lake Superior are also filling up with settlers. The town of Prince Arthur's Landing, at the head of the lake, is now the terminus of the Canadian Pacific Railway, and already numbers fully 2000 inhabitants.

According to the census of 1881, 19,259,909 acres were in occupation, of which 11,294,109 were improved, 304,815 being in gardens and orchards, and 10,989,294 under cultivation in pasture or grain and root crops. Much of the land is well adapted for wheat, but in many places the crop has been grown too often. Barley, oats, and pease are common crops. Maize and tomatoes ripen well. Tobacco and sugar are profitable crops in some districts. The growth of flax is largely on the increase. As the soil in nearly every part of the province is admirably adapted for root crops, cattle are very largely kept, although there are no extensive grazing districts. The beef trade with England has become very extensive, and dairy-farming is largely prosecuted, especially the making of cheese, a large number of cheese factories being now established on the co-operative principle. Honey is an important source of revenue, about 1,200,000 ℔ being exported annually. There is a very large export of timber, including pines, oak, elm, hackmatack, birch, maple, walnut, and hickory. In the official returns of the exports of the different provinces some of the most valuable produce of Ontario is included in the shipments from the ports of Quebec. According to the trade and navigation tables for 1883, the total value of goods entered for consumption was $44,452,804, or £9,134,143, and of exports $32,890,019, or £6,758,242. The splendid natural water communications have been extensively supplemented by railways, of which there are about 4000 miles in operation. There are very extensive saw-mills at Ottawa. The manufacture of agricultural implements employs a large number of persons throughout the province, as does also that of machinery, sewing-machines, and edged tools. Among the principal other manufactures are woollen goods (especially tweeds), cottons, leather, paper, soap, and iron and hardware. According to the census returns the total capital invested in the various industries, not including agriculture but including cheese factories, was $80,950,847, the number of hands employed 118,308, and the total value of products $157,989,870.

Population.—The population in 1871 amounted to 1,620,851; in 1881 it had increased to 1,923,228. Of this, the population of twelve towns of upwards of 5000 inhabitants numbered in 1871 179,829. In 1881 the towns of a population exceeding 5000 had increased from twelve to nineteen, with inhabitants numbering 288,964, leaving the remaining population as occupants of the small towns, rural villages, and farms. At the end of 1883 the population was estimated at 1,935,130 (urban, 671,917; rural, 1,263,213).

Classified according to race, those of European origin were as follows in 1881:—

Irish	627,262	Swiss	2,882
English	535,835	Scandinavian	1,521
Scotch	378,536	Russians and Poles	787
German	188,394	Italians	687
French	102,748	Spanish and Portuguese	285
Dutch	22,163	Jews	254
Welsh	6,397		

In addition to those from other provinces, the United States, &c., there were 15,325 Indians and 12,097 Africans.

Classified according to religion, the principal denominations were in 1881 as follows:—

Methodists	591,503	Lutherans	37,901
Presbyterians	417,479	Congregationalists	16,340
Episcopalians	366,539	Disciples	16,051
Roman Catholics	320,839	Quakers	6,307
Baptists	106,680		

The capital of the province is Toronto (population in 1881, 86,415); next in point of wealth, population, and general local advantages is the city of Hamilton (35,961); Ottawa (27,412) is the capital of the Dominion; the other large centres of population are London (19,746), Kingston (14,091). Next to these are Guelph, St Catherine's (on the Welland Canal), Brantford, Belleville, St Thomas, Stratford, Chatham, Brockville, Peterborough, Port Hope, Woodstock, Galt, and Lindsay, with populations ranging from 9890 to 5080. Cobourg (4957) is the seat of Victoria College.

Education.—One of the most distinctive features of the province is its system of public instruction, to which special attention has been given from an early period. So early as 1797 lands were set apart for educational purposes; and there now exists a thoroughly efficient system of public schools, high schools and collegiate institutes, provincial college and university, under the administration of a minister of education as the head of this department. The management of all funds for general educational purposes, the provincial school inspectors, normal and model schools, &c., are under the direct charge of the educational department. Under its control the local government is vested in boards of school trustees elected by the ratepayers in rural districts or townships, villages, towns, counties, and cities, in accordance with a general system of municipal organization. Each local board determines the required rates to be levied for school purposes, purchases sites, builds schoolhouses, appoints teachers from among those duly qualified and holding Government certificates, and determines and pays their salaries. The councils of county municipalities have certain powers and duties conferred on them in reference to the townships, villages, and towns within each county. They also select duly qualified inspectors, appoint county boards for the examination of third-class teachers, and levy a rate equivalent to the amount of the legislative educational grant to be expended in the payment of one-half of the salaries of their teachers and school inspectors. Collegiate institutes and high schools (in which a higher English course is taught, along with classics, mathematics, and French and German, to pupils admitted from the public schools on an entrance examination) are under the management of special boards of trustees appointed by city or county councils, with the power of requiring the council to raise all funds requisite for the efficient maintenance of the schools. Provincial normal schools for training teachers are established at Toronto and Ottawa, with model schools attached to them; and each county town maintains a model school for training third-class teachers. The school-system is thus mainly dependent on county and local rates levied for the purpose by councils and school-boards elected by the people. This general system is modified in one respect. In any locality where Roman Catholics reside in sufficient numbers, they may require their share of the school funds and rates to be applied for the maintenance of separate schools, under their own special school-board; but their teachers must hold the same Government certificates as others. The system includes provision for enforcing attendance of all children of school age, and, at the option of the trustees, making education free of all charge. The report of the minister of education for 1882 shows that there were in all 104 collegiate institutes and high schools, 5013 public schools, and 193 Roman Catholic separate schools. The system thus thoroughly organized has become a model for the other provinces of the Dominion, with the exception of Quebec, where the Roman Catholic Church has the control of the public schools, and a separate school-system is allowed for the Protestant minority.

Upper Canada College, founded at Toronto on the model of the great public schools of England, was endowed with public lands, from which it now derives an annual income of $15,000 in addition to its fees. The University of Toronto and University College are endowed with lands from the proceeds of which an annual income of upwards of $67,000 is derived. The university prescribes the requirements in all examinations, appoints examiners, and confers degrees in the faculties of law, medicine, and arts. University College gives instruction in the departments of arts and science; but denominational and other colleges are admitted to affiliation, and their students can proceed to degrees in the university. University powers are also exercised by Victoria College, Cobourg, under the control of the Methodist Church; Queen's College, Kingston, under the control of the Presbyterian Church; and Trinity College, Toronto, and the Western University, London, both under the control of the Church of England.

Administration.—Like the other provinces of Canada, Ontario is under a lieutenant-governor, appointed for a term of four years by the governor-general in council; the executive council numbers 6 ministers responsible to the local legislature or house of assembly, which consists of 88 members. The province is represented by 24 senators in the Dominion Senate, and by 92 members in the House of Commons. In addition to the counties and representative towns there are four provisional districts:—Algoma, Muskoka, Parry Sound, and Manitoulin.

History.—Lakes Ontario and Nipissing were visited by Champlain in 1615, and Lake Superior by traders in 1660. Perrot took possession of the district round Lake Huron in 1671. La Salle founded Niagara in 1679, and in the same year the lakes were explored to Lake Michigan. A fort was built at Toronto in 1749. Forming originally part of French Canada, Ontario, then consisting of a few forts and trading ports, was conceded with that province to Britain. Having previously formed part of the province of Quebec, it was, under the name of Upper Canada, formed in 1791 into a distinct province, the first parliament being held at Niagara, 17th November 1792. During the war with the United States in 1812-15 the province was the seat of several conflicts. Political dissent prevailed in it from 1820 until, in 1837, it culminated in rebellion. In 1867 Upper Canada, nnder the name of Ontario. was made the chief province of the Dominiou of Canada. (D. W.)

ONTENIENTE, an old town of Spain, in the province of Valencia, stands on an elevation on the right bank of the Clariano or Onteniente, a sub-tributary of the Jucar, about 11 miles south-south-west from Játiva. It has three churches, a good town-hall, and a palace of the dukes of Almodovar. Linen and woollen cloth, paper, brandy, and earthenware are manufactured; and there is also some trade in the cereals, wine, and oil produced in the neighbouring district, which is very fertile. In 1877 the ayuntamiento had a population of 11,727.

ONTOLOGY. See Metaphysic.

ONYX, a variety of agate consisting of layers of variegated chalcedony, arranged in parallel bands. The colours of the successive strata vary in different stones, but in the typical onyx they are black and white. If one of the layers consists of the brown chalcedony known as "sard" or the red variety called "carnelian," the resulting stone is termed a "sardonyx." It was probably this kind of stone that originally suggested the name "onyx" (from ὄνυξ, a nail), since the contrast between its layers remotely resembles that between the flesh-coloured part of the finger-nail and the white *lunula* at its root. It was the practice of certain Greek writers to restrict the word ὄνυξ to the mineral in its natural condition, and to designate it, when worked into ornamental forms, by the diminutive ὀνύχιον. When an onyx presents a thin layer of whitish chalcedony spread over a black ground, the upper stratum often exhibits a bluish tinge, and collectors at the present day term such a stone a *nicolo*, evidently a corruption of the Italian diminutive *onicolo*, or "little onyx."

India has for ages yielded the finest onyxes, and hence jewellers are in the habit of applying the expression "Oriental onyx" to any stone distinguished by beauty of natural colour and by regularity of its layers. The true Indian stones are found as pebbles, associated with moss-agate, jasper, and other silicious minerals in river-gravels, the materials of which have been derived originally from the agate-nodules of trap-rocks, such as those which occur on an enormous scale in the Deccan. As far back as the first century the author of the *Periplus* of the Red Sea mentions the onyx among the products of Plythanæ, a locality which may probably be identified with Paithon on the Godavari, whence agates are obtained even at the present day. He further states that the onyxes were taken down to Barygaza, the modern Broach, where a great trade in agates is still carried on. It appears that the lapidaries of Broach and of Cambay are now supplied with raw stones chiefly from Ratanpur, in the territory of the rajah of Rajpipla, where the gravels are systematically worked for the sake of their agates, jasper, onyx, and other silicious stones. See Ball's *Economic Geology of India*, 1881, p. 503.

The principal European locality for onyx is the neighbourhood of Oberstein on the Nahe, a river which flows into the Rhine at Bingen. Near Idar, about two miles from Oberstein, is a trap-hill called the Galgenberg, which for centuries was largely worked by means of tunnels driven into the hillside, in order to extract the nodules of agate which are embedded in the melaphyre forming the rock. When these nodules are broken open they occasionally yield a banded chalcedony which serves admirably for onyxes. The quarries have, however, been abandoned for many years in consequence of the discovery of larger and finer nodules in Uruguay, principally among the gravels of the Tarquarie and the Rio Pardo. These agates are still sent over in large quantities to Oberstein, where the cutting and polishing of such silicious stones form almost the sole industry of the locality. Coming from South America, they are commonly known in trade as "Brazilian agates"; and it is from these agates that most of our onyx is now obtained.

It is but rarely that the South-American agates present in their natural condition sufficient diversity of colour to constitute a good onyx, but for many years it has been the practice of the German agate-workers to colour these stones artificially. By this means an agate of dull colour may be rapidly converted into a deep-tinted onyx, the successive layers becoming sharply defined and vividly coloured during the process of staining. How this dyeing is effected has been described in the article Agate, vol. i. p. 277.

The onyx is largely employed for ring-stones, brooches, beads, and other ornamental objects; but its chief use is as a material for *camei* and *intagli*. By taking advantage of the different tints of the strata in this stone, a skilful artist is enabled to produce effects of a very pleasing character. Among the finest examples of ancient stone-engraving which have descended to us are certain vessels in onyx, elaborately ornamented with cameo-work, such as the Cup of the Ptolemies, the Farnese Tazza, and the Mantuan or Brunswick Vase.

According to the Authorized Version of the Old Testament, the onyx formed the eleventh stone in the breast-plate of the high priest; but it is more probable that this stone (שֹׁהַם) is the beryl, and that the onyx is יָהֲלֹם, Exod. xxxix. 11 (E. V. diamond).

It is pointed out by the Rev. C. W. King that the earliest mention of the onyx as a precious stone is to be found in the inscriptions of the Parthenon, which date from the Peloponnesian War (431-404 B.C.), where a large engraved onyx is mentioned as an offering. It is to be specially noted that ancient writers applied the term ὄνυξ to two entirely different stones. While one of them was the true onyx of modern mineralogists, as described above, the other was merely a stalagmitic variety of carbonate of lime, a mineral much softer, less precious, and much more widely distributed than the chalcedonic onyx, yet resembling it in so far as it also presents a parallel-banded structure. This mineral is still known as "onyx-marble" (see MARBLE, vol. xv. p. 529).

OODEYPORE, or UDAIPUR. See vol. v. p. 768.

OPAH (*Lampris luna*), a pelagic fish of the family *Coryphænidæ* or Dolphins. It differs from the typical dolphins (*Coryphæna*) materially in the shape of its body and the structure of the ventral fins. Instead of being elongate, the body is compressed and deep (more so than in the bream), and destitute of distinct scales. A long dorsal fin, high, and pointed anteriorly, runs along nearly the whole length of the back; the caudal is strong and deeply cleft. The ventral fins are broad paddles pointed at the extremity, and composed of numerous rays. This latter character is quite exceptional in the order of spiny-rayed fishes, but finds its explanation in the habits of the fish. A pelagic fish with so deep a body and so short a tail as those of the opah requires additional propelling power to be able to find or pursue its prey; and therefore to the ordinary function of the ventral fins, which in other fishes is confined to balancing the body in the water, has been superadded that of locomotion.

In its gorgeous colours the opah surpasses even the dolphins, all the fins being of a bright scarlet. It is only occasionally found near the shore; its real home is the Atlantic, especially near Madeira and the Azores, but many captures are recorded from Great Britain, Ireland, and Scandinavia; it strays as far north as Iceland and Newfoundland, and probably southwards to the latitudes of the coast of Guinea. It is rare in the Mediterranean. The name opah, which is now generally used, is derived from the statement of a native of the coast of Guinea who happened to be in England when the first specimen was exhibited (1750), and who thought he recognized in it a fish well known by that name in his native country. From its habit of coming to the surface in calm weather, showing its high dorsal fin above the water, it has also received the name of "sun-fish," which it shares with *Orthagoriscus* and the basking shark. It grows to a length of 4 to 5 feet and a weight exceeding 100 lb, and is highly esteemed on account of the excellent flavour of its flesh.

OPAL, a natural form of hydrated silica, occurring in a "porodine" condition, *i.e.*, it has apparently hardened from a gelatinous state. During consolidation it has suffered contraction unequally in different directions; and thus, though amorphous, it behaves in polarized light like a doubly-refracting body.

The beautiful variety known as *noble* or *precious opal* is remarkable for its play of iridescent colours. In the "harlequin opal" these rainbow-tints are flashed forth from small flakes, forming a kind of polychromatic mosaic, while in other kinds of opal the colours are disposed in broad bands or in irregular patches of comparatively large area. The tints vary with the angle at which the light is incident, and with the relative position of the stone and the observer, so that by moving the opal a brilliant succession of flashes of fire may be obtained. Careful examination of a precious opal shows that these flashes are reflected from surfaces of irregular dimensions, situated at different depths in the translucent stone, and intersecting at various angles. The colours are not due to the presence of any material pigment in the mineral, but are optical effects due to certain structural peculiarities.

According to Sir David Brewster the colours of the opal may be referred to the presence of multitudes of microscopic pores arranged in parallel lines, the differences of tint arising from differences in the magnitude of these cavities. M. Descloizeaux, a very high authority on the optical properties of minerals, has also connected the iridescence of the opal with a regular system of internal cavities, but at the same time seems disposed to think that the colours bear some relation to the presence of a small quantity of organic matter in the mineral. Mr Crookes refers the colours to delicate striæ or minute fissures lying in different planes within the opal. The whole subject has been exhaustively studied by H. Behrens, who explains the colour as due not to reflexion from the walls of cavities but to the interposition of very thin lamellæ possessing a different index of refraction from that of the matrix in which they are embedded. He has detected in the opal a variety of microscopic enclosures, including flecks of hydrophane and delicate laminæ of ferric oxide. On the whole, therefore, it seems likely that the iridescence of the opal is simply a case of the well-known colours of thin plates. A ray of light is reflected from the anterior surface of an attenuated film; another ray, having traversed the lamina, is reflected from the posterior surface; and the meeting of these rays differing in phase gives rise to interference phenomena.

The noble opal, in consequence of its brilliant iridescence, is valued as an ornamental stone. It is displayed to best advantage when cut *en cabochon* or with a convex surface. Pliny relates that the rich Roman senator Nonius was proscribed by Mark Antony for the sake of a magnificent *opalus* which he possessed, a stone as large as a hazel nut, and valued at 20,000 sesterces.

The precious opal occurs in veins in trachytic rocks, chiefly in Hungary. The best-known localities are Czerwenitza and Kaschau, but the most brilliantly-coloured stones are said to come from Kremnitz and Dubnik. It is found also in Honduras, principally near Gracias a Dios, where it occurs in like manner, forming veins in volcanic rocks. The American opal is generally less milky and less fiery than the Hungarian. Of late years some very brilliant opal has been sent into the market from Queensland. This is found as thin films spread over the walls of fissures in ironstone nodules, occurring in the neighbourhood of the Baracorra river. It is generally too thin to be cut *en cabochon*, but is largely used for *camei*, the iridescent layers showing to great advantage against the ironstone matrix, which when polished assumes a dark-brown colour. The so-called "black opals," which have lately become popular, consist of this matrix penetrated in all directions by veins and spots of opal, forming a mixture sometimes known as "root of opal." Certain stones sold as black opals have evidently been modified in colour by staining or by heat.

See Brewster, "On the Cause of the Colours in Precious Opal," *Edin. New Phil. Journ.*, xxxviii., 1845, p. 385; Descloizeaux, *Manuel de Minéralogie*, vol. i., 1862, p. 22; Crookes, "On the Spectral Phenomena of Opals," *Quart. Journ. Science*, vi., 1869, p. 481; and especially Behrens, "Mikroskopische Untersuchungen über die Opale," *Sitzungsber. d. k. k. Akad. d. Wissenschaften, Wien: math.-naturwiss. Classe*, lxvi., 1871, p. 519. For a mineralogical description of the varieties of opal see MINERALOGY, vol. xvi. p. 390.

OPENSHAW, a township of Lancashire, England, is situated on the Manchester and Stockport Canal, about 3½ miles east from the Manchester exchange. The church of St Barnabas dates from 1838-39, and that of St Clement from 1871. The mechanics' institute (1872) comprises assembly rooms with a reading-room and library. The town possesses railway-carriage and locomotive works, engineering shops, iron-foundries, cotton-mills, dyeworks, chemical-works, and breweries. The area of the township is 579 acres; population in 1871, 11,108; in 1881, 16,153.

OPERA. See DRAMA, vol. vii. p. 437, and MUSIC.

OPHICLEIDE is a brass musical instrument with keys. It belongs to that class of instruments in which the column of air is set in vibration by a trembling of the lips applied to the edge of a hemispherical cup at the extremity of the tube, called the "embouchure." The lips vibrate from the action of the breath and play the part of reeds; the degree of pressure of the embouchure determines the rapidity of their vibration, on which, concurrently with the length of the tube, depends the pitch, or relative position, of the sound produced.

The name "ophicleide" is compounded of two Greek words, ὄφις, serpent, and κλεῖδες, keys,—the instrument owing, in fact, its origin to the application of keys to the serpent, a wind instrument the invention of which is generally attributed to Edme Guillaume, canon of Auxerre, somewhere about 1590. He contrived it to serve as a bass to the zinken, instruments now entirely obsolete.

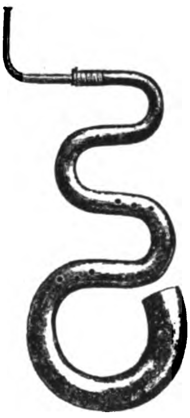
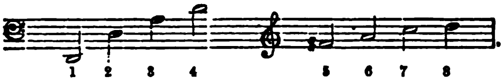


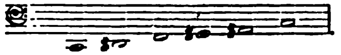
FIG. 1.—The Serpent.

The serpent, represented by fig. 1, is composed of two pieces of wood, hollowed out and cut to the desired contour. They are joined together by gluing so as to form a tube, and are bound with leather to ensure solidity. The upper extremity ends with a bent brass tube or crook, to which the mouthpiece is applied. The tube is pierced laterally with six holes, the first three of which are covered by three fingers of the right hand, and the others by the corresponding fingers of the left hand. When all the holes are thus closed the instrument will produce the following sounds, of which the first is fundamental and the rest are harmonics:—



The instrumentalist fills up the gaps in the diatonic or natural scale by the successive opening of the lateral holes after the manner practised in fingering the flute. The serpent remained in its primitive form for nearly two centuries, and then only it was attempted to improve it by adding keys. From the time of its origin it had served principally as an accompaniment to the liturgical chanting, but towards the middle of the 18th century it began to be employed as a bass for military music, and, notwithstanding its numerous imperfections, it was but slowly given up.

Fig. 2 represents a curious serpent made, about 1830, by L. Embach and Co., Amsterdam. The six lateral holes are here placed more rationally along the tube, but, being beyond the reach of the fingers, they are covered by open keys, besides which the instrument also bears six closed keys for the following tones:—



The primitive form of the serpent was most inconvenient, and it was a musician named Régibo, belonging to the orchestra of the church of St Pierre at Lille, who, about 1780, first thought of giving it the shape of a bassoon (Gerber, *Lexicon der Tonkünstler*, Leipsic, 1790). The merit of this innovation was rapidly recognized in England and Germany. Still to follow Gerber (*Lexicon*, 1812), one Frichot, who was established in London, published in 1800 a description of an instrument, entirely of brass, manufactured by J. Astor, which he claimed as his invention, calling it the basshorn, but which was no other in principle than the new serpent of Régibo. It only made its way to France and Belgium after the passage of the allied armies in 1815. We here reproduce (fig. 3) the drawing of a wooden serpent with bell and mouthpiece of brass, after a scale published by B. Schott of Mainz, in 1816. The English brass basshorn was designated on the Continent the English or the Russian basshorn, the "serpent anglais," or the "basson russe." Under this last name all instruments of the form, whether of wood or brass, were later on confounded in France and Belgium. The "basson russe" remained in great vogue until the appearance of the ophicleide, to disappear with it in the complete revolution brought about by the invention of pistons.

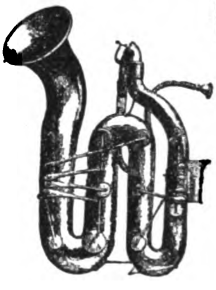


FIG. 2.—Serpent by Embach.

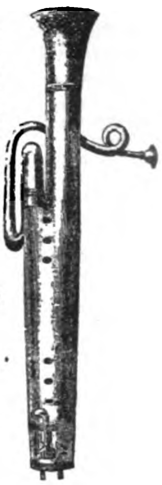
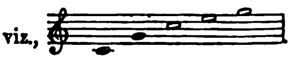


FIG. 3.—Wooden Serpent.

The invention of the ophicleide is generally but falsely attributed to Alexandre Frichot, a professor of music at Lisieux, department of Calvados, France. The instrument, which the inventor called "basse-trompette," was approved of as early as 13th November 1806 by a commission composed of professors of the Paris Conservatoire, but the patent bears the date 31st December 1810. The "basse-trompette," which Frichot in his specification had at first, in imitation of the English basshorn, called "basse cor," was, like the English instrument, entirely of brass, and had, like it, six holes; it only differed in a more favourable disposition brought about by the curvings of the tube, and by the application of four crooks which permitted the instrument to be tuned "in C low pitch and C high pitch for military bands, in C♯ for churches, and in D for concert use." The close relationship between the two instruments suggests the question whether this was the Frichot who worked with Astor in London in 1800.

The first idea of adding keys to instruments with cupped mouthpieces, unprovided with lateral holes, with the aim of filling up some of the gaps between the notes of the harmonic scale, goes back, according to Gerber (*Lexicon* of 1790), to Kölbel, a hornplayer in the Russian imperial band about 1754. Weidinger, trumpeter in the Austrian imperial band, improved upon this first attempt, and applied it in 1800 to the trumpet. But the honour belongs to Joseph Halliday, bandmaster of the Cavan militia, of being the first to conceive, in 1810, the disposition of a certain number of keys along the tube, setting out from its lower extremity, with the idea of producing by their successive or simultaneous opening a chromatic scale throughout the extent of the instrument. The bugle-horn was the object of his reform; the only scale of which, he says, in the preamble of his patent, "until my invention contained but five tones, viz.,  My improvements on that instrument are five keys, to be used by the performer according to the annexed scale, which, with its five original notes, render it capable of producing twenty-five separate tones in regular progression." Fig. 4 represents the keyed bugle of Joseph Halliday.

It was not until 1815 that the use of the new instrument spread upon the Continent. We find in the account-books of a Belgian maker, Tuerlinckx of Mechlin, that his first supply of a bugle-horn bears the date of 25th March 1815, and it was made "aen den Heer Muldener, lieutenant in het régiment duc d'York."

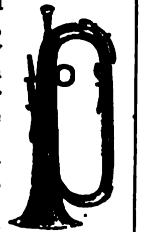
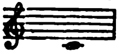
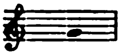
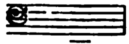
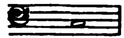


Fig. 4.—Keyed Bugle.

The acoustic principle inaugurated by Halliday consisted in binding together by chromatic degrees the second and third harmonics,  to . He attained it, as we have just seen, by the help of five keys. The principle once discovered, it became easy to extend it to instruments of the largest size, of which the compass, like the "basson russe," began at the lowest sound. It was simply necessary to bind the fundamental  to the next harmonic sound  by a larger number of keys. This was done in 1817 by Jean Hilaire Asté, known as Halary, a professor of music and instrument-maker at Paris. We find the description of the instruments for which he sought a patent in the *Rapport de l'Académie Royale des Beaux-Arts de l'Institut de France*, meeting of 19th July 1817. These instruments were three in number:—(1) the clavi-tube, a keyed trumpet; (2) the quinti-tube, or quinti-clave; (3) the ophicleide, a keyed serpent. The clavi-tube was no other than the bugle-horn slightly modified in some details of construction, and reproduced in the different tonalities A♭, F, E♭, D, C, B♭, A, and A♭. The quinti-tube had nearly the form of a bassoon, and was, in the first instance, armed with eight keys, and constructed in two tonalities, F and E♭. This was the instrument afterwards named "alto ophicleide." The ophicleide, of which we reproduce a drawing (fig. 5), had the same form as the quinti-tube. It was at first adjusted with nine or ten keys, and the number was carried on to twelve,—each key to give a semitone (additional patent of 16th August 1822). The ophicleide or bass of the harmony was made in C and in B♭, the contra-bass in F and in E♭.[1]

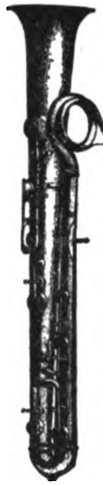
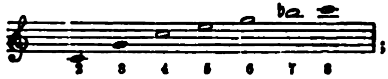


Fig. 5.—Ophicleide of Halary.

It is certain that from the point of view of invention Halary's labours had only secondary importance; but, if the principle of keyed chromatic instruments with cupped mouthpiece[2] goes back to Halliday, it was Halary's merit to know how to take advantage of the principle in extending it to instruments of diverse tonalities, in grouping them in one single family, that of the bugles, in so complete a manner that the improvements of modern manufacture have not widened its limits either in the grave or the acute direction. Keyed chromatic wind instruments made their way rapidly; to their introduction into military full or brass bands we can date the regeneration of military music. After pistons had been invented some forty years, instruments with keys could still reckon their partisans. Now these have utterly disappeared and pistons or rotary cylinders remain absolute masters of the situation.

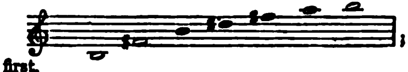
The invention of the piston is due to Stoelzel, a Silesian, and Blümel of Waldenburg (patent of 12th April 1818). It was first signalized by G. B. Bierey, leader of the National Theatre of Breslau, in No. 18 of the *Allgemeine musikalische Zeitung* (Leipsic, 1815). The inventors first applied their discovery to the horn, trumpet, and trombone, and this application consisted of only two pistons, or "ventile," as they called them. We have seen up to this point that chromatic intervals were produced in instruments with cupped mouthpiece by shortenings of the tube by means of lateral openings. It is evident that a column of air so cut off must be very inferior in sonorousness to one vibrating from the mouthpiece to the extremity of the bell; this has been the capital defect of keyed instruments. Stoelzel and Blümel proceeded in contrary fashion: they produced chromatic intervals by lengthening the tube, just as in the trombone with slides. They introduced contrivances the movement of which permitted an instantaneous communication between the principal tube and two additional tubes, lowering the instrument respectively a tone and a half-tone, or by their simultaneous employment one tone and a half. As these combinations did not suffice to produce a complete chromatic scale, a third pisten with an additional tube of a tone and a half was soon afterwards added by the inventors.

Suppose an instrument giving without pistons the harmonics



;

by the employment of the second piston those sounds become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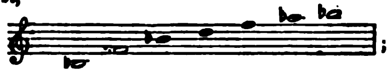
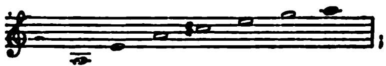
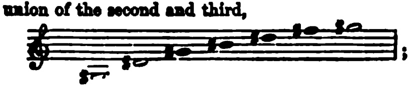
by the first,


;

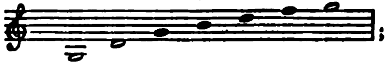
by the third, or union of the first and second,


;

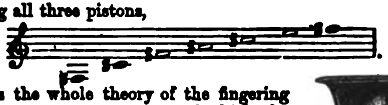
by the union of the second and third,


;

by the union of the first and third,


;

by joining all three pistons,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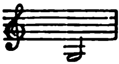
Here is the whole theory of the fingering of these instruments *à pistons*, of which the compass downwards is only bounded by the first harmonic.

A serious defect exists, however, in these piston instruments,—the want of truth of intonation whenever a note is produced by more than one piston. Let us take, for example, the low G . This note is produced, as we have just seen, by the union of the first and third pistons; in employing the first piston the pitch of the instrument is lowered a major second, and to produce the lowering to a fourth (two tones and a half) a further lowering of a minor third (one tone and a half) is necessary. Now the additional pipe to produce this lowering from C is necessarily proportionately shorter than what is required for a pipe already lowered a tone by the employment of the first piston. It therefore results, as will be seen from this special case, that all notes produced by several pistons at one time are too high in pitch.

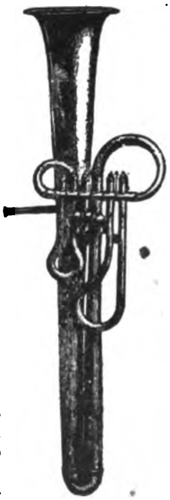


Fig. 6.—Ophicleide with pistons.

The invention of Stoelzel and Blümel, like all new ideas, was not accepted without opposition; notwithstanding its crushing superiority it had a lively struggle to sustain, and it is only within the last thirty years that the system of keys has been

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[1] The report of the Académie des Beaux-Arts on the subject of this invention shows a strange misconception of it, which it is interesting to recall. "As to the two instruments which M. Halary designs under the names of 'quinti-clave' and 'ophicleide,' they bear a great resemblance to those submitted to the Academy in the sitting of the 11th of March 1811 by M. Dumas, which he designed under the names of 'basse et contrebasse guerrières.' . . . The opinion of our commission on the quinti-clave and ophicleide is that M. Halary can only claim the merit of an improvement and not that of an entire invention; still, for an equitable judgment on this point, we should compare the one with the other, and this our commission cannot do, not having the instruments of M. Dumas at our disposal." This is what the commission ought to have had, but it would have sufficed had they referred to the report of the sittings of 6th and 8th April, in which it is clearly explained that the instruments presented by M. Dumas were bass clarinets (*Moniteur Universel* of 19th April 1811).

[2] We designedly omit the employment of the word "brass" to qualify these instruments. The substance which determines the form of a column of air is demonstrably indifferent for the *timbre* or quality of tone so long as the sides of the tubes are equally elastic and rigid.

finally superseded by pistons. We close this article with the curious representation (fig. 6) of an ophicleide *with pistons* manufactured about 1886 by C. Mahillon of Brussels, then at the beginning of his career. (V. M.)

OPHIR (אוֹפִיר), a place famous among the Hebrews for its gold from the time of Solomon, whose Red Sea fleet, in conjunction with the Phœnicians, went to Ophir and brought thence a vast treasure of gold with precious stones and "almug" wood (1 Kings ix. 28, x. 11). It is quite plain from Gen. x. 29 that Ophir belonged to southern Arabia, from which the Phœnicians still derived gold and precious stones in the time of Ezekiel (xxvii. 22). All attempts to place Ophir in India or on the east coast of Africa (Sofála) are at variance with Gen. x. It is true that Indian products were also brought to Solomon (1 Kings x. 22), but these are not said to have come from Ophir, and therefore we cannot even be sure that Ophir was the emporium where the Indian trade and the Western met, as they did in southern Arabia in later times,—unless, indeed, the "almug" or "algum" wood is, as has been conjectured, the Indian sandalwood.

OPHITES. See GNOSTICS.

OPHTHALMOLOGY. The scientific development of the diagnosis and treatment of diseases of the eye belongs to the last hundred years. Helmholtz's invention of the ophthalmoscope is little more than thirty years old. Our knowledge of the refraction and accommodation of the eye has been worked out by Airy, Young, Sanson, Purkinje, Donders, Sneller, Helmholtz. Many of the major operations have been perfected by Von Graefe and his followers in quite recent times. Finally, the important relations of ophthalmology to general medicine have been worked out principally by Hutchinson, Hughlings Jackson, Clifford Allbut, and Gowers within the last few years.

Acute Catarrhal Conjunctivitis begins with a feeling of stiffness of the lids, and pain as if from a particle of grit in the eye. The secretion increases, is at first watery, and is afterwards yellow and muco-purulent, collecting at the inner canthus and gumming the eyelids together. The conjunctiva, especially that on the lids, is reddened, and in severe cases may be so swollen as to overlap the cornea. The eye is generally well in a fortnight. The disease is caused by cold winds, and by irritating particles, and in one form is undoubtedly contagious. The eye must be left uncovered, bathed occasionally with an astringent lotion, and at night some ointment should be applied to the edges of the lids to prevent their adhesion and consequent retention of the secretion.

Chronic conjunctivitis may result from the above, or be due to the irritation of dust. It occurs frequently from overstrain of hypermetropic eyes. The symptoms are similar, but less severe, and require similar treatment with correction of the hypermetropia where present.

Purulent Ophthalmia[1] (ophthalmia of the newly born) is caused by contact of pus from a gonorrheal or leucorrheal discharge or from another eye similarly affected. It is one of the forms of Egyptian ophthalmia. In children both eyes are generally affected; in adults usually one. The symptoms begin, from one to three days after infection, with a watery discharge, which increases rapidly in amount, and becomes yellow and purulent. The conjunctiva becomes greatly congested and swollen, bleeding readily. The lids are so stiffened with infiltration that they can hardly be separated. When they are slightly opened quantities of pus escape. There is great pain in the eye, fever, and sleeplessness. The cornea is much endangered; it may be perforated, may slough wholly or in part, and the eyeball may be destroyed. If one eye only is affected the other must be protected. Locally the greatest cleanliness is necessary, and the discharge must be constantly removed. Once daily the conjunctiva should be touched with a strong solution of nitrate of silver, and in the interval frequently bathed with astringent solutions. Recently, powdered iodoform has been much recommended as a local application. In adults leeching the temple and the continuous application of ice to the eye may be needed. The attendants must be warned of the danger of conveying infection to their own eyes.

Diphtheritic Conjunctivitis is characterized by the formation of a yellowish false membrane on the conjunctiva, which becomes thickened and almost solid from infiltration, and by great liability to sloughing of the cornea. It occurs most frequently in North Germany, attacking weakly children during epidemics of ordinary diphtheria, and, like it, often proves fatal by exhaustion. It should be treated by the internal administration of tonics and stimulants, and by the local use of ice, antiseptic lotions, and the strictest attention to cleanliness.

Chronic Granular Conjunctivitis is a contagious disease arising from prolonged overcrowding under bad sanitary conditions. It is thus specially common among the Jewish and Irish poor, and among workhouse children. The mucous membrane of the lids becomes reddened, thickened, and studded over with small firm "granulations," like boiled sago grains. The friction of these bodies produces a vascular opacity of the cornea (pannus), at first limited to the upper half of the cornea, but in bad cases involving its whole surface. There is considerable pain and discharge, and the eyelids are kept half-shut. There is a peculiar liability to acute exacerbations. The conjunctiva finally shrinks to a dense white scar, which curves the tarsal cartilage inwards, and brings the edge of the lids and the eyelashes to rub on the cornea, and increase its opacity.

It must be persistently treated by strong astringent or caustic applications to the conjunctiva. The pannus, as a rule, disappears with the granulations that caused it. If not, a zone of conjunctiva round the cornea may be divided; or, as a last resort, the eye may be inoculated with pus from a purulent case. All acute exacerbations must be treated by soothing applications. Incurving of the tarsal cartilage and displacement of the lashes need special surgical operations, which are more or less successful.

If a case occurs in a school or in barracks it must be at once isolated.

Pterygium is a triangular thickening of the exposed part of the conjunctiva, which may or may not be vascular. Its apex is towards the cornea, over which it tends to grow, and thus to interfere with vision; otherwise it causes no irritation. Pterygium is a disease of middle life and of warm climates. If it cause no deformity or interference with sight it should be left alone. If large it may be dissected up from the apex and cut off, or transplanted into another part of the conjunctiva, where it will shrivel up.

The diseases of the cornea are of extreme importance, from their great frequency and from the fact that a small lesion may seriously affect the perfect transparency and regularity of curvature so necessary for clear vision.

Chronic Interstitial Keratitis attacks young persons, nearly all of whom, as was first pointed out by Hutchinson, can be shown to be the subjects of hereditary syphilis, and who present some or all of the following physiognomical characters:—a depressed bridge of the nose, scars at the angle of the mouth, and notched and peg shaped central upper incisor teeth. The disease affects both eyes, one generally some time before the other. It begins by the appearance of cloudy spots in the cornea, which spread until the whole cornea has a ground-glass appearance, not uniform throughout but with denser opacities here and there. The corneal surface is "steamy." The ciliary zone of vessels, immediately round the cornea, is congested, and iritis is a frequent complication. As a rule pain and photophobia are not great. The cornea seldom clears in less than a year, and even then only imperfectly. Internally, minute doses of mercurials, or where there is decided struma the syrup of the iodide of iron should be given. Locally, atropine should be used to prevent iritis. As the cornea clears, some stimulant, as the dusting of fine calomel powder, may hasten the absorption of the exudation.

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[1] The term "ophthalmia" is now limited to conjunctival inflammations.

Phlyctenular Ophthalmia occurs in strumous or weakly children, especially after hooping-cough or measles. There is great intolerance of light, the slightest attempt to separate the lids causing a gush of tears. The patient is generally kept in bed in a dark room and buries his head in the pillow to exclude the light. The conjunctiva is reddened generally, but spots of localized congestion are seen near little greyish or yellowish elevations on the conjunctiva, or on the cornea near its margin. These papules or pustules may succeed each other in crops for a long time. On the cornea they give rise to vascular ulcers, which may be single or so numerous as to constitute a condition of pannus. As they heal the vessels shrink, and a small white speck is left to mark the seat of the ulcer. As regards treatment, the patient must have a shade or dark glasses, and be sent out of doors daily when the weather permits. Tonics and nourishing food are required. Locally, so long as the secretion is watery atropine must be used; later, mild astringent lotions; and finally, to aid the healing of the ulcer and clearing of the residual opacities, some mercurial ointment or calomel powder should be applied.

Ulcers of the Cornea.—Ulcers occur under many forms, to which very various names have been given. All the forms have certain symptoms in common with each other and with the above diseases. There is great pain in and about the eye, great intolerance of light (especially in superficial ulcers), and congestion of the ciliary zone. They generally leave an opacity, which greatly interferes with sight if in the centre of the pupil. In *severe inflammatory* or *suppurative* ulceration the above symptoms are well marked; the base of the ulcer is greyish in colour, its edges irregular, and the surrounding cornea infiltrated. It extends superficially and deeply, and may cause hypopyon (pus in the base of the anterior chamber), and even perforation of the cornea, or iritis. The *weak ulcer* has little pain or congestion, and seems simply a loss of substance at one part of the cornea. It causes distorted or multiple images. Its existence is a sign of lowered health, and calls for local stimulation and tonic treatment. The *small central ulcer* of children is a small greyish funnel-shaped spot in the centre of the pupil, with little pain or congestion. It sometimes goes on to abscess, but usually heals quickly. The *senile* or *serpiginous ulcer* is a very serious form. There is great pain and photophobia, and unless treated the ulcer gradually eats its way across the cornea, or extends at its margins so as to isolate the central part of the cornea.

The treatment of corneal ulcers varies very much with the type of disease and with its several stages. In the acute cases the eyes should be shaded, sometimes bandaged; atropine applied locally allays pain; eserine is said to act similarly by reducing tension, and is preferable where conjunctival discharge is aggravated by atropine. The weak ulcer should be touched with a nitrate of silver solution, the senile bathed with a quinine lotion. If the inflammatory ulcer be not checked by atropine, and if hypopyon increase, tension may be diminished by incising the cornea at its margin, or through the base of the ulcer (Saemisch), or by performing iridectomy.

Abscess of Cornea may result from injury or ill-health. It begins as a yellow spot in the substance of the cornea, with some surrounding haze. It may become absorbed, or burst forwards and be converted into an inflammatory ulcer, or backwards, giving rise to hypopyon. If hot fomentations and atropine do not check it, it must be treated surgically like the inflammatory ulcer.

Staphyloma of the Cornea is a bulging forward in whole or in part of the new tissue which replaces the cornea after ulceration or sloughing. It has a bluish or greyish colour, and may be slight in amount, or so great as to keep the eyelids widely separated and cause great irritation. When there is no irritation it may be left alone; when it is increasing an iridectomy may check its progress. When it is large and causes irritation the eye may be removed entirely, or in part so as to leave a stump on which to fit an artificial eye.

Conical Cornea occurs principally in young women whose health has been much reduced from some chronic cause. The cornea becomes thinned in the centre, and is slowly bulged forward. The condition, which is easily recognized from the glistening appearance and the conical form of the cornea, causes great myopia, which can be only imperfectly remedied by biconcave lenses obscured except at a small central aperture or slit. In severe cases operation may be of some service.

Keratitis Punctata is usually secondary to some deeper-seated disease, *e.g.*, iritis, choroiditis, or sympathetic ophthalmitis. Minute greasy-looking dots are deposited at the back of the lower part of the cornea, generally arranged as a triangle with its apex upwards. The ocular tension and amount of aqueous humour increase. The treatment is that of the causal disease, usually iodide of potassium or a mercurial, with atropine locally.

Arcus Senilis is a whitish crescent or ring just inside the corneal margin. It is a senile change, a fatty degeneration of the corneal tissue, not necessarily accompanied by fatty degeneration elsewhere. It does not influence the healing of corneal wounds in any way.

In *Acute Iritis* the iris changes in colour and its fibres lose their definition and look muddy. The pupil becomes small, irregular in outline, and sluggish or immobile when stimulated by light. There is a pink zone of congestion round the cornea (the ciliary zone). The aqueous humour is turbid; it may contain blood, and even pus. There is more or less pain in the eye and temple, which is usually worst at night; there is intolerance of light, great increase in the secretion of tears, and impairment of sight. In most cases lymph escapes from the posterior surface of the iris and fixes its margin to the lens at one or more points, or all round, and may even occlude the pupil. In some cases the exudation is entirely serous and no adhesions are formed (serous iritis). Iritis is one of the symptoms of secondary syphilis; it is caused by rheumatism, by ulcers and diffuse inflammations of cornea, by injuries to the cornea, iris, and lens, and forms part of nearly all cases of sympathetic ophthalmitis. The syphilitic form usually involves both eyes; it produces much exudation and often little yellow nodules, and rarely relapses. Rheumatic iritis is generally serous, unilateral, and recurs frequently. Atropine must be freely applied locally to prevent the formation of adhesions, or to break down such as may have already formed. The temple may be leeched, and opiates given if pain is severe. In the syphilitic forms calomel must be given; in the rheumatic alkalis and colchicum. The eyes must be protected by a shade. Traumatic iritis should be treated by continuous cold and leeching. If it is due to a swollen lens, the latter must be removed. After the disease is past the pupil is frequently irregular from adhesions (synechiæ) of the iris to the lens-capsule. If adhesions have been broken down small brown specks will be seen in the pupil. The whole free edge (exclusion), or the whole posterior surface (total posterior synechiæ), may adhere to the lens-capsule, and the pupil may be completely covered with a film of lymph (occlusion). These three last conditions are apt to cause secondary glaucoma.

Coloboma of the Iris is a congenital defect in the iris. The defect is always in the lower part, and gives the pupil a balloon shape. It may or may not be accompanied by a similar defect in the choroid and retina.

From the intimate association of their vascular supply, the ciliary body, iris, cornea, sclerotic, and choroid are frequently affected together. Diseases in this region all agree in their tendency to relapse frequently during a very chronic course, and to involve separate patches

Sclerotitis (episcleritis) forms a low painful swelling, of a peculiar rusty colour, under the conjunctiva in the ciliary region. It lasts for months, with frequent relapses. The subjects of this disease are mostly rheumatic or anæmic women. Internally, iodide of potassium is sometimes useful. If that fail small doses of mercury should be given. Locally, atropine, blistering the temple, or massage of the swelling through the upper lid may be tried.

Irido-cyclitis, inflammation of the iris and ciliary body, is characterized by congested patches of a violet colour in the ciliary region, cloudy areas in the cornea, and attacks of iritis with much plastic exudation. There is great pain and intolerance of light. It relapses frequently, each attack leaving more cloudiness of cornea and more iritic adhesions, till ultimately the sclerotic presents a bluish bulging in the ciliary region (ciliary staphyloma), the cornea is opaque, its curvature irregular, and the sight gone.

Irido-choroiditis resembles a mild attack of iritis; there is little pain or photophobia. Small deposits form on the back of the cornea (keratitis punctata). Recent choroiditis and sometimes opacities in the vitreous may be seen with the ophthalmoscope if the pupil be clear. This also relapses frequently, with the formation of much iritic adhesion, and sometimes of secondary glaucoma. This occurs mostly in delicate young persons, and generally involves both eyes. The treatment consists of atropine locally, disuse of the eyes, and tonics with iodide of potassium internally; only in mild cases is a good result obtained. The iritic exudation is generally too plastic to be absorbed.

Wounds or Diseases in the Ciliary Region are extremely liable to involve the other eye sympathetically. There are two affections of very different moment. In *sympathetic irritation* the eye is tender and irritable, cannot bear a bright light, and is easily fatigued by continued strain of the accommodation, as in reading or other close work. This condition usually yields speedily when the other eye is removed, which should be advised without hesitation. *Sympathetic inflammation* is of much more serious moment. It may begin quite insidiously, or with acute pain and intolerance of light. Once begun, it becomes an independent disease, little influenced by treatment directed to the exciting eye, and usually ending at last in irreparable blindness. The symptoms are deposits on the back of the cornea (keratitis punctata), violet-coloured ciliary congestion, often great tenderness of the ciliary region, the iris muddy and in severe cases buff-coloured, and with many large blood-vessels on its surface. Extensive iritic adhesions form which cannot be absorbed. The process is an irido-cyclitis or irido-choroiditis. It may be set up two months or many years after the injury; the eye is never safe. Treatment must evidently be mainly preventive. All blind eyes liable to cause sympathetic inflammation should be at once removed. If some vision be left in the wounded eye, and the patient can be kept under observation, it may be left,—the patient being warned of the danger to the other eye. The inflammation once arisen, the exciting eye, if blind, must be removed; but not if there be any sight in it, as it may be eventually the better eye of the two. The patient must be kept in a dark room and not allowed to use his eyes. Atropine solution must be applied locally. After the inflammation is quite quiescent removal of the lens with a portion of the iris may be of use in giving an artificial pupil.

Cataract.—Cataract is an opacity of the crystalline lens. It is due to some alteration in the structure and relationship of its fibres, as the result either of some senile change or defect of development, or local interference with its nutrition (as in glaucoma), of some general diseases such as diabetes, or of local injury to the lens or its capsule. For practical purposes all cataracts are classified under three categories. (A) They may be *hard* or *soft*; below the age of thirty-five, and in diabetes of any age, cataracts are soft. (B) They may be *general* or *partial*, according to the amount of lens involved in the opacity. General cataract may be nuclear (beginning from the centre) or cortical (spreading inward from the periphery); or both conditions may coexist. Partial cataract may be (1) *lamellar*, where one or several of the concentric layers in an otherwise transparent lens becomes opaque. This form is often congenital. It is said to be frequently caused by infantile convulsions. (2) *Pyramidal cataract* is a small white spot on the lens-capsule in the centre of the pupil. This is the result of corneal perforation in purulent ophthalmia. The cornea falls against the lens-capsule when the aqueous humour is evacuated, and becomes adherent to it. The aqueous, refilling after the healing of the perforation, tears away the cornea and leaves the spot of lymph on the capsule. (3) In *posterior polar cataract* the opacity begins at the posterior pole of the lens. It indicates deep-seated disease. (C) Cataract may be *primary* or *secondary*, according as it arises in an eye otherwise healthy or depends on some other disease in it. Cataracts arising from injury to the lens are called *traumatic*.

Symptoms and Treatment of Cataract.—Vision becomes gradually impaired. If the cataract be small and central, vision improves in a dull light or when the eyes are shaded. On ophthalmoscopic examination (see below) the opaque parts appear either as dark striæ converging towards the centre or as a dark central mass. The fundus, if visible, appears red. An attempt should be made to ascertain if it is healthy. On oblique illumination by a convex lens the opaque parts now appear white and the rest of the pupil black. When the cataract is ripe the pupil is filled by a homogeneous pearly-white or amber-coloured opacity. The rest of the eye is healthy if the pupil reacts to light, and the patient can tell the direction of a candle-flame at four feet distance. As a palliative atropine may be used if it be found to improve vision. To remove the cataract operation is required. Operation is undesirable in pyramidal, secondary, and immature cataract, and usually if, while the cataract in one eye is ripe, the other eye remains good, unless the patient specially desires the operation.

The Operation.—In the *soft* cataract of infancy, youth, and diabetes the needle operation should be chosen. The pupil having been dilated by atropine, a fine needle is passed through the cornea near its margin, and lacerates the lens-capsule freely. The lens, acted on by the aqueous humour, swells up and gradually dissolves,—the process of solution taking from two to three months, and generally needing one or two repetitions of the needling. In *hard* cataracts the lens must be extracted entire. The following is the most usual operation. With a narrow knife an incision is made through the upper part of the cornea at its junction with the sclerotic, in length somewhat less than half the corneal circumference. A portion of iris is drawn through the corneal incision and cut off (iridectomy). Then the lens-capsule is lacerated by a needle. The lens is forced out of the eye by gentle pressure on the sclerotic below. All fragments of lens-substance are carefully removed; the edges of the incision are brought together, the eyes bandaged, and the patient kept in bed for a few days. Ninety-five per cent. of the cases do well, the others going wrong from hæmorrhage into the eye, iritis, or suppuration of the eye. In *lamellar* cataract two courses are open. If dilatation of the pupil by atropine enables the patient to see clearly, the removal of a portion of iris (artificial pupil) will be sufficient; if not, the solution of the lens must be effected by the needle operation. In *traumatic* cataract the pupil is kept dilated by atropine to prevent iritis. If severe iritic or glaucomatous symptoms arise an incision must be made in the cornea, and the softened lens removed along a grooved scoop or by suction.

After the cataract is removed strong convex glasses must be worn for near vision and a somewhat weaker pair for distant vision. Their use must not be allowed till at least two months after the operation.

Dislocation of the Lens may arise from a blow or spontaneously. The lens may pass into the anterior or posterior chamber. If in the posterior chamber it may be invisible, but the iris will be tremulous and the refraction very hypermetropic. If the dislocation be partial the edge of the lens may be seen with the ophthalmoscope as a dark curved line. The lens generally becomes opaque. It may, and often does, cause glaucoma.

Glaucoma is a most serious disease, characterized in all its forms by increased tension of the eyeball, impairment of sight, and ultimate irremediable blindness. Its course is usually chronic, lasting sometimes many years; sometimes absolute blindness comes on in a few hours or days.

In the chronic form the earliest symptoms are rapid onset of presbyopia, making it necessary to change the spectacles frequently, and attacks of mistiness of sight, during which artificial lights appear surrounded by coloured rings. Gradually sight is impaired and the field of vision contracted. The pupil is dilated and sluggish; the cornea may be "steamy" and insensitive, the anterior chamber shallow. Large veins pierce the sclerotic a little way from the corneal margin. The lens may have a greenish hue (hence the name), or may become opaque. The optic disk, if visible ophthalmoscopically, is "cupped" or hollowed, and in advanced cases also atrophied. The retinal vessels bend abruptly in rising over its edge, or in deep cupping seem to have their course interrupted for a short distance. The arteries pulsate either spontaneously or on slight pressure on the eyeball. The tension (ascertained by pressing the eyeball against the floor of the orbit) is variously increased. This form may be painless throughout, and the gradual impairment of vision may lead to the fatal error of a diagnosis of cataract. More usually there are occasional acute attacks. Acute glaucoma comes on suddenly; there is much pain in the eye and temple and congestion of the globe; increase of tension and loss of sight are extremely rapid.

All the symptoms depend on the increased tension of the intraocular fluids. The loss of sight and contraction of the visual field result from compression of the retina and its vessels. Pressure on the ciliary nerve paralyses the iris and the accommodation (hence the presbyopia), and renders the cornea insensitive. The anterior chamber is shallowed by the lens being driven forwards, and the disk is cupped by being driven backwards through the lamina cribrosa, the least resistent part of the sclerotic. The veins of the sclerotic are enlarged in order to relieve the obstructed vasa vorticosa. The explanation of the increase of tension is not yet complete. In most cases it is probably due to deficient removal of fluid. Normally this takes place through the suspensory ligament of the lens, round the free edge of the iris, leaving the anterior chamber at the angle of junction of the iris and cornea. Blocking of any part of this channel (most often at the above angle) would cause increase in the tension. Increased blood-supply is also in many cases a cause. Glaucoma is most common after forty. It may be either primary or secondary to some disease or injury of the eye.

Eserine applied locally has proved useful in some early cases of glaucoma. Iridectomy—that is, the removal of a portion of iris through an incision in the cornea—is the most successful mode of checking the disease. In secondary glaucoma the treatment must be directed to the cause, if it is removable.

Muscæ Volitantes.—The floating bodies, specks, &c., so often complained of are usually of no importance. They occur most frequently in myopic eyes. Pathological *muscæ*, however, depend on the presence of opacities in the vitreous, detectable by the ophthalmoscope. They are of very various sizes and shapes, from large masses, as in recent hæmorrhage, to strings, specks, knotted bodies, or finely sparkling particles (cholesterin), or as a diffuse cloud or haze obscuring the retina. From the rate at which the bodies move an opinion may be formed of the fluidity of the vitreous. Disease of the vitreous is usually secondary to disease of some of the surrounding parts, as in high degrees of myopia, in hæmorrhagic and syphilitic choroiditis and retinitis, and diseases of the ciliary region. Hæmorrhage is frequent after blows on or wounds of the eye.

Disseminated Choroiditis is usually a symmetrical disease, arising from acquired or inherited syphilis. There are no characteristic symptoms, but the ophthalmoscope shows in the early stage (rarely observed) yellowish patches (of exudation), over which, unless obscured by haze, the retinal vessels are seen to pass. Later, when the exudation gives place to atrophy, white patches are seen of various sizes with masses of black pigment on or around them, distributed irregularly over the choroid. The retinal vessels may be seen to pass unaltered over some of the white areas. Sometimes the patches of atrophy involve merely the superficial layers and expose the deeper larger choroidal vessels. Vision is impaired, especially if the yellow spot is involved. The treatment is that for syphilis, with rest and protection of the eyes from light. This at least helps to prevent fresh accessions of the disease if it cannot restore the atrophied choroid. Similar spots are seen in non-syphilitic subjects, probably as the result of choroidal hæmorrhage.

In myopia the choroid is frequently atrophied near the disk, especially at its outer edge, forming what is variously known as "posterior staphyloma," "myopic crescent," or "sclerotico-choroiditis posterior." This posterior staphyloma varies much in shape, sometimes surrounding the disk, sometimes limited to the yellow spot, causing then greatly impaired central vision.

Tubercles are sometimes deposited in the choroid, appearing as small yellow spots. Their presence may be of assistance in forming a diagnosis of tubercular disease.

Rupture of the Choroid from injury is generally seen as a long curved line of atrophy with the concavity towards the disk.

Coloboma of the choroid is a congenital defect, indicated by a large white patch of atrophy at the lower part, often embracing the disk,—the surface of the sclerotic often looking uneven. It may exist independently of similar defect in the iris.

Sarcoma of the Choroid is a malignant tumour, usually pigmented, which tends to destroy the eye, to spread along the optic nerve, and to cause metastatic deposits elsewhere in the body. It causes defect of sight, and if the media are clear may be seen by the ophthalmoscope. It often causes glaucoma and cataract. The tumour must be excised with as much of the optic nerve and orbital tissue as can be reached.

Detachment of the Retina is a separation of the retina from the choroid by an effusion of serum or of blood, or by the growth of a tumour between them. It occurs most frequently in myopia and from blows on the eye (also from dislocation of the lens and in albuminuria). The detachment varies greatly in extent; it is most usually situated at the lower part of the retina. It causes blindness on the corresponding opposite part of the visual field. With the ophthalmoscope, instead of the red appearance, a greyish reflexion is seen, generally uneven on the surface, with the retinal vessels, reduced in size and dark in colour, coursing over it. The grey surface may be seen to undulate with movements of the eye. Treatment is generally unsatisfactory. Myopic cases should avoid stooping and strain of the eyes to prevent its extension.

Embolism of the Central Artery of the Retina is a plugging of this vessel by a small body, usually detached from one of the valves of a diseased heart. The eye becomes suddenly blind, and on ophthalmoscopic examination the red reflex is found to be replaced by a diffuse white mist, except at the yellow spot where a "cherry-red" spot appears; and the retinal vessels are often reduced to mere threads. After a time the haze passes off the retina, but an atrophied disk and narrowed blood-vessels are left. Treatment is useless. If the embolism is impacted in one of the branches of the retinal artery these appearances will be localized, and a blind spot will correspond to the affected area.

Albuminuric Retinitis occurs in an advanced stage of chronic Bright's disease of the kidneys, usually when the general health has become much impaired. It is especially associated with the granular kidney, and is not seldom the first indication of this serious disease. It causes defective sight, and some of the following characteristic ophthalmoscopic appearances. In the early stage (rarely observed) a greyish haze presents itself at the centre of the retina (from the presence of an albuminous fluid); later, pearly-white sharply-defined spots of various sizes appear, often grouped round the yellow spot (due to fatty degeneration of the coagulated albumen and nerve-fibres). With these there may be found many small hæmorrhages, or a condition of optic neuritis. Vision is seldom completely lost, and may, except in the severest cases, be expected to improve somewhat, especially in the albuminuria associated with pregnancy. Its treatment is that of its cause.

Syphilitic Retinitis is usually a symptom of the secondary stage, affecting both eyes, and producing dimness of vision and night-blindness. Ophthalmoscopically the disk appears hazy, the vessels full and tortuous, the retina also hazy or showing white misty patches, especially near the yellow spot. It is much benefited by a mercurial course.

Hæmorrhagic Retinitis is indicated by the appearance all over the retina of small flame-shaped hæmorrhages with dilated veins. It is perhaps due to gout (Hutchinson).

Hæmorrhages may result from vascular degeneration. They seriously damage sight if they occur at the yellow spot.

Pigmentary Retinitis is a peculiar chronic disease affecting both eyes symmetrically. It is either congenital or begins early in life and advances gradually till it produces complete blindness. Its cause is not well known. It is strongly hereditary, occurring often in several members of one family; it has been found also in the descendants of parents nearly related to each other, and it is common among deaf-mutes. In many cases no cause can be assigned. Its earliest symptom is an inability to get about in the dusk (night-blindness). Then follows a gradual contraction of the field of vision, the patient feeling as if he looked through a tube, seeing objects clearly within his field in good daylight, but nothing beyond. Eventually this central vision also fails. The ophthalmoscopical appearances are symmetrical in both eyes, and are equally characteristic. At the periphery of the retina masses of black pigment are distributed in an irregularly reticulated or lace-like manner over the retina and along the retinal vessels. The disk is pale and "waxlike," and the retinal vessels are much contracted,—it may be, reduced to mere threads. As the visual field contracts the retinal pigment approaches the disk. Treatment is of little use. Galvanism has lately been recommended.

Glioma of the Retina is a tumour of excessive malignancy, arising in the retina and rapidly filling the eye, and spreading from the eye along the optic nerve to the brain, or through the sclerotic to the orbit. It occurs in young children. Thorough and early removal of the eye with the optic nerve may prevent its recurrence.

The optic nerve may be inflamed in any part of its course, within the skull, in the orbit, and within the eye. To the physician the most important of these inflammations is that of the intraocular end of the nerve or papilla, known as *Optic Neuritis* or *Papillitis* (choked disk), on account of its frequent association with tumour of the brain, of which it is one of the most diagnostic symptoms. The signs may be well marked to the ophthalmoscope before there is the slightest impairment of sight. At first the disk is seen swollen, reddened, its edge indistinct, and the veins distended and tortuous. Later, the swelling of the disk increases, obscuring the disk itself, and extending beyond its edge. The surface has a greyish appearance, streaked with reddish lines, which are enlarged blood-vessels. The retinal arteries and veins at their commencement are obscured by the exudation; at the edge of the swollen disk they bend downwards to reach the retina, over which they pursue a tortuous course, the veins being much distended. Small hæmorrhages are often seen on the disk and retina. All traces of the exudation may pass away. More usually the disk becomes atrophied, of a pale-white colour, with an indistinct margin and shrunken retinal vessels.

Papillitis of both eyes sometimes also arises from lead-poisoning or anæmia. Papillitis of one eye, with subsequent atrophy, is generally due to local injury to the nerve.

Atrophy of the Optic Nerve is sometimes primary, *i.e.*, arises without previous neuritis. In this case the disk becomes gradually of a pale-white or pale-greyish colour, its edge more than usually distinct, and the vessels may not be contracted. Primary atrophy of the optic nerve is one of the most marked symptoms of locomotor ataxia. Many of the cases where no cause is ascertainable are undoubtedly precursory to the usual symptoms of ataxy. Vision always suffers in this form more or less.

Atrophy of the disk may be secondary to glaucoma, neuritis, pigmentary retinitis, and some forms of choroiditis. When unilateral it may be due to embolism, or, if it follow an injury to the head, to fracture of the optic canal, or to a retrobulbar neuritis.

Amblyopia, Amaurosis, &c.—Amblyopia means defective sight; amaurosis, blindness without sufficient obvious cause. Such defective sight is not uncommon in a squinting eye, or one of a different refractive power from its fellow. *Tobacco amblyopia* occurs in adults from excessive tobacco-smoking, especially when combined with alcoholic excess. There is loss of visual acuteness, as tested by reading, of one-fifth to one-tenth, and green and red blindness in the centre of the field. The disk may be normal or have a muddy colour. It usually recovers under abstinence from smoking and alcohol and the use of small doses of strychnia.

Hemianopsia means loss of one-half of the visual field. It is generally bilateral and affects corresponding halves of the two retinæ, *e.g.*, the two right halves or the two left; rarely the two inner halves or the two outer are involved. The dividing line is usually vertical, or nearly so, bending so as to avoid the fixation point. It is due to some disease of the brain, or of one optic tract. (It will be remembered that each optic tract divides at the optic commissure, and supplies one-half of each retina, the right tract going to the right halves, the left to the left.)

Night-blindness without organic change may be due to exposure to bright sunlight, sleeping in moonlight, or to scurvy. Snow-blindness is a similar condition, with congestion of the eyelids and intolerance of light.

In *Hypermetropia* parallel rays falling on the eye meet in a point behind the retina. This is due in most cases to shortening of the axis of the eye (axial hypermetropia), in rarer cases to absence of the lens, and is the physiological condition, after the age of fifty-five, of all previously normal eyes, owing to diminution of the refractive power of the lens. Clear vision is obtained only when the entrant rays are focused on the retina. In the hypermetropic eye this is effected by increase in the refractive power of the lens by the action of the ciliary muscle. In slight hypermetropia this is easily accomplished, and no complaint may be made. In higher degrees the continuous severe strain on the accommodation in reading and other fine work gives rise to aching, watering, and mistiness of the eyes (accommodative asthenopia). These symptoms may first appear after an exhausting illness or prolonged strain of the eyes,—in both cases from reduction of the tone in the ciliary muscle. Convergent squint is a common symptom. In the highest degrees, where no amount of accommodation gives distinct vision, the attempt is given up, and no complaint made. In most cases the continuous use of the accommodation produces a spasm of the ciliary muscle, which renders some of the hypermetropia "latent," what remains being the "manifest" hypermetropia. Both together constitute the "total" hypermetropia. To ascertain the hypermetropia place the patient 20 feet from Snellen's test-types. If a weak convex lens makes sight no worse try stronger and stronger glasses till the best vision is obtained. This gives the "manifest" hypermetropia. If there be no improvement with convex glasses the hypermetropia may be all latent. Paralyse the accommodation by putting a drop of atropine solution and test the "total" hypermetropia. For the ophthalmoscopic tests, see below. Children with asthenopia should wear constantly glasses which nearly correct the hypermetropia. For adults it is not usually necessary to wear glasses for distant vision. For reading the manifest hypermetropia should be corrected, the strength of the glasses being increased as often as asthenopic symptoms reappear.

In *Myopia* or *Short-sight* the retina lies behind the focal point of parallel rays entering the eye; it will therefore be at the conjugate focus of some point at a definite distance from the eye,—its "far point." Objects beyond this point are seen indistinctly. Within this point and up to the "near" point objects are distinctly seen. Myopia is generally due to elongation of the posterior part of the eye, the sclerotic and choroid at the macula being thinned and bulging backwards. In severe cases the bulging is general, thinning all the coats and enlarging the eye. Myopia is highly hereditary. It rarely begins before seven, and rarely advances after twenty-five. It is always aggravated, and may be produced, by using the eyes on fine work, especially in a bad light and in a stooping position. Myopia results also from increased curvature of the cornea, as in interstitial keratitis and conical cornea.

The symptoms of myopia are well known. Distant vision is indistinct, and fine work or printed type is held near the eyes. In high degrees after reading for a time the letters seem to be blurred and to run into each other, while the eyes ache and water owing to inability of the internal recti to keep up the necessary convergence (muscular asthenopia). Divergent squint may be present. The eyes are often kept half shut (hence the name "myopia") to exclude the excess of light. Ophthalmoscopic examination often shows the "myopic crescent" at the outer side of the disk, or all round it, or at the macula. The other tests are described below. As regards treatment, all myopics should work in a good light, and not in a stooping position. If desired, concave lenses may be given for distant vision. For near vision in high myopia concave lenses not fully corrective may be given, to enable the patient to hold his work at a greater distance and to avoid stooping. If there is muscular asthenopia prisms with their bases inwards may be used to relieve the strain on the internal recti. Myopic eyes are liable to various affections,—muscæ volitantes, opacity and fluidity of vitreous, choroidal hæmorrhage, and detachment of retina.

Astigmatism is either regular or irregular. *Regular astigmatism* is due to the fact that the surfaces of the cornea and lens are not segments of spheres. The principal abnormality is in the cornea, and it is found that the meridians of greatest and least curvature (the principal meridians) are always at right angles to each other, and that the intermediate meridians pass by regular gradation from the one to the other. It is evident that rays of light from a point passing through the plane of greatest curvature will have met before those passing through the plane at right angles to it, which will form a line, that similarly the first set of rays will have crossed and will in their turn form a line by the time the second have reached their focus, and that between these two points the image will be circular or oval, but blurred. In no case will the image be a point, and hence vision will never be distinct. If one of the principal meridians be emmetropic the astigmatism is "simple"; if both be either hypermetropic or myopic it is "compound"; if one be hypermetropic and the other myopic it is "mixed."

If spherical lenses do not raise the sight of otherwise healthy eyes to the normal standard astigmatism is probable. On ophthalmoscopic examination the disk will be found oval, and altering its shape when the lens is removed from the eye; with the direct method the vessels are not seen with equal distinctness, and may pass across the field in the two principal meridians in the same direction but at different rates if the astigmatism be compound, in opposite directions in "mixed" astigmatism. If the patient look at an arrangement of radiating lines of equal thickness he will not see them all with equal distinctness. Astigmatism is corrected by neutralizing the inequality of the refractive surfaces by means of cylindrical lenses. In many cases the vision cannot be brought up to the normal standard.

There are many ways of estimating astigmatism. One method is to find by the test-types the spherical lens which gives the best distant vision; then, by means of a narrow slit in a metal disk, to find the plane in which vision is further most improved. Spherical lenses are placed in front of this slit till the one which gives the best attainable vision is found; this gives the cylindrical lens necessary for this plane. A similar inquiry is conducted with the plane at right angles to this. Spectacles are ordered compounded of the spherical lens and the two cylindrical lenses with their axes at right angles to each other.

Irregular astigmatism depends on irregularities in the surface of the cornea or in the refractive power of the lens. It can seldom be remedied.

Presbyopia.—From ten years onwards the "near" point of the eye gradually recedes, owing to increasing firmness of the lens and probably diminishing power in the ciliary muscle. Presbyopia has been arbitrarily fixed as commencing when the near point recedes to 9 inches, because then discomfort in reading is generally complained of. In normal eyes it begins about forty, in hypermetropia earlier, and in myopia later. There is no increased difficulty in seeing distant objects, but ordinary type has to be held inconveniently far away. The treatment consists in giving glasses to enable the patient to read at 9 inches. In practice it is usually sufficient to enable him to read at 12 inches' distance. As age advances the presbyopia increases, and it is necessary from time to time to increase the strength of the spectacles.

Paralysis of the Accommodation is not uncommon after diphtheria; it forms one of the symptoms of paralysis of the third nerve.

Spasm of the Accommodation is common in hypermetropia, and is sometimes present in the opposite condition of myopia.

In strabismus the two eyes are not directed to the same point in space. The deviation may be inwards or outwards, downwards or upwards,—the first two forms being by far the most common. *Inward* or *Convergent Strabismus* is due either (1) to paralysis of the external rectus muscle or (2) to over-development of the interni. (1) *Paralytic convergent squint* is the result of some affection of the sixth nerve or its nerve-centre, owing generally either to syphilis or to nervous exhaustion. It varies in amount from slight weakness to complete paralysis of the muscle. When the paralysis is complete the eye is turned inwards and cannot be moved outwards beyond the middle of the fissure of the eyelids. In minor degrees, where the deformity is not so evident, it may be difficult to tell which is the squinting eye. If the patient be told to look at an object held a short distance in front of him, and a piece of ground glass be placed before the squinting eye, neither eye will move; if the sound eye now be covered the squinting eye will turn outwards to fix the object, while the sound eye will move a greater distance inwards; the "secondary" is greater than the "primary" squint. The reason of this is that the nerve to the paralysed externus and that to the sound internus of the other eye, which work together, both receive the same stimulus from the will, and that the sound muscle acts more strongly than the other. Owing to the displacement of the yellow spot double vision is produced, the false image being projected towards the side of the paralysed muscle (homonymous diplopia). The diplopia is always most distressing, and may cause giddiness when the strabismus is slight. The treatment consists in the use of iodide of potassium in the syphilitic, and in nervine tonics in the neurasthenic cases. The muscle may be faradised to keep up its tone. In bad cases tenotomy of the internal rectus may be necessary. The squinting eye may be covered to prevent the diplopia. (2) *Convergent strabismus from over-development of the internal recti* ("concomitant" strabismus) is almost always due to hypermetropia. Its production depends on the intimate relation between accommodation and convergence, every degree of the one evoking a constant quantity of the other, so that normally the two eyes are converged upon the object accommodated for. In hypermetropia clear vision needs an excess of accommodation which in its turn produces an excess of convergence, so that the two eyes meet in a point nearer than that looked at; they squint, in short. The eyes may squint only during accommodation for a near object (periodic squint), but generally the internal recti become so developed as to produce a constant convergence. If either eye is used indifferently for vision the squint is "alternating." Generally one eye is habitually used, the sight in the other eye becoming defective. The amount of squint bears no ratio to the amount of hypermetropia, being frequently absent in the higher degrees where accommodation fails to give clear sight and is not exercised. Double vision does not occur, because the image of the squinting eye is unconsciously suppressed.

In periodic squint glasses to correct the hypermetropia ought to be given. For permanent squint division of the tendons of one or both internal recti muscles is necessary. The operation diminishes the power of these muscles by allowing them to become attached to the globe farther back. Care must be taken not to produce too great an effect, it being preferable rather to leave a little convergence.

In rare cases myopia is associated with convergent squint.

Divergent Strabismus arises from weakness of the internal rectus, as in myopia. In the condition known as muscular asthenopia it is present only after a prolonged effort of convergence. It arises also where the sight is defective, as with corneal opacities, or from unskilful operation for convergent squint. It can generally be improved by tenotomy of the external and "advancement" of the internal rectus muscle.

In paralysis of the superior oblique muscle the deviation is slight. Owing to interference with the movement downward and outward, double vision is present when the eyes are directed below the horizontal line.

Paralysis of the Third Nerve causes ptosis, loss of accommodation, and dilatation of the pupil, and the eye can be moved only slightly downwards and outwards. All the branches are seldom affected alike.

Ophthalmia Tarsi (blepharitis) is a chronic inflammation of the follicles of the eyelashes and their glands, attacking strumous children, especially after measles. The edges of the lids are covered with small scabs, which gum the lashes into pencils; when the scabs are removed small freely-bleeding ulcers are exposed. The conjunctiva is also reddened. Eventually the lashes either fall out or become misdirected, the border of the lids looks thickened and bald, and the eyes continually water from eversion of the orifice of the tear-duct. The scabs must be removed daily by means of an alkaline lotion, and a weak mercurial ointment applied to the lids. In bad cases the lashes must be pulled out, and the ulcers touched with nitrate of silver.

A *Stye* is an abscess in a Meibomian gland, or in the cellular tissue of the lid. Styes are apt to occur in crops, and generally point to some derangement of health. They should be poulticed till the matter points, then opened with a lancet. Tonics are needed internally.

Chalazion is a cyst in a Meibomian gland. It forms a small pea-sized painless swelling under the skin of the lid. It should be opened from the conjunctival surface and its contents expressed.

Epithelioma (rodent ulcer) occurs in old people, grows slowly, forming a hard irregular mass, with an ulcerated surface covered by scabs; it may extend in all directions, destroying the tissues it reaches. The treatment consists in complete removal by the knife or chloride of zinc paste.

The lacrymal gland sometimes suppurates, and must be treated like any other abscess. Most of the diseases of this system arise in the punctum, canaliculi, lacrymal sac, or nasal duct, and all cause overflow of tears on the cheek. The punctum may be everted, from disease of the conjunctiva, paralysis of the facial nerve, or the dragging of a scar in the cheek. The canaliculus may be constricted or obliterated. The nasal duct may be obstructed from chronic disease of its mucous membrane or bony wall. The result of this is the retention of tears in the lacrymal sac, then the formation by distension of this sac of a small tumour at the inner angle of the eye, from which first clear mucus, and possibly, at a later period, also pus may be pressed back into the eye. Finally, if the case is neglected an abscess may form which may burst externally and cause a troublesome fistula. The treatment in the first place must be the dilatation of the stricture. The canaliculus is first slit on its conjunctival surface along its whole length, then successively larger probes are passed through the stricture. Abscesses when formed must be opened, and when inflammation has subsided the stricture dilated. The sac may be washed with astringent solutions. When the stricture is due to bone-disease its cure is not hopeful.

Blows may rupture the coats of the eye,—the sclerotic and underlying coats being generally injured. Hæmorrhage takes place between the coats and into the chambers of the eye. The eye may be removed at once; if any perception of light remain, the excision should be delayed to see if there be any chance of the eye being saved. Usually the eye shrinks and becomes quite useless.

Blows may cause damage to the interior of the eye without injuring the outer coats. There may be hæmorrhage into the anterior or the posterior chamber,—the latter a most serious condition, seldom completely recovered from. The choroid may be ruptured, the lens dislocated, or the iris torn from part of its ciliary attachment; and the retina is not seldom detached from the choroid.

Wounds.—Small foreign bodies—bits of steel, &c.—are often impacted in the cornea. They should be removed as soon as possible, as they give rise to great pain, and may seriously injure the cornea. If there is much after-irritation atropine should be used freely to the eye.

Burns with caustic alkalis and acids or molten lead are common. When seen the whole conjunctiva should be carefully freed from all of the irritant. If lime has been the cause, a weak acid lotion should be used. Then oil should be dropped into the conjunctival sac, and any inflammatory symptoms treated as they arise. If the epithelial layer of the cornea only has been destroyed, it often clears to a wonderful extent; but deeper injuries may cause severe ulcerative inflammation of the cornea, and the conjunctiva may slough in part, with ultimate formation of a scar binding the lid to the eye (symblepharon).

Penetrating Wounds.—Such wounds of the cornea and sclerotic, if only the foreign body be not in the eye, generally do well. Usually some of the deeper structures are involved, and these cases are always very serious. The eye may be rapidly lost from general inflammation, or if not it may become completely blind. In almost any case, especially where the wound is in the ciliary region, the other eye is apt to be sympathetically involved. If the injured eye therefore is blind, and if there is inflammation in the ciliary region, it must be at once excised. If the eye be not blind, the ciliary region quiet, and no foreign body in the lens or vitreous humour, the eye may be preserved,—the danger of involvement of the other eye being put before the patient. In such cases it is impossible to lay down any general rules. Each case must be judged on its own merits by the ophthalmic surgeon.

Use of the Ophthalmoscope.

The ophthalmoscope consists of a small mirror with a small aperture in the centre. Most instruments have now in addition a series of concave and convex lenses arranged on a disk so that they can be brought successively behind the central perforation. A large lens of about 3-inch focus is also required.

Rays of light entering the eye in any given direction are reflected by the choroid along the same direction. Ordinarily, therefore, the fundus cannot be seen, because an eye so placed as to see the emerging rays intercepts the entrant ones. The ophthalmoscope, by placing the source of light in front of the observer's eye, enables it to see and examine the interior of the other eye.

There are two methods of examination,—the indirect and the direct. (1) The *indirect* method, which forms a real, inverted, and slightly magnified image in front of the observed eye, may be illustrated thus. Place a convex lens of 2-inch focus in front of this page, and let these represent crystalline lens and retina respectively. Place now a second similar lens in front of the first, and the print will be seen inverted and slightly magnified. (2) The *direct* method forms a virtual, erect, much magnified image. Place one of the above lenses within 2 inches of the page and your own eye close to it. The letters will appear erect and enlarged.

To use the ophthalmoscope,—place the patient in a dark room, with a lamp to one side of and a little behind the head. If the indirect method is to be employed, sit in front of the patient, with the mirror in your right hand before your right eye, the large lens in your left. Reflect the light from a distance of about 2 feet into one of the eyes, and when you see a red reflexion place the lens in front of it, and you will obtain the inverted image of the fundus. (A) Begin your examination with the optic disk by telling the patient to direct the observed eye a little inwards. Note the following points:—(*a*) the colour of the disk, normally a yellowish pink, but varying considerably owing to tint of surrounding choroid, &c.; (*b*) a paler spot in its centre, which may be due to the funnel-shaped expansion of the nerve, the *physiological cup*; (*c*) the distinctness of the edge (spots of black pigment here are of no importance); (*d*) when the lens is removed from the eye the image of the disk remains of the same size if the eye is emmetropic, becomes smaller if the eye is hypermetropic, and larger if it is myopic, and alters in shape if there is astigmatism. (B) The retinal vessels appear as red lines, the arteries paler and about two-thirds the size of the darker veins. They arise in the centre of the disk, run usually in pairs, branching as they pass over the retina. Note their light central streak, their amount of tortuosity, and the presence or absence of white lines by their side. (C) Note the usually uniform redness of the choroid. In light-haired and dark-haired persons the vessels appear as dark or light red bands on the general red ground. (D) The yellow spot is indicated either by a deeper redness of the choroid or by a bright yellow spot surrounded by a shifting white halo.

By the direct method the mirror is used without the large lens,—if necessary, one of the smaller lenses being placed behind the central perforation. (A) Examine the crystalline lens (see "cataract" above). (B) Opacities in the vitreous humour are detected as moving bodies when the eye is moved about and then brought to a standstill. (C) Ascertain the refraction. The eye is ametropic if the vessels are seen distinctly at more than 18 inches' distance. It is hypermetropic if the observer on moving his head finds the vessels moving in the same direction; myopic if they go the opposite way. To measure the amount of ametropia needs practice and power of the observer to relax his accommodation completely. Rays leaving the hypermetropic eye are divergent; to be seen clearly by the observer they must be rendered parallel. The strongest convex lens, therefore, which, placed behind the central aperture, gives a clear image of the fundus is the measure of the hypermetropia. Similarly the lowest concave lens with clear image indicates the amount of myopia. (D) To examine the details of the fundus, the mirror is approached closely to the observed eye.

Retinoscopy.—The observer sitting at a distance of 4 feet from the patient reflects the light into his eye, after dilating the pupil with atropine, and rotates the mirror slightly. A shadow will be seen to cross the pupil,—in myopia of more than 1D ($\frac{1}{40}$) in the same direction as the rotation, in all other cases in the opposite direction. This method is useful in determining and correcting the refraction where the patients are too young or too stupid to assist with their answers. (A. BR.)

OPIE, Amelia (1769-1853), the wife of John Opie, noticed below, was the daughter of Dr Alderson, a physician in Norwich, and was born there in 1769. The circumstances of her early life gave the bent to her after-career. In her girlhood she beguiled the solitude of her father's summerhouse by composing songs and tragedies; on her visits to London the superior society into which the accomplishments of her mind and the graces of her person introduced her served to stimulate her aspirations; and after her marriage in 1798 she was encouraged by her husband to become a candidate for literary fame. Accordingly, in 1801 she published a novel entitled *Father and Daughter*. Although this tale showed no artistic ability in dealing either with incidents or with characters, yet it was the work of a lively fancy and a feeling heart, and speedily brought its author into notice. She was encouraged to publish a volume of sweet and graceful poems in 1802, and to persist in the kind of novel-writing which she had so successfully commenced. *Adeline Mowbray* followed in 1804, and *Simple Tales* in 1806. The death of her husband in 1807 and her return to Norwich did not slacken her industry. She published *Temper* in 1812, *Tales of Real Life* in 1813, *Valentine's Eve* in 1816, *Tales of the Heart* in 1818, and *Madeline* in 1822. At length, in 1825, her assumption of the tenets and garb of the Quakers checked her literary ardour and changed her mode of life. Beyond a volume entitled *Detraction Displayed*, and several contributions in prose and verse to various periodicals, nothing afterwards proceeded from her pen. The rest of her life was spent in travelling and in the exercise of Christian benevolence. She died at Norwich in 1853. A *Life* of Mrs Opie, by Miss C. L. Brightwell, was published in 1854.

OPIE, John (1761-1807), historical and portrait painter, was born at St Agnes near Truro in May 1761. He early showed a taste for drawing, and for scholarship also, having at the age of twelve mastered Euclid and opened an evening school for arithmetic and writing. Before long he won some local reputation by portrait-painting; and in 1780 he started for London, under the patronage of Dr Wolcot (Peter Pindar), who hoped to win credit, and still more substantial benefits, from the fame of his young protégé. Opie was introduced to the town as "The Cornish Wonder," a self-taught genius. The world of fashion, ever eager for a new sensation, was attracted; the carriages of the wealthy blocked the street in which the painter resided, and for a time he reaped a rich harvest by his portraits. But soon the fickle tide of popularity flowed past him, and the painter was left neglected. He now applied himself with redoubled diligence to correcting the defects which marred his art, meriting the praise of his rival Northcote—"Other artists paint to live; Opie lives to paint." At the same time he sought to supplement his early education by the study of Latin and French and of the best English classics, and to polish the rudeness of his provincial manners by mixing in cultivated and learned circles. In 1786 he exhibited his first important historical subject, the Assassination of James I., and in the following year the Murder of Rizzio, a work whose merit was recognized by the artist's immediate election as associate of the Academy, of which he became a full member in 1788. He was employed on five subjects for Boydell's "Shakespeare Gallery"; and until his death, on the 9th of April 1807, his practice alternated between portraiture and historical work. His productions are distinguished by breadth of handling and a certain rude vigour, individuality, and freshness. They are wanting in grace, elegance, and poetic feeling. Opie is also favourably known as a writer on art by his *Life of Reynolds* in Wolcot's edition of Pilkington, his *Letter on the Cultivation of the Fine Arts in England*, in which he advocated the formation of a national gallery, and his *Lectures* as professor of painting to the Royal Academy, which were published in 1809, with a memoir of the artist by his widow.

OPITZ, Martin. See Germany, vol. x. p. 530.

OPIUM (*ὄπιον*, dim. from *ὀπός*, juice), a narcotic drug prepared from the juice of the opium poppy, *Papaver somniferum*, L., a plant probably indigenous in the south of Europe and western Asia, but now so widely cultivated that its original habitat is uncertain. The medicinal properties of the juice have been recognised from a very early period. It was known to Theophrastus by the name of *μηκώνιον*, and appears in his time to have consisted of an extract of the whole plant, since Dioscorides about 77 A.D. draws a distinction between *μηκώνειον*, which he describes as an extract of the entire herb, and the more active *ὀπός*, derived from the capsules alone. From the 1st to the 12th century the opium of Asia Minor appears to have been the only kind known in commerce. In the 13th century *opium thebaicum* is mentioned by Simon Januensis, physician to Pope Nicholas IV., while *meconium* was still in use. In the 16th century opium is mentioned by Pyres (1516) as a production of the kingdom of Cous (Kuch Behar, south-west of Bhutan) in Bengal and of Malwa.[1] Its introduction into India appears to have been connected with the spread of Islam. The opium monopoly was the property of the Great

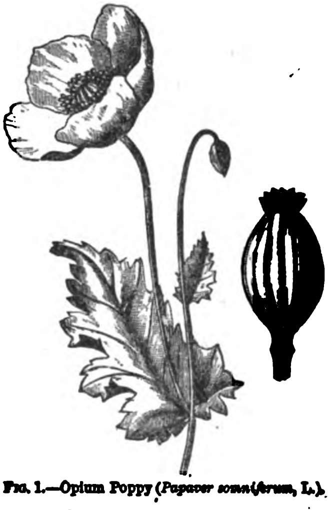

Fig. 1.—Opium Poppy (*Papaver somniferum*, L.).

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[1] *Aromatum Historia*, ed. Clusius, Ant., 1574.

Mogul and was regularly sold. In the 17th century Kaempfer describes the various kinds of opium prepared in Persia, and states that the best sorts were flavoured with spices and called "theriaka." These preparations were held in great estimation during the Middle Ages, and probably supplied to a large extent the place of the pure drug. Opium is said to have been introduced into China, probably by the Arabs (1280-95), during the reign of Taitsu, and its use seems to have temporarily ceased in 1368. It appears to have been commonly used in that country as a medicine before the trade with India commenced.[1] In a Chinese herbal compiled more than two centuries ago both the plant and its inspissated juice are described, together with the mode of collecting it, and in the *General History of the Southern Provinces of Yunnan*, revised and republished in 1736, opium is noticed as a common product. Up to this date, however, it was imported in comparatively small quantity by the Chinese solely as a remedy for dysentery, diarrhœa, and fevers, and was usually brought from India by junks as a return cargo. In the year 1757 the monopoly of opium cultivation passed into the hands of the East India Company through the victory of Clive at Plassey. Up to 1773 the trade with China had been in the hands of the Portuguese, but the quantity annually exported to that country rarely exceeded 200 chests. In that year the East India Company took the trade under their own charge, and in 1776 the annual export reached 1000 chests, and 4054 chests in 1790. Although the importation was forbidden by the Chinese emperor Keaking in 1796, and opium-smoking punished with severe penalties, which were ultimately increased to transportation and death, the trade continued and had increased during 1820-30 to 16,877 chests per annum. In 1839 a proclamation was issued threatening hostile measures if the English opium ships serving as depôts were not sent away. The demand for removal not being complied with, 20,291 chests of opium (of 149½ ℔ each), valued at £2,000,000, were destroyed by the Chinese commissioner Lin; but still the British sought to smuggle cargoes on shore, and some outrages committed on both sides led to an open war, which was ended by the treaty of Nanking in 1842 (see CHINA, vol. v. p. 651). From that time to the present, in spite of the remonstrances of the Chinese Government, the exportation of opium from India to China has continued, having increased from 52,925 piculs (of 133⅓ ℔) in 1850 to 96,839 piculs in 1880. It appears to be certain, however, that, while the court of Peking was endeavouring to suppress the foreign trade in opium from 1796 to 1840, it did not or could not put a stop to the home cultivation of the drug, since a Chinese censor in 1830 represented to the throne that the poppy was grown over one-half of the province of Chekeang, and in 1836 another, Cho Tsun, stated that the annual produce of opium in Yunnan could not be less than several thousand piculs. At present it is estimated that south-western China, including Szechuen, produces not less than 224,000 piculs, while the entire import from India does not exceed 100,000 piculs. Opium is now produced in nine out of the eighteen provinces of China. The comparative cheapness of the Chinese opium, the lighter duties levied upon it, and the increasing care taken in its cultivation are enabling it to compete successfully with the Indian drug even in eastern China, where, however, it has hitherto been chiefly used to mix with and cheapen the foreign article. A time is confidently anticipated by the Chinese when Indian opium will be entirely supplanted by the native drug. See *Commercial Reports*, China, No. 2 (1881), p. 138.

The amount of opium imported into Great Britain in 1861, 1871, and 1881 was 284,005, 591,466, and 793,146 ℔ respectively, and the exports for the same years 290,120, 307,399, and 401,883 ℔.

Production and Commerce.—Although the collection of opium is possible in all places where there is not an excessive rainfall and the climate is temperate or subtropical, the yield is smaller in temperate than in tropical regions, and the industry can only be profitably carried on where labour and land are sufficiently cheap and abundant; hence production on a large scale is limited to comparatively few countries. The varieties of poppy grown, the mode of cultivation adopted, and the character of the opium produced differ so greatly that it will be convenient to consider the opiums of each country separately.

Turkey.—The poppy cultivated in Asia Minor is the variety *glabrum*, Boissier, distinguished by the sub-globular shape of the capsule and by the stigmata or rays at the top of the fruit being ten or twelve in number. The flowers are usually of a purplish colour, but are sometimes white, and the seeds, like the petals, vary in tint from dark violet to white. The cultivation is carried on, both on the more elevated and lower lands, chiefly by peasant proprietors. A naturally light and rich soil, further improved by manure, is necessary, and moisture is indispensable, although injurious in excess, so that after a wet winter the best crops are obtained on hilly ground, and in a dry season on the plains. The land is ploughed twice, the second time crosswise, so that it may be thoroughly pulverized; and the seed, mixed with four times its quantity of sand, to prevent its being sown too thickly, is scattered broadcast, about ¾ to 1 ℔ being used for every toloom (1600 square yards). The crop is very uncertain owing to droughts, spring frosts, and locusts, and, in order to avoid a total failure and to allow time for collecting the produce, there are three sowings at intervals from October to March,—the crops thus coming to perfection in succession. But notwithstanding these precautions quantities of the drug are wasted when the crop is a full one, owing to the difficulty of gathering the whole in the short time during which collection is possible. The first sowing produces the hardiest plants, the yield of the other two depending almost entirely on favourable weather. In localities where there is hoar frost in autumn and spring the seed is sown in September or at latest in the beginning of October, and the yield of opium and seed is then greater than if sown later. After sowing, the land is harrowed, and the young plants are hoed and weeded, chiefly by women and children, from early spring until the time of flowering. In the plains the flowers expand at the end of May, on the uplands in July. At this period gentle showers are of great value, as they cause an increase in the subsequent yield of opium. The petals fall in a few hours, and the capsules grow so rapidly that in a short time—generally from nine to fifteen days—the opium is fit for collection. This period is known by the capsules yielding to pressure with the fingers, assuming a lighter green tint, and exhibiting a kind of bloom called "cougak," easily rubbed off with the fingers; they are then about 1½ inches in diameter. The incisions are made by holding the capsule in the left hand and drawing a knife two-thirds round it, or spirally beyond the starting-point (see fig. 2, *a*, p. 790), great care being taken not to let the incisions penetrate to the interior lest the juice should flow inside and be lost. (In this case also it is said that the seeds will not ripen, and that no oil can be obtained from them.) The operation is usually performed after the heat of the day, commencing early in the afternoon and continuing to nightfall, and the exuded juice is collected the next morning. This is done by scraping the capsule with a knife and transferring the concreted juice to a poppy-leaf held in the left hand, the edges of the leaf being turned in to avoid spilling the juice, and the knife-blade moistened with saliva by drawing it through the mouth after every alternate scraping to prevent the juice from adhering to it. When as much opium has been collected as the size of the leaf will allow, another leaf is wrapped over the top of the lump, which is then placed in the shade to dry for several days. The pieces vary in size from about 2 oz. to over 2 ℔, being made larger in some districts than in others. The capsules are generally incised only once, but the fields are visited a second or third time to collect the opium from the poppy-heads subsequently developed by the branching of the stem. The yield of opium varies, even on the same piece of land, from ½ to 7½ chequis (of 1·62 ℔) per toloom (1600 square yards), the average being 1½ chequis of opium and 4 bushels (of 50 ℔) of seed. The seed, which yields 35 to 42 per cent. of oil, is worth about two-thirds of the value of the opium. The whole of the operation must, of course, be completed in the few days—five to ten—during which the capsules are capable of yielding the drug. A cold wind or a chilly atmosphere at the time of collection lessens the yield, and rain washes the opium off the capsules. Before the crop is all gathered in a meeting of buyers and sellers takes place in each district, at which the price to be asked is discussed and settled, and the opium handed to the buyers, who in many instances have advanced money on the standing crop. When sufficiently solid the pieces of opium are packed in cotton bags, a quantity of the fruits of a species of *Rumex* being thrown in to prevent the cakes from adhering together. The bags are then sealed up, packed in oblong or circular baskets, and sent to Smyrna or other ports on mules. On the arrival of the opium at its destination, in the end of July or beginning of August, it is placed in cool warehouses to avoid loss of weight until sold. When transferred to the buyer's warehouses the bags are opened and each piece is examined by a public inspector in the presence of both buyer and seller, the quality of the opium being judged by appearance, odour, colour, and weight. It is then sorted into three qualities:—(1) finest quality; (2) current or second; (3) chicanti or rejected pieces. A fourth sort consists of the very bad or wholly factitious pieces. The substances used to adulterate opium are grape-juice thickened with flour, fig-paste, liquorice, half-dried apricots, inferior gum tragacanth, and sometimes clay or pieces of lead or other metals. The chicanti is returned to the seller, who disposes of it at 20 to 30 per cent. discount to French and German merchants for the manufacture of morphia. After inspection the opium is hermetically sealed in tin-lined boxes containing about 150 lb. Turkey opium is principally used in medicine on account of its purity and the large percentage of morphia that it contains, a comparatively small quantity being exported to China.

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[1] Mr R. Saunders of Ghazipur suggests (*Pharm. Journ.*, [3], iv. p. 652) that it was introduced from Nepal and afterwards supplied by the Dutch, who purchased the drug for export long before the East India Company held possessions in India.

A number of varieties exist in commerce, differing in certain qualities, and, to a certain extent, in external character. These are generally exported under the names of the districts where they are prepared, but are more generally known in English commerce by the name of the port from which they are shipped. Thus, Constantinople opium includes the produce of Bogaditz, Karahissar Sahib, Kutchaya, Balukhissar, Kurkagatsch, Ghéve, Beybazar, Angora, Malatia, and Tokat, as well as Macedonian opium from Salonica. Smyrna opium comprises opium from Afium Karahissar, Ushak, Akhissar, Tanshauli, Isbarta, Koniyeh, Bulladan, Hamid, and Magnesia, and the Yerli[1] varieties. In English commerce these are roughly divided into shipping, druggist's, and manufacturer's opium.

Shipping opium includes varieties of a pale or yellowish colour internally, of a soft consistence, and free from poppy débris, &c., or "chaff," as it is technically called. Such opium affords a large amount of extract, and leaves very little insoluble residue when dissolved in water, and on this account is preferred in countries where opium-smoking or eating is practised. The principal varieties used for this purpose are Malatia (including that of Kharput), Tokat, Salonica, Balukhissar (including the produce of Kurkagatsch), Bogaditz, and the finest qualities of Angora and Yerli. The chief markets are China, Peru, the West India Islands, British Guiana, and Brazil; and the United States also purchase the same kinds for reshipment.

Druggist's opium includes the varieties purchased for use in medicine in European countries and the United States. It is generally of firmer consistence and rather darker colour than shipping opium. The finest varieties of this kind in English commerce are Beybazar, Yerli, Karahissar (including Adet, Amasia, and Akhissar opiums), "Current" Smyrna, and Angora. Ushak, Yerli, and Karahissar opiums are purchased chiefly for the American market, and the Ghéve or Ismid opium for the Continental.

Manufacturer's opium includes chicanti or low-priced qualities of all varieties, and is used only for the manufacture of morphia. Persian opium is used for this purpose when Turkey opium is dear.

Malatia opium usually occurs in pieces of irregular shape, weighing from 1½ to 3 lb, and about 1½ to 2 inches thick, the "paste" or substance being soft and pale and remarkably free from foreign matter or "chaff," and the exterior being covered with a bright bluish green leaf; the paste of Tokat is similar, but usually of thinner consistence and darker colour. Bogaditz opium is met with in smaller pieces, usually 2 to 3 oz., and is covered with a yellowish green leaf, the surface being rough with *Rumex* fruit. Occasionally, however, pieces are met with from 1 to 1½ lb in weight, still more rarely up to 4 lb in weight, approaching more nearly to the Balukhissar and Kurkagatsch varieties, which are usually similar to the Bogaditz, but in larger pieces. Karahissar opium is in rather large conical lumps; formerly the pieces frequently bore the impress of a poppy-head pressed into the top. The Adet, Akhissar, and Amasia opiums are very similar in appearance, and usually pass under the name of Karahissar. Angora opium usually occurs in small pieces carelessly prepared, so as to be rough and unsightly in appearance although of good quality. Occasionally samples of good colour, soft consistency, and excellent quality are met with, and these are always used as shipping opium. Yerli is a fine pasty or gummy opium, with a rough surface and with much *Rumex* fruit adhering to it. Ghéve or Ismid[2] opium is usually in small rounded cakes, weighing about 2 to 3 oz. in weight. The pieces, known in trade as "Constantinople pats," have a smooth shining appearance, with the midrib of the poppy-leaf they are wrapped in forming a median line on the surface. The interior often shows layers of light and dark colour. Yoghourma is a very inferior opium, and, as its name implies, is "remade" or made up at the port of shipment. It is usually sold to morphia manufacturers at a price determined by analysis.

In Macedonia opium culture was commenced in 1865 at Istip, with seed obtained from Karahissar in Asia Minor, and has since extended to the adjacent districts of Kotchava, Stroumnitza, Tikvish, and Kinprulu-veles. The crop in 1882 was 135,000 lb of opium and 500,000 to 600,000 lb of seed, most of the drug being exported under the name of Salonica opium to Great Britain at prices ranging from 12s. 6d. to 16s. per lb. Macedonian opium, especially that produced at Istip, is very pure, yielding about 11 per cent. of morphia, and is considered equal to the Malatia produce. The Turkish Government encourage the development of the industry by remitting the tithes on opium and poppy-seed for one year on lands sown for the first time, and by distributing printed instructions for cultivating the poppy and preparing the opium. In these directions it is pointed out that the opium crop is ten times as profitable as that of wheat. Four varieties of poppy are distinguished,—two with white flowers, large oval capsules without holes under their "combs" (stigmas), and bearing respectively yellow and white seed, and the other two having red or purple flowers and seeds of the same colour, one bearing small capsules perforated at the top, and the other larger oval capsules not perforated. The white varieties are recommended as yielding a more abundant opium of superior quality. The yellow seed is said to yield the best oil; that obtained by hot pressure is used for lamps and for paint, and the cold-pressed oil for culinary purposes.

Opium is also grown in Bulgaria, but almost entirely for home consumption; any surplus produce is, however, bought by Jews and Turks at low prices and sent to Constantinople, where it is sold as Turkish opium. It is produced in the districts of Kustendil, Lowtscha, and Halitz, and is made into lumps weighing about 4 oz., of a light-brown colour internally, and containing a few seeds; it is covered with leaves which have not been identified. Samples that have been analysed by Herr Theegarten have yielded from 7 to 19 per cent. of morphia, and only 2 to 3 per cent. of ash, and are therefore of excellent quality.

India.—The poppy grown in India is generally the same as that used in Persia, but in the Himalayas a red-flowered variety with black seeds is met with. The largest amount of opium is produced in the central tract of the Ganges, extending from Dinajpur in the east to Agra in the west, and from Gorakhpur in the north to Hazaribagh in the south, and comprising an area of about 600 miles long by 200 broad. The region next in importance consists of the tableland of Malwa and the slopes of the Vindhya Hills in Indore.

The opium industry in Bengal is a Government monopoly, and the districts are divided into two agencies, Behar and Benares, which are under the control of officials residing respectively at Patna and Ghazipur. In 1883 468,829 acres were under poppy cultivation in the Behar agency, and 412,625 in that of Benares. Any one who chooses may undertake the industry, but cultivators are obliged to sell the opium exclusively to the Government agent at a price fixed beforehand by the latter, which is approximately 3s. 6d. per lb, the Government selling it at about 11s. per lb. The peasant is, however, said to be fully remunerated by the price he receives. It is considered that with greater freedom the cultivator would produce too great a quantity, and loss to the Government would soon result. Advances of money are often made by the Government to enable the ryots to grow the poppy.

In Malwa the cultivation is free and extremely profitable, the crop realizing usually from three to seven times the value of wheat or other cereals, and in exceptionally advantageous situations from twelve to twenty times as much. On its entering British territory a heavy duty is imposed on Malwa opium, so as to raise its price to an equality with the Government article. The tax was formerly collected at Indore only, but since other stations have been made at Ujjain, Jaora, and Udaipur the export has increased to 500 chests a month. Malwa opium is shipped from Bombay.[3]

The area under poppy cultivation outside these districts is comparatively small, but it appears to be increasing throughout the plains of the Punjab. The poppy is grown for opium, according to Stewart (*Punjaub Plants*, Lahore, 1869, p. 10), in the valley of the Bias east of Lahore. It is cultivated up to 7500 feet above sea-level, the opium of Kulu in this district being considered of excellent quality. In Nepal, Bashahr, and Rampur, and at Doda Kashtwar in the Jammu territory, opium is produced and exported to Yarkand, Khotan, Aksu, and various Chinese provinces.

The land intended for poppy culture is usually selected near villages, in order that it may be more easily manured and irrigated. On a rich soil a crop of maize or vegetables is grown during the rainy season, and after its removal in September the ground is prepared for the poppy-culture. Under less favourable circumstances the land is prepared from July till October by ploughing, weeding, and manuring. The seed is sown between the 1st and 15th of November, and germinates in ten or fifteen days. The fields are divided for purposes of irrigation into beds about 10 feet square, which usually are irrigated twice between November and February, but if the season be cold, with hardly any rain, the operation is repeated five or six times. When the seedlings are 2 or 3 inches high they are thinned out and weeded. The plants during growth are liable to injury by severe frost, excessive rain, insects, fungi, and the growth of a root-parasite (*Orobanche indica*). The poppy blossoms about the middle of February, and the petals when about to fall are collected for the purpose of making "leaves" for the spherical coverings of the balls of opium. These are made by heating a circular-ridged earthen plate over a slow fire, and spreading the petals, a few at a time, over its surface. As the juice exudes, more petals are pressed on to them with a cloth until a layer of sufficient thickness is obtained. The leaves are forwarded to the opium-factories, where they are sorted into three classes, according to size and colour, the smaller and dark-coloured being reserved for the inside of the shells of the opium-balls, and the larger and least coloured for the outside. These are valued respectively at 10 to 7 and 5 rupees per maund of 82$\frac{2}{7}$ lb. The collection of opium commences in Behar about 25th February, and continues to about 25th March, but in Malwa is performed in March and April. The capsules are scarified vertically (fig. 2, *b*) in most districts (although in some the incisions are made horizontally, as in Asia Minor), the "nushtur" or cutting instrument being drawn twice upwards for each incision, and repeated two to six times at intervals of two or three days. The nushtur (fig. 2, *c*) consists of three to five flattened blades forked at the larger end, and separated about one-sixteenth of an inch from each other by winding cotton thread between them, the whole being also bound together by thread, and the protrusion of the points being restricted to one-twelfth of an inch, by which the depth of the incision is limited. The operation is usually performed about three or four o'clock in the afternoon, and the opium collected the next morning. In Bengal a small sheet-iron scoop or "seetoah" is used for scraping off the dried juice, and, as it becomes filled, the opium is emptied into an earthen pot carried for the purpose. In Malwa a flat scraper is employed, a small piece of cotton soaked in linseed oil being attached to the upper part of the blade, and used for smearing the thumb and edge of the scraper to prevent adhesion of the juice; sometimes water is used instead of oil, but both practices injure the quality of the product. Sometimes the opium is in a fluid state by reason of dew, and in some places it is rendered still more so by the practice adopted by collectors of washing their scrapers, and adding the washings to the morning's collection. The juice, when brought home, is consequently a wet granular mass of pinkish colour, from which a dark fluid drains to the bottom of the vessel. In order to get rid of this fluid, called "pasewa" or "pussewah," the opium is placed in a shallow earthen vessel tilted on one side, and the pussewah drained off. The residual mass is then exposed to the air in the shade, and regularly turned over every few days, until it has reached the proper consistence, which takes place in about three or four weeks. The drug is then taken to the Government factory to be sold. It is turned out of the pots into wide tin vessels or "tagars," in which it is weighed in quantities not exceeding 21 lb. It is then examined by a native expert (purkhea) as to impurities, colour, fracture, aroma, and consistence. To determine the amount of moisture, which should not exceed 30 per cent., a weighed sample is evaporated and dried in a plate on a metallic surface heated by steam. Adulterations such as mud, sand, powdered charcoal, soot, cow-dung, powdered poppy petals, and powdered seeds of various kinds are easily detected by breaking up the drug in cold water. Flour, potato-flour, ghee, and ghoor (crude date-sugar) are revealed by their odour and the consistence they impart. Various other adulterants are sometimes used, such as the inspissated juice of the prickly pear, extracts from tobacco, stramonium, and hemp, pulp of the tamarind and bael fruit, mahwah flowers, and gums of different kinds. The price paid to the cultivator is regulated chiefly by the amount of water contained in the drug. When received into the Government stores the opium is kept in large wooden boxes holding about 50 maunds and occasionally stirred up, if only a little below the standard. If containing much water it is placed in shallow wooden drawers and constantly turned over. During the process it deepens in colour. From the store about 250 maunds are taken daily to be manufactured into cakes.

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[1] The word *yerli* means "grown near," and is applied to opium produced in the immediate neighbourhood of Smyrna.

[2] Ghéve is the commercial name for opium from Geiveh on the river Sakaria, running into the Black Sea. It appears to find its way to Constantinople *via* the port of Ismid, and hence is known also by the latter name.

[3] In 1882-83 India exported to China and other places a total of 91,796 chests (126,789 cwts.) of opium, valued at £11,481,376.

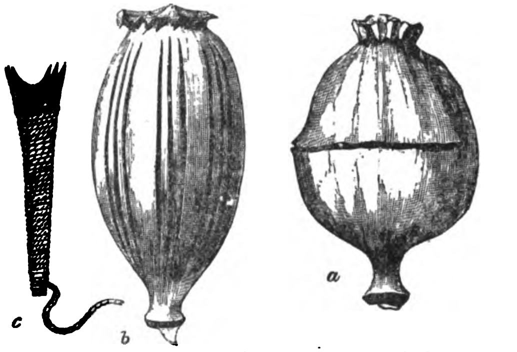

Fig. 2.—Opium Poppy Capsules, &c., $\frac{2}{3}$ natural size. *a*, capsule showing mode of incision practised in Turkey; *b*, capsule as incised in India; *c*, nushtur, or instrument used in India for making the incisions. Drawn from specimens in the Museum of the Pharmaceutical Society of Great Britain.

Various portions, each weighing 10 sers (of 2$\frac{1}{16}$ lb), are selected by test assay so as to ensure the mass being of standard consistence (70 per cent. of the pure dry drug and 30 per cent. of water), and are thrown into shallow drawers and kneaded together. The mass is then packed into boxes all of one size, and a specimen of each again assayed, the mean of the whole being taken as the average. Before evening these boxes are emptied into wooden vats 20 feet long, 3$\frac{1}{2}$ feet wide, and 1$\frac{1}{2}$ feet deep, and the opium further kneaded and mixed by men wading through it from end to end until it appears to be of a uniform consistence. Next morning the manufacture of the opium into balls commences. The workman sits on a wooden stand, with a brass cup before him, which he lines with the leaves of poppy petals before-mentioned until the thickness of half an inch is reached, a few being allowed to hang over the cup; the leaves are agglutinated by means of "lewa," a pasty fluid which consists of a mixture of inferior opium, 8 per cent. of pasewa, and the "dhoe" or washings of the vessels that have contained opium, and the whole is made of such consistence that 100 grains evaporated to dryness over a water-bath leave 53 grains of solid residue. All the ingredients for the opium-ball are furnished to the workmen by measure. When the inside of the brass cup is ready a ball of opium previously weighed is placed on the leafy case in it, and the upper half of it covered with leaves in the same way that the casing for the lower half was made, the overhanging leaves of the lower half being pressed upwards and the sphere completed by one large leaf which is placed over the upper half. The ball, which resembles a Dutch cheese in size and shape, is now rolled in "poppy trash" made from the coarsely-powdered leaves, capsules, and stalks of the poppy plant, and is placed in an earthen cup of the same size as the brass one; the cups are then placed in dishes and the opium exposed to the sun to dry for three days, being constantly turned and examined. If it becomes distended the ball is pierced to liberate the gas and again lightly closed. On the third evening the cups are placed in open frames which allow free circulation of the air. This operation is usually completed by the end of July. The balls thus made consist on the average of—

Standard opium	1	ser	7·50	chittacks.
Lewa	0	"	3·75	"
Leaves (poppy petals)	0	"	5·43	"
Poppy trash	0	"	0·50	"
	2	sers	1·18	chittacks.

The average number of cakes that can be made daily by one man is about 70, although 90 to 100 are sometimes turned out by clever workmen. The cakes are liable to become mildewed, and require constant turning and occasional rubbing in dry "poppy trash" to remove the mildew, and strengthening in weak places with fresh poppy leaves. By October the cakes are dry and fairly solid, and are then packed in chests, which are divided into two tiers of twenty square compartments for the reception of as many cakes, which are steadied by a packing of loose poppy trash.[1] Each case contains about 120 catties (about 160 lb). The chests need to be kept in a dry warehouse for a length of time, but ultimately the opium ceases to lose moisture to the shell, and the latter becomes extremely solid. This is known as "provision" opium.

For home consumption Bengal opium is prepared in a different shape, and is known as Abkari or excisable opium. It is exposed to the heat of the sun until it contains only 10 per cent. of moisture, and is then formed into square cakes of 2 lb each, which are wrapped in oiled paper, or it is made into flat square tablets. In this form it has not the aroma of the ball-opium.

The care bestowed on the selection and preparation of the drug in the Bengal opium-factories is such that the merchants who purchase it rarely require to examine it, although permission is given to open at each sale any number of chests or cakes that they may desire.

In Malwa the opium is manufactured by private enterprise, the Government levying an export duty of 600 rupees (£60) per chest. It is not made into balls but into rectangular or rounded masses, and is not cased in poppy petals. It contains as much as 95 per cent. of dry opium, but is of much less uniform quality than the Bengal drug, and, having no guarantee as to purity, is not considered so valuable. The cultivation in Malwa does not differ in any important particular from that in Bengal. The opium is collected in March and April, and the crude drug or "chick" is thrown into an earthen vessel and covered with linseed oil to prevent evaporation. In this state it is sold to itinerant dealers. It is afterwards tied up in quantities of 25 lb and 50 lb in double bags of sheeting, which are suspended to a ceiling out of the light and draught to allow the excess of oil to drain off. This takes place in seven to ten days, but the bags are left for four to six weeks until the oil remaining on the opium has become oxidized and hardened. In June and July, when the rains begin, the bags are taken down and emptied into shallow vats 10 to 15 feet across, and 6 to 8 inches deep, in which the opium is kneaded until uniform in colour and consistence and tough enough to be formed into cakes of 8 or 10 ounces in weight. These are thrown into a basket containing chaff made from the capsules. They are then rolled in broken leaves and stalks of the poppy and left, with occasional turning, for a week or so, when they become hard enough to bear packing. In October and November they are weighed and sent to market, packed in chests containing as nearly as possible 1 picul = 133⅓ lb, the petals and leaves of the poppy being used as packing materials. The production is said to amount to about 20,000 chests annually.

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[1] This is purchased from the ryots at 12 annas per maund.

The amount of opium revenue collected in India was £10,480,051 in 1881. It is a remarkable fact that the only Indian opium ever seen in England is an occasional sample of the Malwa sort, whilst the Government monopoly opium is quite unknown; indeed, the whole of the opium used in medicine in Europe and the United States is obtained from Turkey. This is in some measure due to the fact that Indian opium contains less morphia. It has recently been shown, however, that opium grown in the hilly districts of the Himalayas yields 50 per cent. more morphia than that of the plains, and that the deficiency of morphia in the Indian drug is due, in some measure, to the long exposure to the air in a semiliquid state which it undergoes. In view, therefore, of the probable decline in the Chinese demand, the cultivation of the drug for the European market in the hilly districts of India, and its preparation after the mode adopted in Turkey, viz., by drying the concrete juice as quickly as possible, might be worthy of the consideration of the British Government.

Persia.—The variety of poppy grown in Persia appears to be *P. somniferum*, var. *γ. album* (*P. officinale*, Gm.), having roundish ovate capsules. It is most largely produced in the districts of Ispahan, Shiraz, Yezd, and Khonsar, and to a less extent in those of Khorasan, Kermanshah, and Fars. The Yezd opium is considered better than that of Ispahan, but the strongest or *Theriak-e-Arabistani* is produced in the neighbourhood of Dizful and Shuster, east of the river Tigris. Good opium is also produced about Sari and Balfarush in the province of Mazanderan. The capsules are incised vertically, or in some districts vertical cuts with diagonal branches are made. The crop is collected in May and June and reaches the ports for exportation between September and January. Although the cultivation of opium in Persia was probably carried on at an earlier date than in India, Persian opium was almost unknown in England until about the year 1870, except in the form of the inferior quality known as "Trebizond," which usually contains only 0·2 to 3 per cent. of morphia. This opium is in the form of cylindrical sticks about 6 inches long and half an inch in diameter, wrapped in waxed paper. Since 1870 Persian opium has been largely exported from Bushire and Bandar-Abbas in the Persian Gulf to London, the Straits Settlements, and China. At that date the annual yield is said not to have exceeded 2600 cases; but, the profits on opium having about that time attracted attention, all available ground was utilized for this to the exclusion of cereals, cotton, and other produce. The result was a severe famine in 1871-72, which was further aggravated by drought and other circumstances. Notwithstanding the lesson thus taught, the cultivation is being extended every year, especially in Ispahan, which abounds in streams and rivers, an advantage in which Yezd is deficient. About Shiraz, Behbehan, and Kermanshah it now occupies much of the land, and has consequently affected the price and growth of cereals. The trade—only 300 chests in 1859—gradually increased until 1877, when the Persian opium was much adulterated with glucose. The heavy losses on this inferior opium and the higher prices obtained for the genuine article led to a great improvement in its preparation, and in 1880 the export had increased to 7700 chests. About five-sixths of this total finds its way to the Chinese market, chiefly by sea, although some is carried overland through Bokhara, Khokand, and Kashgar; a considerable quantity is exported by way of Trebizond and Samsun to Constantinople, and the remainder to Great Britain. The produce of Ispahan and Fars is carried for exportation to Bushire, and that of Khorassan and Kirman and Yezd partly to Bushire and partly to Bandar-Abbas. The Shuster opium is sent partly *via* Bushire to Muscat for transhipment to Zanzibar, and part is believed to be smuggled into India by way of Baluchistan and Mekran. Smaller quantities grown in Teheran, Tabriz, and Kermanshah find their way to Smyrna, where it is mixed with the local drug for the European market, the same practice being carried on at Constantinople with the Persian opium that arrives there from Samsun and Trebizond. For the Chinese market the opium is usually packed in chests containing 10½ shahmans (of 13½ lb), so that on arrival it may weigh 1 Chinese picul (= 133⅓ lb), 5 to 10 per cent. being allowed for loss by drying. At Ispahan, Shiraz, and Yezd the drug, after being dried in the sun, is mixed with oil in the proportion of 6 or 7 lb to 141 lb of opium, with the object, it is said, of suiting the taste of the Chinese,—that intended for the London market being usually free from oil.

Persian opium, as met with in the London market, occurs in several forms, the most common being that of broad rounded cones weighing 6 to 10 oz. or more, or rarely twice that size. These are packed in poppy trash, or are wrapped separately in paper, or sometimes in poppy, fig, or vine leaves. Ispahan opium also occurs in the form of parallelepipeds weighing about 16 to 20 oz.; sometimes flat circular pieces weighing about 20 oz. are met with. The opium is usually of much firmer and smoother consistence than that of Turkey, of a chocolate-brown colour and cheesy appearance, the pieces bearing evidence of having been beaten into a uniform mass previously to being made into lumps. The odour differs but slightly, except in oily specimens, from that of Turkey opium. Great care is now taken to prevent adulteration, and consequently Persian opium can be obtained nearly as rich in morphia as the Turkish drug,—on the average from 8 to 12 per cent. The greater proportion of the Persian opium imported into London is again exported, a comparatively small quantity being used, chiefly for the manufacture of morphia when Turkey opium is dear, and a little in veterinary practice. According to Dr Reveil, Persian opium usually contains 75 to 84 per cent. of matter soluble in water, and some samples contain from 13 to 30 per cent. of glucose.

China.—The variety of poppy grown in China appears to be chiefly the *P. somniferum*, *γ. album*, especially in the low lands, but red and purple varieties are also met with. The production is principally carried on in the south-western provinces of Szechuen, Yunnan, and Kweichow. It is grown to a less extent in Shanse Shense, and Shantung in the north, as well as in eastern Mongolia and north-eastern Manchuria and Shingking; but in these provinces the richest soil and the utmost care are necessary to ensure the success of the crop, and the area under opium cannot be greatly extended. Formerly the province of Shense produced 30 per cent. of the native product, but since the famine caused by the neglect of cereals for opium the extension of the cultivation has been rigidly prohibited in Shense, Honan, and Chihli. In Kwangtung the soil and climate have been found unsuitable, and in Fuhkeen sugar proves equally remunerative, if not more so. There can be no question, however, that, as already stated, the cultivation of the poppy is extending rapidly, in spite of prohibitory edicts issued from time to time; four-fifths of the opium at present used in China is home-grown. According to Consul Spence's report (1882) the poppy is cultivated chiefly on land near villages where manure and labour can be easily obtained. As soon as the summer crop has been reaped the land is ploughed and cleaned, roots and weeds are burnt and the resulting ashes scattered over the ground, and dressings of night-soil are liberally applied. The seeds are sown in November and December in drills 18 inches apart. In January, when the plants are a few inches high, the rows are thinned and earthed up so as to leave a free passage between. The ground is afterwards weeded occasionally and the earth stirred up. The poppy blooms in March or April, according to the situation. As soon as the capsules begin to form, dressings of liquid manure are given, and in April and May the opium is collected. Vertical incisions are made in the capsules as in India. In some districts, however, a vertical shaving appears to be taken off the surface of the capsule. The excreted juice is scraped off and transferred to a small pot suspended at the waist. The mode of preparation for the market has not been described, but, from the occasional samples that have been sent to England, the opium appears to have undergone manipulation, since it has a uniform pasty consistence and is without any trace of the granular structure indicative of unmixed opium like that of Turkey. The colour is darker and the consistence softer than that of Persian opium, but the odour is good. Some of the Szechuen opium appears to have been mixed with oil. The Yunnan and Szechuen opiums are made into flat cakes, and are wrapped in white paper. Chekeang opium is in the form of treacly extract, and is sold in jars containing 2 to 4 lb. The yield of opium is calculated at 350 oz. per acre. The Shense drug is highly esteemed because it has a flavour resembling the Patna kind and gives 85 to 90 per cent. of extract. Yunnan opium comes next and Szechuen third in value.

The use of foreign opium by the Chinese bears some relation to its introduction, which was in the following order:—Patna, Malwa, Benares, and Persian. Thus the Patna opium is preferred along the south-eastern coast as far north as the Yangtsze river, except in the district about Ningpo. Malwa is chiefly consumed in the northern provinces, including part of Kwangtung, Kwangse. Keangse, and Ganhwuy, while Benares is the favourite kind in

Formosa and some parts of Fuhkeen. Persian replaces the Malwa to a limited extent on account of its lower price; it goes principally to the province of Kwangse. Malwa opium is reputed to have a strong flavour and biting taste, and to be more stimulating; it is said to cause heartburn in those unaccustomed to its use, to induce an unhealthy action of the skin, and to prove irritating to the nervous system. Patna is considered mild but narcotic. Persian is also reckoned hot and acrid, and apt to cause dysentery. In some respects the native opium is comparable to the Malwa, having a coarser and more fiery flavour than the Patna, and also has the disadvantage of causing troublesome eruptions on the skin. It is said to be frequently adulterated with seaweed, jelly, oil, &c. It seems worthy of inquiry how far this difference of flavour and action may be due to the oil with which both Malwa and Chinese opiums are often prepared. The native opium is said to have the advantage over the foreign that the habit of smoking it can be broken off with comparative ease, which is not the case with the Indian drug.

Egypt.—The variety grown in Egypt is the same as in Asia Minor. The cultivation is carried on in Upper Egypt near Esneh, Kenneh, and Siout. The capsules are incised in March by drawing a knife twice round them horizontally. The concreted juice is scraped off next day by a scoop-knife, collected on a leaf, and placed in the shade to harden. Good samples, which are of rare occurrence, yield 9 to 12 per cent. of morphia; but, as a rule, the plant is grown in too moist a soil, scarification is not always performed at the right date, and adulteration is extensively practised, so that the average yield of morphia is only 3 to 4 per cent. As met with in English commerce Egyptian opium is in the form of hard, flat, circular cakes about 4 inches in diameter, covered with poppy and other leaves, but free from the *Rumex* fruits usually seen on Turkey opium. The fracture is porous, dark liver-coloured, with shining embedded particles and reddish yellow points, and occasionally starchy granules. The total amount exported in 1879 was valued at £2310, of which there was sent to Italy £990, France £630, Greece £540, and Turkey £150. It is not now regularly imported into Britain owing to its inferior quality. M. Gastinel found that, when cultivated in his garden at Cairo, the poppies yielded 10 to 12 per cent. of morphia when the capsules were nearly ripe, while opium collected immediately after the flowering was over contained only 3 to 4 per cent.

Algeria.—Opium has been grown in Algeria, but this kind is not known in English commerce.

Mozambique.—A company was established in Lisbon in 1877, with a grant of 50,000 acres of land in Mozambique, and certain exclusive privileges; the cultivation was commenced in 1879 and was carried on at Chaima between the Mulo and Quaqua rivers. The ground has been sown with Malwa seed, the plants thrive well, and the capsules are larger than those grown in India. The collection of opium is made about seventy-five days after the seed has been sown, and the yield compares favourably with that obtained in India. It is said to be mixed on the spot with 80 to 100 per cent. of a special matter known only to the cultivators. The mixture is made into balls weighing about 1 ℔; these are packed in boxes with poppy trash and covered with a layer of indigenous cotton. The yield from the first crop amounted only to a few pounds, and upon examination proved to be of moderate quality only. It was of soft consistence, brownish colour, and yielded 4 per cent. of morphia and 4·3 per cent. of narcotin, and 40·9 per cent. of moisture. In 1884 specimens were sent to the London market in the form of spherical balls, having the size and general appearance of Malwa and evidently intended to compete with it in the Chinese market.

Australia.—Experiments in opium-cultivation have been made during the last ten years in the neighbourhood of Melbourne, near Bairnsdale in Gippsland, and at Dromana on Port Phillip Bay, and a few cwts. of opium have been obtained. The first specimens collected contained only 2 per cent. of morphia and about 8 per cent. of narcotin; in subsequent experiments opium yielding 4 to 10 per cent. of morphia was obtained. The seed, procured from Smyrna, was sown in June, July, and the beginning of August, and the opium collected in the summer months of January, February, and March. The plants attained a height of 5 to 7 feet, and each produced three or four large white flowers. The East India variety, with double purple or nearly black flowers, was found to produce only one flower and give but little opium. It seems probable that, with greater care in selection of sheltered hilly localities and rich soil for the cultivation of the poppy, and attention to the very important point of collecting the juice at exactly the right time, opium of very excellent quality might be produced in Australia in sufficient quantity to meet the local demand.

Europe.—Experiments made in England, France, Italy, Switzerland, Greece, Spain, Germany, and even in Sweden prove that opium as rich in morphia as that of Eastern countries can be produced in Europe. In 1830 Mr Young, a surgeon at Edinburgh, succeeded in obtaining 56 ℔ of opium from an acre of poppies, and sold it at 36s. per ℔. In France the cultivation has been carried on since 1844 at Clermont-Ferrand by M. Aubergier. The juice, of which a workman is able to collect about 9·64 troy oz. in a day, is evaporated by artificial heat immediately after collection. The juice yields about one-fourth of its weight of opium, and the percentage of morphia varies according to the variety of poppy used, the purple one giving the best results. By mixing assayed samples he is able to produce an opium containing uniformly 10 per cent. of morphia. It is made up in cakes of 50 grammes, but is not produced in sufficient quantity to become an article of wholesale commerce. Some specimens of French opium have been found by Guibourt to yield 22·8 per cent. of morphia, being the highest percentage observed as yet in any opium. Experiments made in Germany by Karsten, Jobst, and Vulpius have shown that it is possible to obtain in that country opium of excellent quality, containing from 8 to 13 per cent. of morphia. It was found that the method yielding the best results was to make incisions in the poppy-heads soon after sunrise, to collect the juice with the finger immediately after incision, and evaporate it as speedily as possible, the colour of the opium being lighter and the percentage of morphia greater than when the juice was allowed to dry on the plant. Cutting through the poppy-head caused the shrivelling up of the young fruit, but the heads which had been carefully incised yielded more seed than those which had not been cut at all. Newly-manured soil was found to act prejudicially on the poppy. The giant variety of poppy yielded most morphia.

The difficulty of obtaining the requisite amount of cheap labour at the exact time it is needed and the uncertainty of the weather render the cultivation of opium too much a matter of speculation for it ever to become a regular crop in most European countries.

North America.—In 1865 the cultivation of opium was attempted in Virginia by Mr A. Robertson, and a product was obtained which yielded 4 per cent. of morphia. In 1867 Dr H. Black grew opium in Tennessee which contained 10 per cent. of morphia. Opium produced in California by Dr H. Flint in 1873 yielded 7¾ per cent. of morphia, equal to 10 per cent. in perfectly-dried opium. The expense of cultivation exceeded the returns obtained by its sale. As in Europe, therefore, the high price of labour militates against its production on a large scale.

Chemical Constitution.—The activity of opium is principally due to the vegetable alkaloid morphia or morphine, which opium of good quality contains to the extent of 8 to 17 per cent., the average amount being 10 per cent. Opium yielding less than this is considered of inferior grade and below the commercial standard for use in medicine.

Morphia is interesting as being the first one that was discovered of the now large class of bodies known as alkaloids. Its basic nature was first clearly pointed out in 1816 by Sertürner. It exists in opium in combination with sulphuric and meconic acids. Lactic acid has also been found in opium, but is believed to be formed in it subsequently to the collection of the drug.

Besides morphia several other basic substances have been detected in different varieties of opium, but only in minute quantities, rarely amounting to 1 per cent. These are narceia; codeia, 0·2 to 0·4 per cent.; thebaia, 0·15 to 1·0 per cent.; papaveria, 1·0 per cent.; cryptopia, meconidia, hydrocotarnia, laudanosia, protopia, codamia, gnoscopia; also a few other bodies of a feebly alkaline or neutral character, viz., narcotin, 2 to 8 per cent.; pseudomorphin, 0·02; lanthopin, ·005; and meconoiosin.

Opium also contains in considerable quantity a resinoid body which is soluble in its own weight of water, but is thrown down when this solution is diluted with ten times its bulk of water; 11 per cent. of caoutchouc; a gum distinct from gum arabic; pectin; albumen; wax, consisting of palmitate and cerotate of cerotyl; and 4 to 8 per cent. of calcareous salts. Sugar has been frequently found in opium, but whether natural or added as an adulteration is not known. The amount of caoutchouc present has probably some bearing on the value of opium for smoking, since the Chinese estimate its value roughly by the "touch," *i.e.*, the rapidity or slowness with which a thread drawn out from the mass will break by its own weight.

Of the alkaloids above mentioned only three are used to any extent in medicine, viz., morphia, codeia, and narcotin. Narceia has also been used in medicine in France.

Morphia, $C_{17}H_{19}NO_3$.—Turkey opium of good quality and freed from moisture contains from 10 to 15 per cent. of morphia, and if less than 10 per cent. be present it is probably more or less adulterated. Persian opium is very variable in this respect, when of good quality yielding from 8 to 13 per cent., while the variety met with in the form of sticks sometimes contains only 0·2 to 3 per cent. Indian opium is remarkable for the low percentage of morphia, the average yield being only 3 to 4 per cent., although samples of the kinds known as Khandesh and Garden Patna have afforded on analysis 6 to 7 per cent. Chinese opium is similar in this respect, giving, as a rule, only 3 to 7 per cent. of this alkaloid. The amount of morphia present in opium bears no relation to the preference exhibited by smokers, opium containing a large quantity of morphia being generally considered by them as inferior in quality and apt to cause headache. For use in medicine those containing a large percentage of morphia are the most esteemed. Opium dried as soon as possible after being collected is usually much richer in morphia than that kept for some time in a moist state and exposed to the air; and poppies grown on the hills yield an opium containing more morphia than those cultivated on the plains. Guibourt found that opium twenty years old contained less morphia than when previously analysed in the fresh state. To ascertain the percentage of morphia, the merchant extracts, by means of an instrument like a cheese-cutter, a small cylinder of opium about the thickness of a penholder and about 2 inches long, out of one-third of the pieces in a chest, and it is considered that the analysis of these pieces will fairly represent the value of the chest. Various methods are adopted for estimating the morphia, most of which depend upon the fact that this alkaloid can be precipitated from its salts by ammonia, and that it is insoluble in ether and only very slightly soluble in cold water. When pure it forms colourless shining prismatic crystals having an alkaline reaction. It unites with acids to form salts, most of which are soluble in water. It is soluble in 36 parts of boiling and 100 of cold alcohol, in 500 of boiling water, and very slightly in chloroform. It is also soluble in the fixed and volatile oils, and in solution of the fixed caustic alkalis and lime water, but only very slightly in caustic ammonia. With nitric acid it gives a red colour passing into yellow, with test solution of ferric chloride a blue colour which is destroyed by free acids or alcohol, and with sulphuric acid and bichromate of potash a greenish but not a purple or violet colour. Heated in the open air it burns readily, a portion being volatilized. The salts chiefly used in medicine are the hydrochlorate, sulphate, and acetate; and for subcutaneous injection the tartrate has been recommended by Erskine Stuart, since it is more soluble, and more concentrated solutions can be used of it than of the other salts. Heated in a sealed tube with hydrochloric acid, morphia is decomposed and an alkaloid named "apomorphia," $C_{17}H_{17}NO_2$, formed, which is one of the most speedy and effectual emetics known, and is of great value in cases of accidental poisoning, the subcutaneous injection causing the emptying of the contents of the stomach in a few minutes even when all ordinary emetics fail to act. In minute doses it has also valuable expectorant properties. It is soluble in ether and 50 parts of alcohol and in 68 parts of boiling water, but the solution soon decomposes, and assumes a green colour; consequently it should be made fresh for use in medicine.

Codeia, $C_{18}H_{21}NO_3$, exists in opium in combination with meconic acid, and remains in solution after the morphia is precipitated by ammonia; it may be obtained by evaporating the solution and purifying the crystals that form by dissolving them in hot ether, from which it crystallizes out on cooling in rather large octahedral prisms. It differs from morphia in not being soluble in solution of caustic potash or soda, while with nitric acid (sp. gr. 1·200) it gives a yellow solution which does not become red. It is soluble in 17 parts of boiling and 80 of cold water. Codeia has been found also in Turkish, French, and Indian opiums.

Narcotin, $C_{22}H_{23}NO_7$.—This substance exists chiefly in a free state in opium; being insoluble in cold water, it is left behind in considerable quantity when opium is macerated in that liquid, although a small portion, probably in combination with sulphuric acid, is dissolved. It is, however, very soluble in ether and benzol, and may be readily obtained by means of these solvents from the crude drug. It is doubtful if it should be classed with the alkaloids, for, although it forms definite compounds with some of the mineral acids, it does not exert any influence on vegetable colours. It differs from morphia in being insoluble in the caustic alkalis and not producing a blue colour with ferric salts. When heated on a piece of paper over a candle it leaves a greasy stain.

Narceia, $C_{23}H_{29}NO_9$, has been also used occasionally in medicine. Its alkaloidal character has been disputed; but it is now generally classed as an alkaloid. It differs from morphia in giving a blue colour with dilute mineral acids, but does not give a blue colour with ferric salts or a red colour with nitric acid. For recent details concerning the less important alkaloids reference may be made to Dr Hesse's papers, translated in the *Pharm. Journ. and Trans.*; September 1870, p. 205, and January 1872, p. 549.

Opium of good quality for medicinal use should not lose more than 12½ per cent. of water in drying, should not yield more than 8 per cent. of ash from the dried drug, and ought to afford at least 60 per cent. of matter soluble in water. It should be of somewhat tenacious consistence, yellowish brown colour, strong narcotic odour, and bitter taste. The preparation of crude opium most largely used in medicine is the tincture, commonly known as "laudanum." It is composed of 1½ oz. of powdered opium and 1 pint of spirit of wine of specific gravity 0·920. This name was, however, at first applied to a solid preparation, a pill-mass made of opium and various aromatics, which in the *London Pharmacopœia* of 1639 consisted of saffron, castor, ambergris, musk, and oil of nutmeg. The liquid preparation which bears the name of laudanum was apparently first introduced by the celebrated Dr Sydenham, and was inserted in the *London Pharmacopœia* for 1721. It also contained aromatics.

Physiological Action.—See NARCOTICS, *supra*, pp. 231-2.

Medicinal Uses.—The chief value of opium is to relieve pain, to relax spasm, to allay both local and general irritation of the nervous system, and to procure sleep. Its power of diminishing secretions is taken advantage of in the cure of catarrh, bronchorrhœa, diarrhœa, and other forms of inflammation of the mucous membranes accompanied with excessive secretion, and also in diabetes. It is found of great value when conjoined with emetics in improving or stimulating the secretions of the skin. Its use is dangerous in inflammation of the brain or determination of blood to the head. The action of opium is exerted much more powerfully in proportion upon infants than upon adults, as small a dose as one drop of laudanum having proved fatal to an infant. For remedies in cases of poisoning see POISONS. Morphia differs slightly in its properties from opium. It is less stimulant, and does not produce the full diaphoretic action; it causes less headache, nausea, and constipation. When used hypodermically its action is more rapid and smaller doses are required. Codeia is used in diabetes, in coughs, &c. Narceia is considered to be purely hypnotic. Narcotin is official in the pharmacopœia of India as a tonic in general debility arising from prolonged lactation, and in convalescence from acute febrile and inflammatory diseases.

Opium-eating.—Opium, like many other poisons, produces after a time a less effect if frequently administered as a medicine, so that the dose has to be constantly increased to produce the same result on those who take it habitually. When it is used to relieve pain or diarrhœa, if the dose be not taken at the usual time the symptoms of the disease recur with such violence that the remedy is speedily resorted to as the only means of relief, and thus the habit is exceedingly difficult to break off. Opium-eating is chiefly practised in Asia Minor, Persia, and India. Opinions differ widely as to the injurious effect of the habit; the weight of evidence appears, however, to indicate that it is much more deleterious than opium-smoking. It has been practised in India from very ancient times; some idea of its prevalence there may be gathered from the fact that the mere licence fees for one year amounted to £493,343, and that some of the opium dealers in Calcutta have each no less than seventeen shops where this drug only is sold.

The following statistics collected by Vincent Richards regarding Balasór in Orissa throw some light on the influence of this practice on the health. He estimates that one in every 12 or 14 of the population use the drug, and that the habit is increasing. Of the 613 opium-eaters examined by him he found that the average age at which the habit was commenced was 20 to 26 years for men and 24 to 30 years for women. Of this number 143 had taken the drug for from 10 to 20 years, 62 for from 20 to 30 years, and 38 for more than 30 years. The majority took their opium twice daily, morning and evening, the quantity taken varying from 2 to 46 grains daily, large doses being the exception, and the average 5 to 7 grains daily. The dose, when large, had been increased from the beginning; when small, there had usually been no increase at all. The causes which first led to the increase of the drug were disease, example, and a belief in its aphrodisiac powers. The diseases for which it was chiefly taken were malarial fever, dysentery, diarrhœa, spitting of blood, rheumatism, and elephantiasis. A number began to take it in the famine year, 1866, as it enabled them to exist on less food and mitigated their sufferings; others used it to enable them to undergo fatigue and to make long journeys. Mr Richards concludes that the excessive use of opium by the agricultural classes, who are the chief consumers in Orissa, is very rare indeed. Its moderate use may be and is indulged in for years without producing any decided or appreciable ill effect except weakening the reproductive powers, the average number of the children of opium-eaters being 1·11 after 11 years of married life. It compares favourably as regards crime and insanity with intoxicating drinks, the inhabitants of Balasor being a particularly law-abiding race, and the insane forming only 0·0069 per cent. of the population. Dr W. Dymock of Bombay, speaking of western India, concurs in Mr Richards's opinion regarding the moderate use of the drug. He believes that excessive indulgence in it is confined to a comparatively small number of the wealthier classes of the community. Dr Moore's experience of Rajputana strongly supports the same views. It seems probable that violent physical exercise may counteract in great measure the deleterious effect of opium and prevent it from retarding the respiration, and that in such cases the beneficial effects are obtained without the noxious results which would accrue from its use to those engaged in sedentary pursuits. There is no doubt that the spread of the practice is connected with the ban imposed in Mohammedan countries on the use of alcoholic beverages, and to some extent with the long religious fasts of the Buddhists, Hindus, and Moslems, in which opium is used to allay hunger.

To break off the habit of opium-eating is exceedingly difficult, and can be effected only by actual external restraint, or the strongest effort of a powerful will, especially if the dose has been gradually increased. Various remedies have been proposed to support the system while the habit is being dropped, the most recent of which are coca and strychnia.

The habit is not confined to India, Persia, and Turkey, but is unfortunately practised in other forms in Western countries. In a few districts of England more opium is consumed than in the rest of the United Kingdom, and in the United States it is calculated that the number of opium-eaters is 82,696, and the average amount of opium consumed by each opium-eater in the State of Michigan is estimated at 1 oz. avoirdupois per week. Advanced opium-eaters also use in addition chloral and chloroform or ether. Of late years also the practice of using hypodermic injections of morphia has been followed as a luxury by many who have first experienced the speedy relief from pain obtained by its use.

Opium-smoking.—This is chiefly practised by the inhabitants of China and the islands of the Indian Archipelago, and in the countries where Chinese labour is largely employed. It is said to have commenced in China forty or fifty years before the English began to import opium into that country. In 1858 it was estimated that about 2,000,000 of Chinese smoked opium, and in 1878 from one-fourth to three-tenths of the entire population of 400,000,000.

For smoking the Chinese use an extract of opium, the privilege of preparing and the exclusive right to deal in which is let to the highest bidder by the Government for a fixed term of years. The present holder of the monopoly in Hong-Kong pays 205,000 dollars annually. The same arrangement is in vogue in Singapore, French Cochin China, and Macao. The process of preparation is thus described by Mr Hugh M'Callum, Government analyst at Hong-Kong:—

"The opium is removed from its covering of leaves, &c., moistened with a little water, and allowed to stand for about fourteen hours; it is then divided into pans, 2½ balls of opium and about 10 pints of water going to each pan; it is now boiled and stirred occasionally until a uniform mixture having the consistence of a thin paste is obtained. This operation takes from five to six hours. The paste is at once transferred to a larger pan and cold water added to about 8 gallons, covered, and allowed to stand for from fourteen to fifteen hours. A bunch of 'tang suin' (lamp-wick, the pith of some plant) is then inserted well into the mass, and the pan slightly canted, when a rich, clear, brown fluid is thus drawn off, and filtered through 'chi mui' (paper made from bamboo fibre). The residue is removed to a calico filter and thoroughly washed with boiling water, the wash water being reboiled and used time after time. The last washing is done with pure water; these washings are used in the next day's boiling.

"The residues on the calico filters are transferred to a large one of the same material and well pressed. This insoluble residue, called 'nai chai' (opium dirt), is the perquisite of the head boiling coolie, who finds a ready market for it in Canton, where it is used for adulterating, or rather in manufacturing, the moist inferior kinds of prepared opium. The filtrate or opium solution is concentrated by evaporation at the boiling point, with occasional stirring until of a proper consistence, the time required being from three to four hours; it is then removed from the fire and stirred with great vigour till cold, the cooling being accelerated by coolies with large fans. When quite cold it is taken to the hong and kept there for some months before it is considered in prime condition for smoking. As thus prepared it has the consistence of a thin treacly extract, and is called boiled or prepared opium. In this state it is largely exported from China to America, Australia, &c., being carefully sealed up in small pots having the name of the maker (*i.e.*, hong) on each.

"The Chinese recognise the following grades of opium:—(1) 'raw opium,' as imported from India; (2) 'prepared opium,' opium made as above; (3) 'opium dross,' the scrapings from the opium pipe; this is reboiled and manufactured as a second-class prepared opium; a Chinese doctor stated lately at a coroner's inquest on a case of poisoning that it was more poisonous than the ordinary prepared opium; (4) 'nai chai' (opium dirt), the insoluble residue left on exhausting the raw opium thoroughly with water. The opium is sent every day from the hong (*i.e.*, shop or firm) to the boiling-house, the previous day's boiling being then returned to the hong. The average quantity boiled each day is from six to eight chests of Patna opium, this being the only kind used."

By this process of preparation a considerable portion of the narcotin, caoutchouc, resin, oil, or fatty and insoluble matters are removed, and the prolonged boiling, evaporating, and baking over a naked fire tend to lessen the amount of alkaloids present in the extract. The only alkaloids likely to remain in the prepared opium, and capable of producing well-marked physiological results, are morphia, codeia, and narceia. Morphia, in the pure state, can be sublimed, but codeia and narceia are said not to give a sublimate. Even if sublimed in smoking opium, morphia would, in M'Callum's opinion, probably be deposited in the pipe before it reached the mouth of the smoker. The bitter taste of morphia is not noticeable when smoking opium, and it is therefore possible that the pleasure derived from smoking the drug is due to some product formed during combustion. This supposition is rendered probable by the fact that the opiums most prized by smokers are not those containing most morphia, and that the quality is judged by the amount of soluble matter in the opium, by its tenacity or "touch," and by peculiarities of aroma,—the Indian opium, especially the Patna kind, bearing much the same relation to the Chinese and Persian drug that champagne does to vin ordinaire. Opium-smoking is thus described by Mr Theo. Sampson of Canton:—

"The smoker, lying on his side, with his face towards the tray and his head resting on a high hard pillow (sometimes made of earthenware, but more frequently of bamboo covered with leather), takes the pipe in his hand; with the other hand he takes a dipper and puts the *sharp* end of it into the opium, which is of a treacly consistency. Twisting it round and round he gets a large drop of the fluid to adhere to the dipper; still twisting it round to prevent it falling he brings the drop over the flame of the lamp, and twirling it round and round he roasts it; all this is done with acquired dexterity. The opium must not be burnt or made too dry, but roasted gently till it looks like burnt worsted; every now and then he takes it away from the flame and rolls it (still on the end of the dipper) on the flat surface of the bowl. When it is roasted and rolled to his satisfaction he gently heats the centre of the bowl, where there is a small orifice; then he quickly thrusts the end of the dipper into the orifice, twirls it round smartly, and withdraws it; if this is properly done, the opium (now about the size of a grain of hemp-seed or a little larger) is left adhering to the bowl immediately over the orifice. It is now ready for smoking.

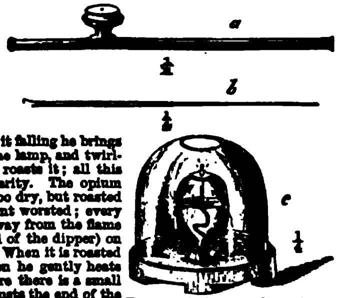


FIG. 3.—Opium-smoking Apparatus. *a*, pipe; *b*, dipper; *c*, lamp.

"The smoker assumes a comfortable attitude (lying down of course) at a proper distance from the lamp. He now puts the stem to his lips, and holds the bowl over the lamp. The heat causes the opium to frizzle, and the smoker takes three or four long inhalations, all the time using the dipper to bring every particle of the opium to the orifice as it burns away, but not taking his lips from the end of the stem, or the opium pellet from the lamp till all is finished. Then he uses the flattened end of the dipper to scrape away any little residue there may be left around the orifice, and proceeds to prepare another pipe. The preparations occupy from five to ten minutes, and the actual smoking about thirty seconds. The smoke is swallowed, and is exhaled through both the mouth and the nose."

Large quantities of morphia are exported to China from Europe for the purpose of preparing the so-called "cure for opium-smoking," which consists of one-third of a grain of hydrochlorate of morphia mixed with a little powdered rice. The powders are taken at gradually increasing intervals, until the morphia is left off altogether.

Mr. Allen Williams, in a work recently published, states that there are now nearly a million persons in the United States who indulge in opium-smoking, and the habit seems to be on the increase in New York and other eastern cities, as well as in the west. The records of the National Bureau of Statistics show that, while the number of the Chinese in the United States has remained nearly stationary since 1876, the amount of opium imported has increased from 189,354 ℔ of the crude and 49,375 ℔ of the prepared drug in 1872 to 248,211 ℔ of the former and 77,196 ℔ of the latter in 1880. Of the crude opium a certain quantity appears to be re-exported to the West Indies; the larger proportion of the prepared drug is used in San Francisco.

So far as can be gathered from the conflicting statements published on the subject, opium-smoking may be regarded much in the same light as the use of alcoholic stimulants. To the great majority of smokers who use it moderately it appears to act as a stimulant, and to enable them to undergo great fatigue and to go for a considerable time with little or no food. According to the reports given by authorities on the subject, when the smoker has plenty of active work it appears to be no more injurious than smoking tobacco. When carried to excess it becomes an inveterate habit; but this happens chiefly in individuals of weak will-power, who would just as easily become the victims of intoxicating drinks, and who are practically moral imbeciles, often addicted also to other forms of depravity. The effect in bad cases is to cause loss of appetite, a leaden pallor of the skin, and a degree of leanness so excessive as to make its victims appear like living skeletons. All inclination for exertion becomes gradually lost, business is neglected, and certain ruin to the smoker follows. There can be no doubt that the use of the drug is opposed by all thinking Chinese who are not pecuniarily interested in the opium trade or cultivation, for several reasons, among which may be mentioned the drain of bullion from the country, the decrease of population, the liability to famine through the cultivation of opium where cereals should be grown, and the corruption of state officials.

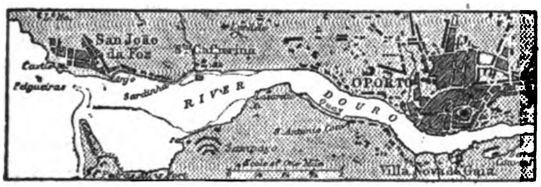
See *Pharmaceutical Journ.*, [1] xi. p. 269, xiv. p. 395; [2] x. p. 434; Impey, *Report on Malwa Opium*, Bombay, 1848; *Report on Trade of Hankow*, 1869; *New*

Remedies, 1876, p. 220; *Pharmacographia*, 1879, p. 42; *Journal of the Society of Arts*, 1883; *United States Dispensatory*, 1883, p. 1054; *The Friend of China*, 1883, &c. (E. M. H.)

OPODELDOC, a name now applied to a liniment composed of soap, camphor, the volatile oils of rosemary and origanum, solution of ammonia, and spirit of wine. It is made of such a consistence that it is solid at ordinary temperatures, but melts with the warmth of the hand. The origin of the name is lost in obscurity, but is believed to have been first applied to a plaster, invented by Mindererus or Paracelsus, and used for bruises and external injuries. In the *Edinburgh Pharmacopœia* (1721) opodeldoc was official under the name of *unguentum opodeldoch*, and then consisted of thirteen aromatic ingredients besides Venice soap, camphor, and spirit of wine. Its first appearance in the *London Pharmacopœia* seems to have been in 1746 under the name of *linimentum saponaceum*. In the *British Pharmacopœia* of 1867 it is represented by the liniment of soap, which differs from the earlier preparations in being fluid at ordinary temperatures.

OPORTO (*i.e.*, *O Porto*, The Port), the second city of the kingdom of Portugal, the capital of Entre Douro e Minho, the best-cultivated and the most fruitful province of the country, is situated on both banks of the Douro, about 3 miles from its mouth, in 41° 9′ N. lat. and 8° 37′ W. long. The part south of the Douro is known as Villa Nova da Gaia. The mouth of the river is obstructed by a very dangerous shifting sandbank, protected by a lighthouse and a castle situated in the village of São João da Foz, which, along with Campanha, Paranhos, and Sordello, completes the suburbs. The population of the city is 80,295, and with the suburbs 108,346.

The view of the town from the river is singularly attractive and quaint. It possesses many buildings of interest, and picturesque thoroughfares, which, however, from the situation of the city, are very steep and irregular. The principal edifices are the cathedral and the archbishop's palace—the latter, containing a fine staircase, conspicuously situated on a high rock—and the Torre dos Clerigos, a granite tower 210 feet high, built in 1748, commanding a splendid view, and visible at sea a long way off. The English factory (built in 1790), including a library, reading-room, and ballroom, is one of the largest buildings, while the exchange (once the monastery of S. Francisco) is perhaps the finest and most elaborately decorated structure in the country. The walls and floor of the hall are entirely covered with beautiful inlaid devices in polished native-coloured woods of all hues brought from the virgin forests of the Brazils. The museum, the public library, containing over 80,000 volumes, the barracks, the Da Miseracordia Hospital, and the opera-house are the other most important public buildings. The Rua Nova dos Inglezes is the most frequented street, and the Rua das Flores is one of the most interesting from the rich display of gold-work, for which the town is famous, both in its shop windows as well as—more characteristically and attractively—on the persons of the fishwomen in their everyday garb. The Praça de San Ovidio, situated on the heights, and laid out in terraces of flowers, deserves a visit from the traveller, while the Largo da Torre da Marva is interesting as standing on the site of the ancient Cale, from which the kingdom derives its name (Porto Cale). The chapel of Cedo Feita, said to have been founded in 559 by the Visigothic king Theodomir (but much more probably not till the 12th century), is very curious; the church of Nossa Senhora da Lapa, a well-known landmark, is a handsome Corinthian edifice. The city at one time had no less than 80 monasteries and chapels. The English community maintain a chaplain and a doctor, and have a cemetery for their own dead. Railways run from Oporto to Lisbon, and up the valley of the Douro to Pezo da Regoa, and recently a junction has been made with the line through Spain to Paris, whereby the long journey from Lisbon to that capital *via* Madrid is vastly shortened; a branch also runs to the frontier town of Valença on the Minho. Oporto possesses good schools, a medical college with numerous chairs, and a botanical garden. Several newspapers appear daily.



Oporto and Mouth of the Douro.

The industries of Oporto are the most important and numerous in the kingdom, employing about 6000 hands, the chief being paper, linen, wool, cotton, silk, and gold manufactures, brocade, lace, glove, button, and pottery making. Oporto is chiefly famous for the export of the wine which bears its name, of which the great storehouses are on the south side of the river. The vines from which it is made grow on the Alto Douro, a hilly and precipitous region lying about 60 miles up the river, and having an area of 27 miles in length by 5 or 6 in breadth, cut off from the sea, and shut in from the north-east by a range of mountains. The trade was established in 1678, but the shipments for some years did not exceed 600 pipes (of 115 gallons each). In 1703 Lord Methven made a treaty with Portugal, under which Portuguese wines were admitted on easier terms than those of Gascony, and henceforward "port" began to be drunk. In 1747 the export reached 17,000 pipes. In 1754 the great wine monopoly company of Oporto originated, under which the shipments rose to 33,000 pipes. At the beginning of the present century the policy of the Government more and more favoured port wine, besides which the vintages from 1802 to 1815 were splendid both in Portugal and in Madeira,—that of 1815 has, in fact, never been excelled. For the next few years the grape crop was not at all good, but the 1820 vintage was the most remarkable of any. It was singularly sweet and black, besides being equal in quality to that of 1815. This henceforth became the standard taste and colour for true port, and to keep up the vintage of following years to this exceptional standard adulteration by elder-berries, syrup, and *jeropiga* was resorted to. This practice did not long continue, for it was cheaper to adulterate the best wines with inferior sorts of port wine itself. There is scarcely a Portuguese wine, says Crawfurd, in skilful and intelligent hands not capable of being made both sound and palatable without recourse to any sort of adulteration. Port is now one of the purest wines. In 1852 the *Oidium* which spread over Europe destroyed most of the Portuguese vineyards. In 1867 the second monopoly company was abolished, and since then the exports have been increasing till 1877, when the amount shipped was 61,278 pipes, of which England absorbed 38,898. Since 1863 the total exported has been 732,171 pipes (521,531 to England). In England port is adulterated with the red Spanish wine of Tarragona, which is a true wine, but procurable at half the cost of the cheapest port. The port wine duties are, however, not oppressive, and, though the *Phylloxera* has produced great ravages, the trade is still very prosperous. Brand wines are those made of different vintages blended together; "vintage" is a wine blended by nature herself, and is of rare occurrence.

Besides wine Oporto exports oranges (228,000,000 in 1878), onions, shipped as of Spanish growth, and varying vastly in amount according to the season, and olives (which go to Brazil alone, although they are cheaper and finer-flavoured when truly ripe than those of any other country). An important trade is done in live cattle. Portugal is one of the few countries never visited by the cattle-plague. They are sent to England as fat cattle, and are said to yield the finest grass-fed beef admitted into the country. About 15,000 head were imported in 1878. Feijões or haricot (mostly the black, feijão pret) beans form a considerable item of export to Brazil: 975,000 kilos were shipped in 1877. They are identical with those from Sorrento, and are a little dearer, but of a distinctly finer quality. Cork and sumach are also among the exports. The imports are numerous: codfish (bacalhão), a national dish, in immense quantities, as well as coals and ore, are brought from Newfoundland, and cottons and yarns from Great Britain (mostly), France, and Holland. Iron and steel goods were in 1877 imported from England to the amount of 7,000,000 kilos, paying a 5 per cent. *ad valorem* duty; in 1878, however, Sweden and Norway entered strongly into competition. Coal is also imported from England, and costs the consumer in Oporto twice its cost there. In 1878 of

215 steamers which entered Oporto (no vessel, owing to the dangerous bar, comes into this port to call simply) 153 were British.

History.—The history of Oporto dates from an early period. Before the Roman invasion, under the name of Gaia, or Cago, it was a town with a good trade; the Alani subsequently founded a city on the opposite or northern bank, calling it *Castrum Novum.* About 540 A.D. the Goths under Leovogild obtained possession of the northern district, who yielded place in 716 to the Moors under Abdul Hassan, who then conquered the whole of that region. The Christians, however, again gained possession by the overthrow of the Moors, when it became the key of their position for the long period during which the latter held sway in the southern provinces of Portugal. The Moors once more became its masters for a short period, till in 1092 it was brought by Dom Alfonso Frederico finally under Christian domination. The town is renowned also in English military annals from the duke of Wellington's famous passage of the Douro in its immediate neighbourhood, close to where the fine bridge of the northern railway now spans the river, by which he surprised and put to flight Soult's army, capturing the city on the 11th May 1809. It sustained a severe siege in 1833 during the civil war headed by Dom Miguel, and was bravely defended by Dom Pedro with 7500 men, but with the loss of 16,000 of its inhabitants.

See *Commercial Reports* for 1878-79; *Report* of Wine Committee of House of Commons in 1879; Crawfurd, *Portugal, Old and New*, 1872. (H. O. F.)

OPOSSUM. The animals to which this name is applied are the only non-Australian members of the Marsupials or pouched animals, being found throughout the greater part of the continent of America, from the United States to Patagonia, the number of species being largest in the more tropical parts (see MAMMALIA—*Marsupialia*, vol. xv. p. 380). They form the family *Didelphyidæ*, distinguished from the other Marsupial families by their equally developed hind-toes, their nailless but fully opposable hallux, and by their dentition, its formula being $i\frac{5}{4}\ c\frac{1}{1}\ pm\frac{3}{3}\ m\frac{4}{4}$, total 50, a number only exceeded among heterodont Mammalia by the Australian *Myrmecobius fasciatus.* The peculiarity in the mode of succession of these teeth has been explained in the article referred to, where also (p. 378) a figure of the teeth may be seen. Opossums are small animals, varying from the size of a mouse to that of a large cat, with long noses, ears, and tails, the latter being as a rule naked and prehensile, and with their great toes so fully opposable to the other digits as to constitute a functionally perfect posterior pair of "hands." These opposable great toes are without nail or claw, but their tips are expanded into broad flat pads, which are no doubt of the greatest use to such a climbing animal as an opossum. On the anterior limbs all the five digits are provided with long sharp claws, and the pollex or thumb is but little opposable. Their numerous teeth are covered with minute sharply-pointed cusps, with which to crush the insects on which they feed, for the opossums seem to take in South America the place in the economy of nature filled in other countries by the true *Insectivora*, the hedgehogs, moles, and shrews.

The family consists of two well-recognized genera only, viz., *Didelphys*, containing all the members of the family, with the exception of the Yapock, a curious animal which forms by itself the second genus, *Chironectes*, and is distinguished from all other opossums by its webbed feet, non-tuberculated soles, and peculiar coloration. Its ground colour is light grey, with four or five sharply-contrasted brown bands passing across its head and back, giving it a very peculiar mottled appearance. It is almost wholly aquatic in its habits, living on small fish, crustaceans, and other water animals; its range extends from Guatemala to southern Brazil.

The other genus of opossums, *Didelphys*, is an extremely heterogeneous one, and has been split up into several groups, some of which perhaps ought also to be recognized as genera. The first of these consists of three or four large dull-coloured long- and coarse-haired species, with perfect marsupial pouches, large leafy ears, and greatly-developed muscular ridges on their skulls. The best known of these, and indeed of all the family, is the Virginian Opossum, *Didelphys virginiana*, an animal spread over all temperate North America; it is extremely common, being even found living in the towns, where it acts as a scavenger by night, retiring for shelter by day upon the roofs of the houses or into the sewers. It produces in the spring from six to sixteen young ones, which are placed by the mother in her pouch immediately after birth, and remain there until able to take care of themselves; the period of gestation is from fourteen to seventeen days. Another very similar species is found in central and tropical South America, and is known as the Crab-eating Opossum (*D. cancrivora*). The second group, or sub-genus, named *Metachirus*, contains a considerable number of species found all over the tropical parts of the New World. They are of medium size, with short close fur, very long, scaly, and naked tails, and have less developed ridges on their skulls. They have as a rule no pouches in which to carry their young, and the latter therefore commonly ride on their mother's back, holding on by winding their prehensile tails round hers. The accompanying woodcut represents Lord Derby's Opossum (*D. derbiana*) carrying its young in this manner.

Didelphys derbiana.

The third group is *Micoureus* (*Grymæomys* of Burmeister), differing only from *Metachirus* by the comparatively smaller size of its members and by certain slight differences in the shape of their teeth. Its best-known species is the Murine Opossum (*D. murina*), no larger than a house-mouse, of a bright-red colour, which is found as far north as central Mexico, and extends thence right down to the south of Brazil. The last sub-genus contains three or four wonderfully shrew-like species, of very small size, with short, hairy, and non-prehensile tails, not half the length of the trunk, and with wholly unridged skulls. The most striking member of the group is the Three-striped Opossum (*D. tristriata*), from Brazil, which is of a reddish-grey colour, with three clearly-defined deep-black bands down its back, very much as in some of the striped mice of Africa. This sub-genus has been named *Hemiurus* or "half-tail" by Geoffroy Saint-Hilaire (*Microdelphys* of Burmeister), and should perhaps be allowed full generic rank.

The numerous fossil remains referable to species of the *Didelphyidæ* are of special interest as showing some of the connecting links in geographical distribution between the opossums and the Australian Marsupials, now so widely and absolutely separated. They consist of the bones of a considerable number of species from the Eocene and Early Miocene deposits of central France, one or two Eocene species having also been found in southern England. These ancient opossums have been separated generically from *Didelphys* on account of certain differences in the relative sizes of the lower premolars, but as nearly the whole of the species have been formed on lower jaws only, of which some hundreds have been found, it is impossible to judge how far these differences are correlated with other dental or osteological characters. In the opinion of Dr Filhol, who has devoted considerable attention to the subject, the fossils themselves represent two genera, *Peratherium*, containing the greater part of the species, about twenty in number, and *Amphiperatherium*, with three species only. All are comparatively small animals, few of them exceeding the size of a rat.

Besides these interesting European fossils, a certain number of Didelphian bones have been found in the caves of Brazil, but these are either closely allied to or identical with the species now living in the same region. (O. T.)

OPPELN (Polish, *Oppolie*), the chief town of a district of its own name and the seat of government for Upper Silesia, Prussia, lies on the right bank of the Oder, 50 miles to the south-east of Breslau. It contains the oldest Christian church in the district, founded at the close of the 10th century, and a ducal palace of the 15th century, on an island in the Oder. The most prominent among the other buildings are the offices of the district authorities, the town-house, the normal seminary, and the hospital. The Roman Catholic gymnasium is established in an old Jesuit college. The industries of Oppeln include the manufacture of Portland cement, soap, cigars, and lime; and a trade is carried on by rail and river in cattle, grain, and the mineral produce of the district. The population in 1880 was 14,447, of whom 10,772 were Roman Catholics. The upper classes speak German, the lower Polish.

Oppeln was already a flourishing place at the beginning of the 11th century, and after 1132 was the capital of an independent duchy, which became a fief of Bohemia in 1327, and was absorbed by the empire in 1556.

OPPENHEIM, a small town in the grand-duchy of Hesse-Darmstadt, Germany, is picturesquely situated on a hill on the left bank of the Rhine, 20 miles to the south of Mainz. It contains (1880) 3288 inhabitants, half Roman Catholics and half Protestants, who cultivate the vine and manufacture tacks, quinine, and leather.

Oppenheim which occupies the site of the Roman castle Bauconica, was formerly much larger than at present; and in the early Middle Ages it was a free town of the empire and one of the most important members of the Rhenish League. It lost its independence in 1398, when it was given in pledge to the elector palatine. During the Thirty Years' War the town was alternately occupied by the Swedes and the Imperialists, and in 1689 it was entirely destroyed by the French under Melac. The only relic of its former importance is the church of St Catherine, one of the most beautiful Gothic edifices of the 13th and 14th centuries in Germany, recently carefully restored at the expense of Government.

OPPIAN. The literary history of the three Greek poems on fishing, hunting, and fowling respectively which have come down to us from antiquity under the name of Oppian involves several perplexing questions. According to Suidas, Eusebius, and Syncellus, the author was a native of Anazarbus or Corycus in Cilicia, and flourished in the reign of Marcus Aurelius. Athenæus also, who almost certainly wrote under Septimius Severus, speaks of Oppian as a predecessor and near contemporary. According to an anonymous biographer, he was the son of a philosopher of Anazarbus named Agesilaus, who having incurred the displeasure of Severus by neglecting to wait upon him was banished to Malta. Young Oppian accompanied his father, and by the exercise of his poetical talents obtained his recall, and was further rewarded by a piece of gold for every line he had written. He died prematurely upon his return to his native country, and was honoured by an epitaph, which has been preserved, celebrating his precocious genius, but affording no clue to his works or his date. On turning to Oppian himself we find that his poem on fish and fishing (*Halieutica*) is actually addressed to an emperor Antoninus who can have been no other than Marcus Aurelius, since the monarch's son is frequently mentioned, and the other Antonine princes were childless. The author seems to speak of himself as a Cilician. On the other hand, the poem on hunting (*Cynegetica*) is no less unmistakably addressed to the successor of Severus, Antoninus Caracalla, and the writer represents himself as a citizen of Pella or Apamea in Syria. The style of the two poems, moreover, is dissimilar, the former being polished and poetical, the latter inelegant and commonplace. If the *Cynegetica* had been the earlier this might have been explained, but the reverse is the fact. There seems no alternative, therefore, but to divide the authorship, and the allusions of the author of the *Halieutica* to Commodus make it almost certain that he must have written between the elevation of that prince to the dignity of Augustus and the death of Marcus (177-180 A.D.), while the *Cynegetica* seem to have been composed after the death of Severus (211 A.D.). The improbability of two poets of the same name and writing on such similar subjects having been such near contemporaries may be escaped by the supposition that the later writer was not really named Oppian, but has been confounded with his predecessor from their poems being transcribed together. This is the more probable as the poem on fowling (*Ixeutica*), which seems to resemble the *Cynegetica* in style, but is only extant in a prose epitome, is attributed in some MSS. to a certain Dionysius. In this case Oppian's premature death and his epitaph may be accepted as historical and genuine. The story of his deliverance of his father must be apocryphal, and the imperial reward is probably founded upon a too literal interpretation of the epithet "golden" applied to his verses.

The *Halieutica* are indeed excellent verses. Oppian has made the most of his subject, which he has adorned with all the resources of aquatic fancy and fable, and to which he has ingeniously imparted human interest by constant parallels between the existence of fishes and the pursuits and perils of human life. His matter is arranged to the best advantage: "he loves descriptions," says M. Henri Martin, "but not digressions." Though careless of fact in comparison with poetic embellishment, he has a first-hand acquaintance with his theme as a sportsman and a lover of nature. His diction is choice, his style animated, and his versification sonorous. Rhetorical display, the accumulation of detail, and an occasional inaptness in his comparisons are his only serious faults. The writer of the *Cynegetica*, who sometimes copies and spoils him, is a far inferior writer, frequently tasteless, generally awkward and dry. Some of his descriptions, however, possess merit; he is a naturalist as well as a poet, and his observation of nature is often remarkably close, although, like his predecessor, he abounds in fables. His poem seems to want a final book, in which the stratagems of the chase would have been more fully described. The poetical qualities of the *Ixeutica*, if any, have evaporated in the paraphrase; the descriptions of the fowler's snares are clear and precise.

The *Halieutica* were first printed in 1478, in the metrical Latin version of L. Lippus. The editio princeps of the original was published by Junta at Florence in 1515; the *Halieutica* and *Cynegetica* were printed together by Aldus in 1517; the *Ixeutica* did not appear till 1704. The principal modern editions are those by Schneider (Strasburg, 1776), who first distinguished between the two Oppians, and by Lehrs (Paris, 1846, along with the Bucolic poets), who adopted a number of ingenious emendations by Koechly. Copious scholia on the *Halieutica* were edited by Bussemaker (Paris, 1849). The best authorities on the literary questions connected with the Oppians are Ferdinand Peter, *Commentatio*, Zeitz, 1840; Henri Martin in the *Journal général de l'Instruction Publique*, vols. xxxi. and xxxii.; and Ausfeld, *De Oppiano*, &c., Gotha, 1876. The English translation of the *Halieutica* by Diaper, completed by Jones (Oxford, 1722), is not deficient in spirit, but much too diffuse. The French prose translations by Limes and Belin de Ballu have been superseded by Bourquin's, Coulommiers, 1877. (R. G.)

OPPIUS, Caius, was an intimate friend and confidant of Julius Cæsar. He managed the dictator's private affairs, and took no public office, but during the time when Cæsar was absent from Rome he, together with Balbus, exercised very great influence on public business. According to Suetonius, many authorities considered Oppius to have written the histories of the Spanish, African, and Alexandrian wars which are printed among the works of Cæsar. Niebuhr unhesitatingly assigns the African war to Oppius,

OPTICS, GEOMETRICAL. The subject of optics is so extensive that some subdivision of it is convenient if not necessary. Under the head of LIGHT will be found a general sketch accompanied by certain developments. The wave theory and those branches of the subject which are best expounded in connexion with it are reserved for treatment in a later volume. The object of the present paper is to give some account of what is generally called geometrical optics,—a theoretical structure based upon the laws of reflexion and refraction. We shall, however, find it advisable not to exclude altogether the conceptions of the wave theory, for on certain most important and practical questions no conclusions can be drawn without the use of facts which are scarcely otherwise interpretable. Indeed it is not to be denied that the too rigid separation of optics into geometrical and physical has done a good deal of harm, much that is essential to a proper comprehension of the subject having fallen between the two stools.

Systems of Rays in General.—In the investigation of this subject a few preliminary propositions will be useful.

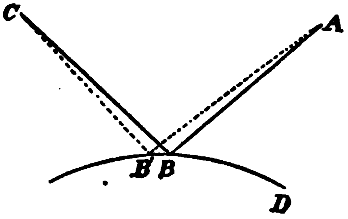


Fig. 1.

If a ray AB (fig. 1) travelling in a homogeneous medium suffer reflexion at a plane or curved surface BD, the total path between any two points A, C on the ray is a minimum, *i.e.*, AB + BC is less along the actual path than it would be if the point B were slightly varied.

For a variation of B in a direction perpendicular to the plane of reflexion (that of the diagram) the truth of this statement is at once evident. For a small variation BB′ in the plane of reflexion we see that the difference AB′ − AB is equal to the projection of BB′ upon AB, and that the difference CB − CB′ is equal to the projection of BB′ upon BC. These projections are equal, since by the law of reflexion AB and BC are equally inclined to BB′, and thus the variation of the total path, AB′ + B′C − (AB + BC), vanishes.

A corresponding proposition holds good in the case of refraction. If we multiply the distances travelled in the first and second media respectively by the refractive indices appropriate to the media, the quantity so obtained is a minimum for the actual path of the ray from any point to any other. It is sufficient to consider the case of a variation of the point of passage in the plane of refraction.

In the first medium (fig. 2) $\mu AB' - \mu AB = \mu BB' \cos ABD$, and in the second medium $\mu' CB - \mu' CB' = \mu' BB' \cos CBD$. The whole variation of the quantity in question is therefore

$$BB' (\mu \cos ABD - \mu' \cos CBD).$$

Now by the law of refraction the sines of the angles of incidence and refraction are in the ratio $\mu' : \mu$, and accordingly

$$\mu \cos ABD - \mu' \cos CBD = 0.$$

In whichever direction, therefore, the point of transition be varied, the variation of the quantity under consideration is zero. It is evident that the second proposition includes the first, since in the case of reflexion the two media are the same.

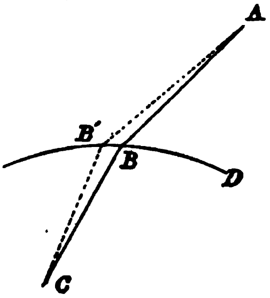


Fig. 2.

The principle of the superposition of variations now allows us to make an important extension. If the quantity, which we may denote by $\Sigma\mu s$, be a minimum for separate variations of all the points of passage between contiguous media, it is also a minimum even when simultaneous variations are admitted. However many times a ray may be reflected or refracted at the surfaces of various media, the actual path of the ray between any two points of its course makes $\Sigma\mu s$ a minimum. Even if the variations of refractive index be gradual instead of sudden, the same principle holds good, and the actual path of the ray makes $\int\mu ds$, as it would now be written, a minimum.

The principle itself, though here deduced from the laws of reflexion and refraction, is an immediate consequence of the fundamental suppositions of the wave-theory of light, and if we are prepared to adopt this point of view we may conversely deduce the laws of reflexion and refraction from the principle. The refractive index μ is inversely proportional to the velocity of propagation, and the principle simply asserts that in passing from any point to any other the light follows the shortest course, that is, the course of earliest arrival.

If two points be such that rays issuing from one of them, and ranging through a finite angle, converge to the other after any number of reflexions and refractions, the value of $\Sigma\mu s$ from one focus to the other must be the same for all the rays.

Thus, in order to condense rays issuing from one point S upon a second point H by a single reflexion (fig. 3), the reflecting surface must be such that $SP + HP = \text{const.}$, *i.e.*, must be an ellipsoid of revolution with S and H for foci.

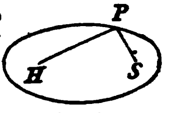


Fig. 3.

Again, if it be required to effect the same operation by a single refraction at the surface of a medium whose index is μ, we see that the surface (fig. 4) must be such that

$$SP + \mu HP = \text{const.}$$

If S be at an infinite distance, *i.e.*, if the incident rays be parallel, the surface is an ellipsoid of revolution with H for focus, and of eccentricity μ^{-1} ($\mu > 1$).

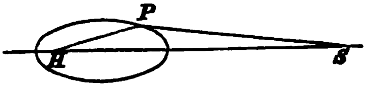


Fig. 4.

Another important proposition, obvious from the point of view of the wave-theory, but here requiring an independent proof, was enunciated by Malus. It asserts that a system of rays, emanating originally from a point, retains always the property of being normal to a surface, whatever reflexions or refractions it may undergo in traversing singly-refracting media.

Suppose that ABCDE, A′B′C′D′E′ . . . (fig. 5) are rays originally normal to a surface AA′, which undergo reflexions or refractions at BB′, CC′, &c. On every ray take points E, E′, &c., such that $\Sigma\mu s$ is the same along the courses AE, A′E′, &c. We shall prove that the rays in the final medium are normal to the surface EE′. For by hypothesis $\Sigma\mu s$ along ABCDE is the same as along A′B′C′D′E′, and, by the property proved above to attach to every ray, $\Sigma\mu s$ reckoned along the neighbouring hypo-

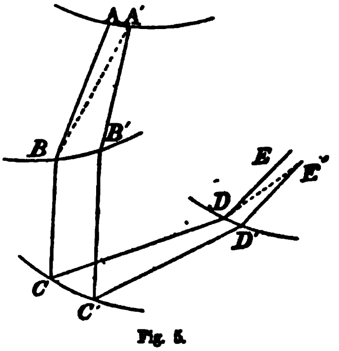


Fig. 5.

thetical course A'BCDE' is the same as along A'B'C'D'E'. Hence $\Sigma\mu s$ along A'BCDE' is the same as along ABCDE, or (on subtraction of the common part) the same along A'B', DE' as along AB, DE. But since AB is perpendicular to AA', the value along A'B is the same as along AB, and therefore the value along DE' is the same as along DE; or, since the index is the same, DE = DE', that is, EE' is perpendicular to DE. The same may be proved for every point E' which lies infinitely near E, and thus the surface EE' is perpendicular to the ray DE, and by similar reasoning to every other ray of the system. It follows that reflexions and refractions cannot deprive a system of rays of the property of being normal to a surface, and it is evident that a system issuing from a point enjoys the property initially.

Consecutive rays do not in general intersect one another; but if we select rays which cut the orthogonal surface along a *line of curvature*, we meet with ultimate intersection, the locus of points thus determined being a *caustic* curve to which the rays are tangents. Other lines of curvature of the same set give rise to similar caustic curves, and the locus of these curves is a caustic surface to which every ray of the system is a tangent. By considering the other set of lines of curvature we obtain a second caustic surface. Thus every ray of the system touches two caustic surfaces.

In the important case in which the system of rays is symmetrical about an axis, the orthogonal surface is one of revolution. The first set of lines of curvature coincide with meridians. The rays corresponding to any one meridian meet in a caustic curve, and the surface which would be traced out by causing this to revolve about the axis is the first caustic surface. The second set of lines of curvature are the circles of latitude perpendicular to the meridians. The rays which are normal along one of these circles form a cone of revolution, and meet in a point situated on the axis of symmetry. The second caustic surface of the general theorem is therefore here represented by a portion of the axis.

The character of a limited symmetrical pencil of rays is illustrated in fig. 6, in which BAC is the orthogonal surface, and HFI the caustic curve having a cusp at F, the so-called geometrical focus. The distance FD between F and the point where the extreme ray bHDG cuts the axis is called the longitudinal aberration. On account of the symmetry FD is an even function of AB. If the pencil be small, we may in general consider FD to be proportional to AB^2, although in particular cases the aberration may vanish to this order of approximation. Let us examine the nature of the sections at various points as they may be exhibited by holding a piece of paper in the solar rays converging from a common burning-glass of large aperture. In moving the paper towards the focus nothing special is observed up to the position HI, where the caustic surface is first reached. A bright ring is there formed at the margin of the illuminated area, and this gradually contracts. At D the second caustic surface DF is reached, and a bright spot develops itself at the centre. A little farther back, at EG, the area of the illuminated patch is a minimum, and its boundary is called the least circle of aberration. Farther back still the outer boundary corresponding to the extreme rays begins to enlarge, although the circle of intersection with the caustic surface continues to contract. Beyond F the caustic surfaces are passed, and no part of the area is specially illuminated.

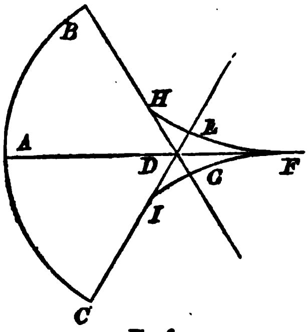


Fig. 6.

As a simple example of a symmetrical system let us take the case of parallel rays QR, OA (fig. 7), incident upon a spherical minor AR. By the law of reflexion the angle ORq = angle ORQ = angle qOR. Hence the triangle RqO is isosceles, and if we denote the radius of the surface OA by r, and the angle AOR by a, we have

$$Oq = \frac{r}{2\cos a}$$

If F be the geometrical focus, OF = AF = $\frac{1}{2}r$. If a be a small angle, the longitudinal aberration $Fq = Oq - OF = \frac{1}{2}r(\sec a - 1) = \frac{1}{4}a^2r$, in which $AR = ra$.

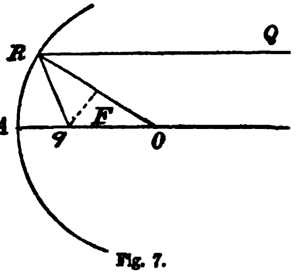


Fig. 7.

Focal Lines.—In the general case of a small pencil of rays there is no one point which can be called the geometrical focus. Consider the corresponding small area of the orthogonal surface and its two sets of lines of curvature. Of all the rays which are contiguous to the central ray there are only two which intersect it, and these will in general intersect it at different points. These points may be regarded as foci, but it is in a less perfect sense than in the case of symmetrical pencils. Even if we limit ourselves to rays in one of the principal planes, the aberration is in general a quantity of the first order in the angle of the pencil, and not, as before, a quantity of the second order. If, however, we neglect this aberration and group the rays in succession according to the two sets of lines of curvature, we see that the pencil of rays passes through two focal lines perpendicular to one another and to the central ray, and situated at the centres of curvature of the orthogonal surface. At some intermediate place the section of the pencil is circular.

It happens not unfrequently that the pencil under consideration forms part of a symmetrical system, but is limited in such a manner that the central ray of the pencil does not coincide with the axis of the system. The plane of the meridian of the orthogonal surface is called the primary plane, and the corresponding focus, situated on the caustic surface, the primary focus. The secondary focus is on the axis of symmetry through which every ray passes. The distinction of primary and secondary is also employed when the system, though not of revolution, is symmetrical with respect to a plane passing through the central ray, this plane being considered primary.

The formation of focal lines is well shown experimentally by a plano-convex lens of plate-glass held at an obliquity of 20° or 30° in the path of the nearly parallel rays, which diverge from a small image of the sun formed by a lens of short focus. The convex face of the lens is to be turned towards the parallel rays, and a piece of red glass may be interposed to mitigate the effects of chromatic dispersion.

To find the position of the focal lines of a small pencil incident obliquely upon a plane refracting surface of index μ.

The complete system of rays issuing from Q (fig. 8) and refracted at the plane surface CA is symmetrical about the line QC drawn through Q perpendicularly to the surface. Hence, if QA be the central ray of the pencil, the secondary focus q_2 lies at the intersection of the refracted ray with the axis. If ϕ be the angle of incidence, ϕ' of refraction, $AQ = u$, $Aq_2 = v_2$, then

$$\frac{v_2}{u} = \frac{\sin\phi}{\sin\phi'} = \mu \ldots\ldots\ldots\ldots\ldots\ldots (1).$$

To find the position of the primary focus q_1, let QA' be a neighbouring ray in the primary plane (that of the paper) with angles of incidence and refraction $\phi + \delta\phi$ and $\phi' + \delta\phi'$, $Aq_1 = v_1$. We have

$$AA'\cos\phi = u\delta\phi, \qquad AA'\cos\phi' = v_1\delta\phi';$$

moreover, by the law of refraction,

$$\cos\phi\,\delta\phi = \mu\cos\phi'\delta\phi';$$

and thus

$$\frac{v_1}{u} = \frac{\mu \cos^2 \phi'}{\cos^2 \phi} \quad \ldots\ldots\ldots\ldots\ldots\ldots(2).$$

If the refracting surface be curved, with curvature r^{-1}, we get by similar reasoning

$$\frac{\mu \cos^2\phi'}{v_1} - \frac{\cos^2\phi}{u} = \frac{\mu \cos \phi' - \cos \phi}{r}, \quad \ldots\ldots(3);$$

$$\frac{\mu}{v_2} - \frac{1}{u} = \frac{\mu \cos \phi' - \cos \phi}{r}, \quad \ldots\ldots\ldots\ldots(4);$$

in which (1) and (2) are of course included as particular cases.

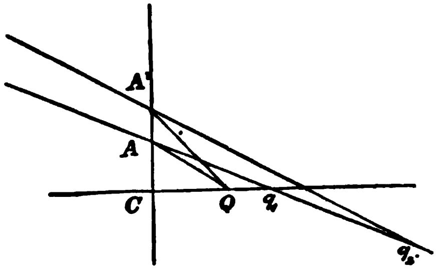


Fig. 8.

When the incidence is direct, $\cos \phi' = 1$, $\cos \phi = 1$, and $v_2 = v_1$. In this case (3) and (4) become

$$\frac{\mu}{v} - \frac{1}{u} = \frac{\mu - 1}{r}, \quad \ldots\ldots\ldots\ldots\ldots\ldots(5).$$

To find the positions of the focal lines of a pencil refracted obliquely through a plate of thickness t *and index* μ.

If ϕ be the angle of incidence (and emergence), ϕ' the angle of refraction of the ray QAST (fig. 9), $Sq_1 = v_1$, $Sq_2 = v_2$, $AQ = u$, we get by successive applications of (1) and (2)

$$v_1 = u + \frac{t \cos^2 \phi}{\mu \cos^3 \phi'}, \quad \ldots\ldots\ldots\ldots\ldots\ldots(6);$$

$$v_2 = u + \frac{t}{\mu \cos \phi'}, \quad \ldots\ldots\ldots\ldots\ldots\ldots(7).$$

If the incidence be direct,

$$v_1 = v_2 = u + \frac{t}{\mu} \quad \ldots\ldots\ldots\ldots\ldots\ldots(8).$$

Thus, if we interpose a plate between the eye and an object, the effect is to bring the object apparently nearer by the amount

$$\frac{(\mu - 1)t}{\mu} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(9).$$

On this result is founded a method for determining the refractive index of materials in the form of plates. A set of cross wires is observed through a magnifying glass. On interposition of the plate the glass must be drawn back through a distance given by (9) in order to recover the focus. If we measure this distance and the thickness of the plate we are in a position to determine the refractive index.

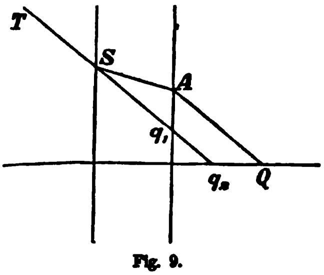


Fig. 9.

Prism.—By a prism is meant in optics a portion of transparent material limited by two plane faces which meet at a finite angle in a straight line called the edge of the prism. A section perpendicular to the edge is called a principal section.

Parallel rays, refracted successively at the two faces, emerge from the prism as a system of parallel rays. The angle through which the rays are bent is called the deviation.

The deviation depends upon the angles of incidence and emergence; but, since the course of a ray may always be reversed, the deviation is necessarily a symmetrical function of these angles. The deviation is consequently a maximum or a minimum when a ray within the prism is equally inclined to the two faces, in which case the angles of incidence and emergence are equal. It is in fact a minimum; and this position of the prism is described as the position of minimum deviation, and is usually adopted for the purposes of measurement.

The relation between the minimum deviation D, the angle of the prism ι, and the refractive index μ is readily found. In fig. 10 the internal angles ϕ', ψ' are each equal to $\frac{1}{2}\iota$. The external angles ϕ, ψ are also equal, and are connected with ϕ' by the law of refraction $\sin \phi = \mu \sin \phi'$. The deviation is $2(\phi - \phi')$. Hence

$$\mu = \frac{\sin \phi}{\sin \phi'} = \frac{\sin \frac{1}{2}(D + \iota)}{\sin \frac{1}{2}\iota};$$

and this is the formula by which the refractive index is usually determined, since both D and ι can be measured with great precision.

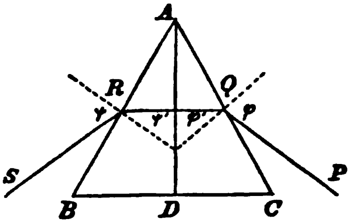


Fig. 10.

The instrument now usually employed for this purpose is called a goniometer or spectrometer. Parallel rays are provided by a collimator, consisting of an object-glass and telescope-tube, by means of which the subject of examination, either a fine slit or a set of cross wires, is seen as if it were at an infinite distance. The parallel rays from the collimator, after reflexion from a face or refraction through the body of the prism, are received by a telescope also provided with a set of cross wires at its focus. The table upon which the prism is supported, as well as the telescope, are capable of rotation about a vertical axis, and the position of either can be read off at any time by means of graduated circles and verniers.

As a preliminary to taking an observation it is necessary to focus the collimator and telescope. The first step is to adjust the eye-lens of the telescope until the cross wires are seen distinctly and without effort. The proper position depends, of course, upon the eyesight of the observer, and is variable within certain limits in virtue of the power of accommodation. It is usually best to draw out the lens nearly to the maximum distance consistent with distinct vision. The telescope is now turned to a distant object and focused by a common motion of the cross wires and eye-lens, until both the object and the cross wires are seen distinctly at the same time. The final test of the adjustment is the absence of a relative motion when the eye is moved sideways across the eye-piece. The collimator is now brought opposite to the telescope and adjusted until the cross wires in its focus behave precisely like the distant object.

To measure the angle of a prism it may be placed with its edge vertical upon the table, in a symmetrical position with respect to the collimator (fig. 11). The telescope is then successively brought into such positions that the cross wires of the telescope coincide with the cross wires of the collimator when seen by reflexion in the two faces. The difference of the readings is twice the angle of the prism.

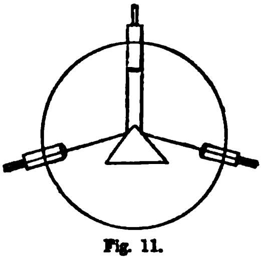


Fig. 11.

Another method is also often employed in which the telescope is held fixed and the prism is rotated. The angle between the two positions of the table found by use in succession of the two faces is the supplement of the angle of the prism.

Suppose next that we wish to determine D for the given prism and for sodium light. The slit of the collimator is backed by a sodium flame, the telescope is adjusted for direct vision of the slit, and the reading taken. The prism is now placed upon the table, and rotated until the deviation of the light from its original direction when seen through the prism is a minimum. The difference of the readings for the two positions of the telescope is the value of D. The angle to be observed may be doubled by using the deviation in both directions. In this case no direct reading in the absence of the prism is required.

The following table of indices of refraction is taken from Watt's *Dictionary of Chemistry*, article "Light."

Name of Substance.	Index of Refraction.	Name of Substance.	Index of Refraction.
Chromate of lead	2·50 to 2·97	Phosphoric acid	1·544
Diamond	2·47 to 2·75	Sulphate of copper ..	1·531 to 1·552
Phosphorus..........	2·224	Canada balsam	1·532
Glass of antimony ..	2·216	Citric acid	1·527
Sulphur (native)	2·115	Crown glass	1·525 to 1·534
Zircon	1·95	Nitre..................	1·514
Borate of lead	1·866	Plate glass	1·514 to 1·542
Carbonate of lead	1·81 to 2·08	Spermaceti	1·503
Ruby..............	1·779	Crown glass	1·500
Felspar..............	1·764	Sulphate of potassium	1·500
Tourmalin	1·668	Ferrous sulphate	1·494
Topaz (colourless)....	1·610	Tallow; wax	1·492
Beryl..............	1·598	Sulphate of magnesium	1·488
Tortoise-shell	1·591	Iceland spar	1·654
Emerald	1·585	Obsidian	1·488
Flint glass	1·57 to 1·58	Gum	1·476
Rock-crystal	1·547	Borax	1·475
Rock-salt..............	1·545	Alum................	1·457
Apophyllite	1·543	Fluorspar	1·436
Colophony	1·543	Ice....................	1·310
Sugar	1·535	Tabasheer	1·1115

A selection from some results given by Hopkinson,[1] relating to Chance's glasses, may be useful to those engaged in the designing of optical instruments. D is the more refrangible of the pair of sodium lines; *b* is the most refrangible of the group of magnesium lines; (G) is the hydrogen line near G.

	Hard Crown *a*.	Soft Crown.	Extra Light Flint.	Light Flint.	Dense Flint.	Extra Dense Flint.	Double Extra Dense Flint.
Specific Gravity	2·48575	2·55035	2·86636	3·20609	3·65865	3·88947	4·42162
B	1·513623	1·510916	1·536450	1·568558	1·615701	1·642874	1·701060
C	1·514568	1·511904	1·537678	1·570011	1·617484	1·644866	1·703478
D	1·517114	1·514591	1·541011	1·574015	1·622414	1·650388	1·710201
E	1·520331	1·518010	1·543306	1·579223	1·628895	1·657653	1·719114
b	1·520967	1·518686	1·546166	1·580271	1·630204	1·659122	1·720924
F	1·523139	1·520996	1·549121	1·583886	1·634748	1·664226	1·727237
(G)......	1·527994	1·526207	1·555838	1·592190	1·645267	1·676111	1·742063
G	1·528353	1·526595	1·556372	1·592824	1·646068	1·677019	1·743204
h	1·530902	1·529359	1·560010	1·597332	1·651840	1·683577	1·751464
H_1	1·532792	1·531416	1·562760	1·600727	1·656219	1·688569	1·757785

To determine the index of refraction of a liquid it must of course be placed in a hollow prism, whose faces are formed of some transparent material, usually of glass. The following results of Dale and Gladstone show the influence of temperature upon the refracting power of some important liquids. They relate to the soda flame, or the line D in the solar spectrum.

Temperature.	Bisulphide of Carbon.	Water.	Ether.	Alcohol Absolute.
0°	1·6442	1·3330	..	..
10°	1·6346	1·3327	1·3592	1·3658
20°	1·6261	1·3320	1·3545	1·3615
30°	1·6182	1·3309	1·3496	1·3578
40°	1·6103	1·3297	..	1·3536
50°	..	1·3280	..	1·3491
60°	..	1·3259	..	1·3457

Refractive Indices of Bisulphide of Carbon for the several Fixed Lines.

Temperature.	A	B	D	E	F	G
11° 36°·5	1·6142 1·5945	1·6207 1·6004	1·6333 1·6120	1·6465 1·6248	1·6584 1·6362	1·6836 1·6600
Difference	0·0197	0·0203	0·0213	0·0217	0·0222	0·0236

The rapid alteration of refractive power with temperature is a serious obstacle to the use of bisulphide of carbon prisms for exact purposes. Not only does the dispersive power vary from day to day, but inequalities of temperature in the various parts of the liquid at any one moment disturb the optical uniformity, and are thus the cause of bad definition. A difference of 1° Cent. alters the index about as much as a change in the light from one of the two D lines to the other, so that a variation of one degree within the prism may be expected to prevent the satisfactory resolution of this double line.

Excellent results have recently been obtained by Liveing with prisms containing aqueous solution of iodide of potassium and mercury. This liquid can be brought up to a density as high as three times that of water, and gives a powerful dispersion. Some difficulty has, however, been experienced in finding a suitable cement for the faces. Bisulphide of carbon prisms are usually cemented with a mixture of glue and treacle.

For many purposes the deviation of the light in passing through an ordinary prism is objectionable. In such cases recourse may be had to *direct vision* prisms (fig. 12), in which two materials, usually flint and crown, are so combined that the refractions are equal and opposite for a selected ray, while the dispersions are as unequal as may be. The direct vision prism may be contrasted with the achromatic lens (see LIGHT). In the first the object is to obtain dispersion without refraction, and in the second to obtain refraction without dispersion.

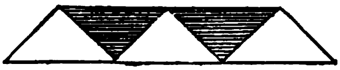


Fig. 12.

Compound prisms, composed of a flint between two crowns, are also made, in which the action of the crown is not carried so far as to destroy the deviation due to the flint. By this construction a larger angle is admissible for the more dispersive material, but it is not clear that any sufficient advantage is gained.

The principle of the compound prism is carried to its limit by employing media of *equal* refracting power for the part of the spectrum under examination. For this purpose bisulphide of carbon and flint glass may be chosen. With Chance's "dense flint" the refractions are the same, and the difference of dispersions is about as great as for "double-extra-dense flint" and crown. A dozen glass prisms of 90° may be cemented in a row on a strip of glass and immersed in a tube of bisulphide of carbon closed at the ends by glass plates. To vary the ray, which passes without deviation, ether may be mixed with the bisulphide.[2]

The formation of a pure spectrum, which may be either thrown upon a screen or photographic plate, or received at once by the eye armed with a magnifier, has been explained under LIGHT. It sometimes happens that the object is not to see the spectrum itself, but to arrange a field of view uniformly illuminated with approximately homogeneous light. For this purpose the pure spectrum is received upon a screen perforated by a narrow slit parallel to the fixed lines. The light which passes this second slit (eye-slit) is approximately homogeneous. Suppose that it corresponds to the red of the spectrum. The eye, placed immediately behind the eye-slit, receives only red light, and, if focused upon the prism, sees a red field of view whose brightness is uniform if the light falling in different directions upon the original slit be uniform. To secure the fulfilment of the last condition we may use the light from an overcast sky, or that of the sun reflected from a large surface of white paper. If it be desired to work by artificial light, an Argand gas flame diffused by an opal globe will be found suitable. When the adjustments are correct the tint should be perfectly uniform. Any difference of colour on the two sides of the field of view is an indication that the screen is not in its proper place.

The most important application of this arrangement is to the investigation of compound colours, as carried out by Maxwell.[3] If light be admitted also through a second slit displaced laterally from the position occupied by the first, a second spectrum overlapping the former will be thrown upon the screen, and a second kind of light will be admitted to the eye. In this way we may obtain a field of view lighted with a mixture of two or more spectrum colours, and we may control the relative proportions by varying the widths of the slits. For instance, by mixing almost any kind of red with any kind of green not inclining to blue we may match the brightest yellows, proving what so many find it difficult to believe, that yellow is a compound colour. In Maxwell's systematic examination of the spectrum, mixtures of three colours were used, and the proportions were adjusted so as to match the original white light incident upon the apparatus.

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[1] *Proc. Roy. Soc.*, June 1877.

[2] See "Investigations in Optics," *Phil. Mag.*, January 1880.

[3] "Theory of Compound Colours," *Phil. Trans.*, 1860.

A similar arrangement (with one original slit) was employed by Helmholtz in his examination of a fundamental question raised by Brewster. The latter physicist maintained that there was abundant evidence to show that light of definite refrangibility was susceptible of further analysis by absorption, so that the colour of light (even of given brightness) could not be defined in terms of refrangibility or wave-length alone. The appearances which misled Brewster have since been explained as the effect of contrast or of insufficient purity. It is obvious that light, *e.g.*, from the red end of the spectrum, may be contaminated with light from some other part, say the yellow, in such proportion that though originally entirely preponderant it may fall into the second place under the action of a medium very much more transparent to yellow than to red. To obtain light of sufficient purity for these experiments Helmholtz found it advisable to employ a double prismatic analysis. A spectrum is first thrown upon a screen perforated by a slit in the manner already described. The light which penetrates the second slit, already nearly pure, is caused to pass a second prism by the action of which any stray light is thrown aside. Using such doubly purified light, Helmholtz found the colour preserved, whatever absorbing agents were brought into play. Light of given refrangibility may produce a variety of *effects*, visual, thermal, or chemical, but (apart from polarization) it is not itself divisible into parts of different kinds. If yellow light produces the compound sensation of yellow, we are to seek the explanation in the constitution of the retina, and not in the divisibility of the light.

In all accurate work with the prism the use of a collimating lens to render the incident light parallel is a matter of necessity. If the incident rays diverge from a point at a finite distance, the pencil after emergence will be of a highly complicated character. There are, however, cases in which a collimator is dispensed with, and thus it is a problem of interest to find the foci of a thin pencil originally diverging from a point at a moderate distance. Even when a collimator is employed, the same problem presents itself whenever the focusing is imperfect. For the sake of simplicity the pencil is supposed to pass so near the edge of the prism that the length of path within the glass may be neglected in comparison with the distances of the foci.

We denote as usual the angles of incidence and emergence by ϕ, ψ, and the corresponding angles within the glass by ϕ', ψ'. The distance AQ from the edge of the prism to original source is denoted by u; the corresponding distances for the primary and secondary foci q_1, q_2 by v_1, v_2. By successive applications of the results already proved for a single refraction, we get

$$v_2 = u, \quad v_1 = \frac{\cos^2\phi' \cos^2\psi}{\cos^2\phi \cos^2\psi'} u \quad \text{............}(1);$$

so that

$$\frac{v_1}{v_2} = \frac{\cos^2\phi' \cos^2\psi}{\cos^2\phi \cos^2\psi'} = \frac{(\mu^2-1)\tan^2\phi + \mu^2}{(\mu^2-1)\tan^2\psi + \mu^2} \quad \text{......}(2).$$

In order that the primary and secondary foci may coincide we must have $\psi = \phi$; that is to say, the ray must pass with minimum deviation. This is sometimes given as a reason why this arrangement should be adopted in spectroscopes; but in reality, since the slit is parallel to the edge of the prism, a slight elongation in this direction of the image of a point is without detriment to the definition. Hence a good image will be seen when the telescope is adjusted for the *primary* focus; and it is not clear that any improvement would arise from coincidence of the two foci, the question being in fact one of aberration. The position of minimum deviation is, however, usually adopted for the sake of definiteness, and sometimes it is convenient that the fixed lines and the extremities of the slit (or the markings produced by dust) should be in focus together.

The deviation is a symmetrical function of ϕ and ψ, and therefore is not altered by an interchange of these angles. The corresponding values of v are thus by (1) reciprocals, and their product is equal to u^2. This principle has been ingeniously applied by Schuster[1] to the adjustment for focus of the telescope and collimator of a spectroscope. The telescope is so placed that the deviation necessary to bring the object upon the cross wires is greater than the minimum, and the prism is adjusted in azimuth until the effect is produced, that position being chosen for which the angle of incidence is greater than the angle of emergence, so that v_1 is greater than u. After focusing the telescope the prism is turned into the other position which gives the same deviation, and the *collimator* is focused, the telescope remaining untouched. The prism is next brought back to the first position, and the telescope is again focused. A few repetitions of this operation, always focusing the telescope in the first position of the prism and the collimator in the second, will bring both into perfect adjustment for parallel rays.

Lenses.—The usual formula for the focal length of lenses (vol. xiv. p. 593),

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{r} - \frac{1}{s}\right) \text{..................}(1),$$

ignores the fact that the various parts of a lens bounded by spherical surfaces have not the same focus, and is applicable in strictness only when the aperture is small. It is not necessary here to repeat the process by which (1) is usually obtained, but before passing on to give the formulæ for the aberration of lenses it may be well to exhibit the significance of (1) from the point of view of the wave-theory.

Taking the case of a convex lens of glass, let us suppose that parallel rays DA, EC, GB (fig. 13) fall upon the lens ACB, and are collected by it to a focus at F. The points D, E, G, equally distant from ACB, lie upon a front of the wave before it impinges upon the lens. The focus is a point at which the different parts of the wave arrive at the same time, and that such a point can exist depends upon the fact that the propagation is slower in glass than in air. The ray ECF is retarded from having to pass through the thickness (t) of glass by the amount $(\mu - 1)t$. The ray DAF, which traverses only the extreme edge of the lens, is retarded merely on account of the crookedness of its path, and the amount of the retardation is measured by AF − CF. If F is a focus these retardations must be equal, or

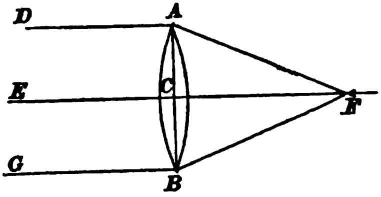

Fig. 13.

$$AF - CF = (\mu - 1)t.$$

Now if y be the semi-aperture AC of the lens, and f be the focal length CF,

$$AF - CF = \sqrt{\{f^2 + y^2\}} - f = \tfrac{1}{2}\frac{y^2}{f} \text{ approximately,}$$

whence

$$f = \frac{y^2}{2(\mu - 1)t} \text{......................}(2).$$

In the case of plate-glass $\mu - 1 = \tfrac{1}{2}$ nearly, and then the rule (2) may be thus stated: *the semi-aperture is a mean proportional between the focal length and the thickness.* The form (2) is in general the more significant, as well as the more practically useful, but we may of course express the thickness in terms of the curvatures and semi-aperture by means of

$$t = \tfrac{1}{2}y^2\left(\frac{1}{r} - \frac{1}{s}\right).$$

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[1] *Phil. Mag.*, February 1879.

In the preceding statement it has been supposed for simplicity that the lens comes to a sharp edge. If this be not the case we must take as the thickness of the lens the *difference* of the thicknesses at the centre and at the circumference. In this form the statement is applicable to concave lenses, and we see that the focal length is positive when the lens is thickest at the centre, but negative when the lens is thickest at the edge.

To determine practically the focal length of a convex lens we may proceed in several ways. A convenient plan is to set up a source of light Q (fig. 14) and a screen q at a distance exceeding four times the focal length, and to observe the two positions of the lens A, A′ at which the source is in focus upon the screen. These positions are symmetrically situated, and the distance between them is observed. Thus

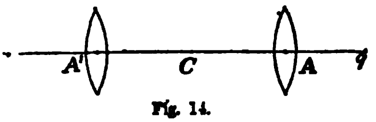

Fig. 14.

$$AQ = \tfrac{1}{2}Qq + \tfrac{1}{2}AA', \qquad Aq = \tfrac{1}{2}Qq - \tfrac{1}{2}AA'.$$

Now

$$\frac{1}{AQ} + \frac{1}{Aq} = \frac{1}{f},$$

so that

$$f = \frac{AQ \, . \, Aq}{AQ + Aq} = \tfrac{1}{4}\,\frac{Qq^2 - AA'^2}{Qq}.$$

From the measured values of Qq and AA', f can be deduced.

If A and A′ coincide, the conjugate foci Q and q are as close as possible to one another, and then $f = \tfrac{1}{4}Qq$.

The focal length on a concave lens may be found by combining it with a more powerful convex lens of known focus.

Aberration of Lenses.—The formula (1) determines the point at which a ray, originally parallel to the axis and at but a short distance from it, crosses the axis after passage through the lens. When, however, the ray considered is not quite close to the axis, the point thus determined varies with the distance y. In the case of a convex lens the ray DH (fig. 15), distant HC ($=y$) from the axis, crosses it after refraction at a point F′ which lies nearer to the lens than the point F determined by (1), and corresponding to an infinitely small value of y. The distance F′F is called the *longitudinal aberration* of the ray, and may be denoted by δf.

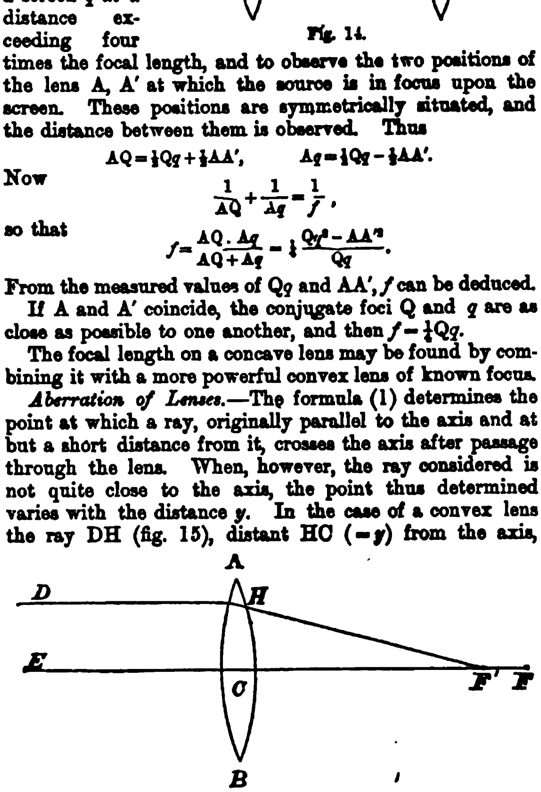

Fig. 15.

The calculation of the longitudinal aberration as dependent upon the refractive index (μ) and the anterior and posterior radii of the surfaces (r, s) is straight forward, but is scarcely of sufficient interest to be given at length in a work like the present. It is found that

$$-\delta f : \frac{y^2}{f} = \frac{\mu - 1}{2\mu^2}\left\{\frac{1}{r^3} + \left(\frac{\mu+1}{f} - \frac{1}{s}\right)\left(\frac{1}{f} - \frac{1}{s}\right)^2\right\} f^3 \ldots (3),$$

r, s, and f being related as usual by (1).

The first question which suggests itself is whether it is possible so to proportion r and s that the aberration may vanish. Writing for brevity R, S, F respectively for r^{-1}, s^{-1}, f^{-1}, and taking $G = \frac{\mu F}{\mu - 1}$, so that $-S = (G/\mu) - R$, we get

$$\frac{1}{r^3} + \left(\frac{\mu+1}{f} - \frac{1}{s}\right)\left(\frac{1}{f} - \frac{1}{s}\right)^2 = G\{R^2(\mu+2) - RG(2\mu+1) + \mu G^2\}$$

$$= G\left\{\sqrt{(\mu+2)} \, . \, R - \frac{(2\mu+1)G}{2\sqrt{(\mu+2)}}\right\}^2 + \frac{\mu^3 F^3}{(\mu-1)^3}\,\frac{4\mu - 1}{4(\mu+2)} \ldots (4).$$

Since $\mu > 1$, both terms are of the same sign; and thus it appears that the *aberration can never vanish*, whatever may be the ratio of r to s. Under these circumstances all that we can do is to ascertain for what form of lens the aberration is a minimum, the focal length and aperture being given. For this purpose we must suppose that the first term of (4) vanishes, which gives

$$r = \frac{2(\mu+2)(\mu-1)}{\mu(2\mu+1)} f \ldots\ldots\ldots\ldots (5).$$

The corresponding value of $-s$ is

$$-s = \frac{2(\mu+2)(\mu-1)}{4+\mu-2\mu^2} f \ldots\ldots\ldots\ldots (6);$$

so that

$$-s : r = \frac{\mu(2\mu+1)}{4+\mu-2\mu^2} \ldots\ldots\ldots\ldots (7).$$

In the case of plate-glass $\mu = 1{\cdot}5$ nearly, and then from (5), (6), (7)

$$r = \frac{7}{12} f, \quad -s = \frac{7}{2} f, \quad -s : r = 6 : 1.$$

Both surfaces are therefore convex, but the curvature of the anterior surface (that directed towards the incident parallel rays) is six times the curvature of the posterior surface. By (3) the outstanding aberration is

$$\delta f = -\frac{15}{14}\,\frac{y^2}{f} \ldots\ldots\ldots\ldots 8).$$

The use of a plano-convex lens instead of that above determined does not entail much increase of aberration. Putting in (3) $s = \infty$, and therefore by (1) $r = \tfrac{1}{2}f$, we get

$$\delta f = -\frac{7}{6}\,\frac{y^2}{f} \ldots\ldots\ldots\ldots (9).$$

This is on the supposition that the curved side faces the parallel rays. If the lens be turned round so as to present the plane face to the incident light we have $r = \infty$, $-s = \tfrac{1}{2}f$, and then

$$\delta f = -\frac{9}{2}\,\frac{y^2}{f} \ldots\ldots\ldots\ldots (10),$$

nearly four times as great.

For a somewhat higher value of μ the plano-convex becomes the form of minimum aberration. If $s = \infty$ in (6), $4 + \mu - 2\mu^2 = 0$, whence $\mu = 1{\cdot}69$.

If μ be very great, we see from (5) and (6) that r and s tend to become identical with f.

For the general value of μ the minimum aberration corresponding to (7) is by (4)

$$-\delta f : \frac{y^2}{f} = \frac{\mu(4\mu-1)}{8(\mu-1)^2(\mu+2)} \ldots\ldots\ldots\ldots (11).$$

The right-hand member of (11) tends to diminish as μ increases, but it remains considerable for all natural substances. If $\mu = 2$,

$$-\delta f : \frac{y^2}{f} = \frac{7}{16}.$$

Oblique Pencils.—Hitherto we have supposed that the axis of the pencil coincides with the axis of the lens. If the axis of the pencil, though incident obliquely, pass through the centre of the lens, it suffers no deviation, the surfaces being parallel at the points of incidence and emergence. In this case the primary and secondary foci are formed at distances from the centre of the lens which can only differ from the distance corresponding to a direct pencil by quantities of the second order in the obliquity. Hence, if the obliquity be moderate, we may use the same formulæ for oblique as for direct pencils.

The consideration of excentrical pencils leads to calculations of great complexity, upon which we do not enter.

Chromatic Aberration.—The operation of simple lenses is much interfered with by the variation of the refractive index with the colour of the light. The focal length is decidedly less for blue than for red light, and thus in the ordinary case of white light it is impossible to obtain a perfect image, however completely the spherical aberration may be corrected. From the formula for the focal length we see that

$$\frac{\delta f}{f^2} = -\delta\mu\left(\frac{1}{r} - \frac{1}{s}\right) = -\frac{\delta\mu}{\mu - 1}\,\frac{1}{f},$$

so that

$$-\delta f = \frac{\delta\mu}{\mu - 1} f;$$

or the longitudinal chromatic aberration varies as the focal length and as the dispersive power of the material composing the lens. The best image will be formed at a position midway between the two foci, and the diameter d of the circle over which the rays are spread bears the same ratio to the semi-aperture of the lens (y) that δf bears to f. Hence

$$d=\frac{\delta\mu}{\mu-1}y.$$

The diameter of the circle of chromatic aberration is thus proportional to the aperture and *independent of the focal length*; and, since the linear dimensions of the image are proportional to the focal length, the confusion due to chromatic aberration may be considered to be inversely as the focal length. Before the invention of the achromatic object-glass this source of imperfect definition was by far the most important, and, in order to mitigate its influence, telescopes were made of gigantic length. Even at the present day the images of large so-called achromatic glasses are sensibly impaired by secondary chromatic aberration, the effect of which is also directly as the aperture and inversely as the focal length.

Achromatic Object-glasses.—It has been shown in vol. xiv. p. 595 that the condition of achromatism for two thin lenses placed close together is

$$\frac{\delta\mu}{\mu-1}\,\frac{1}{f}+\frac{\delta\mu'}{\mu'-1}\,\frac{1}{f'}=0 \quad\ldots\ldots\ldots\ldots\ldots(1),$$

in which f, f' are the focal lengths of the two lenses, and $\delta\mu/(\mu-1)$, $\delta\mu'/(\mu'-1)$ the dispersive powers of the two kinds of glass. In practice crown and flint glass are used, the dispersive power of the flint being greater than that of the crown. Thus f' is negative and numerically greater than f, so that the combination consists of a convex lens of crown and a concave lens of flint, the converging power of the crown overpowering the diverging power of the flint. When the focal length F of the combination is given, the focal lengths of the individual lenses are determined by (1) in conjunction with

$$\frac{1}{F}=\frac{1}{f}+\frac{1}{f'} \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2).$$

The matter, however, is not quite so simple as the above account of it might lead us to suppose. In consequence of what is called the irrationality of spectra, the ratio of dispersive powers of two media is dependent upon the parts of the spectrum which we take into consideration. Whatever two rays of the spectrum we like to select, we can secure that the compound lens shall have the same focal length for these rays, but we shall then find that for other rays the focal length is slightly different. In the case of a single lens the focal length continually diminishes as we pass up the spectrum from red to violet. By the use of two lenses the spectrum, formed as it were along the axis, is doubled upon itself. The focal length is least for a certain ray, which may be selected at pleasure. Thus in the ordinary achromatic lens, intended for use with the eye, the focal length is a minimum for the green, and increases as we pass away from the green, whether towards red or towards blue. Stokes has shown that the secondary colour gives a sharp test of the success of the achromatising process.

"The secondary tints in an objective are readily shown by directing the telescope to a vertical line separating light from dark, such as the edge of a chimney seen in the shade against the sky, and covering half the object-glass with a screen having a vertical edge. So delicate is this test that, on testing different telescopes by well-known opticians, a difference in the mode of achromatism may be detected. The best results are said to be obtained when the secondary green is intermediate between green and yellow. This corresponds to making the focal length a minimum for the brightest part of the spectrum.

"To enable me to form a judgment as to the sharpness of the test furnished by the tint of the secondary green, as compared with the performance of an object-glass, I tried the following experiment. A set of parallel lines of increasing fineness was ruled with ink on a sheet of white paper, and a broader black object was laid upon it as well, parallel to the lines. The paper was placed, with the black lines vertical, at a considerable distance on a lawn, and was viewed through two opposed prisms, one of crown glass and the other of flint, of such angles as nearly to achromatise each other in the positions of minimum deviation, and then through a small telescope. The achromatism is now effected, and varied in character, by moving one of the prisms slightly in azimuth, and after each alteration the telescope was focused afresh to get the sharpest vision that could be had. I found that the azimuth of the prism was fixed within decidedly narrower limits by the condition that the secondary green should be of such or such a tint, even though no attempt was made to determine the tint otherwise than by memory, than by the condition that the vision of the fine lines should be as sharp as possible. Now a small element of a double object-glass may be regarded, so far as chromatic compensation is concerned, as a pair of opposed prisms; and therefore we may infer that the tint of the secondary green ought to be at the very least as sharp a test of the goodness of the chromatic compensation as the actual performance of the telescope."[1]

In the case of photographic lenses the conditions of the problem are materially different. It is usually considered to be important to secure "coincidence of the visual and chemical foci," so that the sensitive plate may occupy the exact position previously found by the eye for the ground glass screen. For this purpose the ray of minimum focus must be chosen further up in the spectrum. If, however, the object be to obtain the sharpest possible photographs, coincidence of visual and chemical foci must be sacrificed, the proper position for the sensitive plate being found by trial. The middle of the chemically-acting part of the spectrum, which will vary somewhat according to the photographic process employed, should then be chosen for minimum focus.

When the focal lengths of the component lenses have been chosen, it still remains to decide upon the curvatures of the individual faces. Between the four curvatures we have at present only two relations, and thus two more can be satisfied. One of these is given by the condition that the first term in the expression for the aberration—that proportional to the square of the aperture—shall vanish for parallel rays. As to the fourth condition, various proposals have been made. If equal and opposite curvatures are given to the second and third surfaces, the glasses may be cemented together, by which some saving of light is effected. Herschel proposed to make the aberration vanish for nearly parallel, as well as for absolutely parallel, rays. This leads to a construction nearly agreeing with that adopted by Fraunhofer.

The following results are given by Herschel[2] for the radii of the four surfaces, corresponding to various dispersive powers, and to mean refractive indices 1·524 (crown) and 1·585 (flint). The focal length of the combination is taken equal to 10, and, as well as the radii, is measured in arbitrary units; so that all the numbers in the table (with the exception of the first column) may be changed in any proportion.

Ratio of Dispersive Powers.	Radius of First Surface. +	Radius of Second Surface. −	Radius of Third Surface. −	Radius of Fourth Surface. −	Focal Length of Crown Lens. +	Focal Length of Flint Lens. −
·50	6·7485	4·2827	4·1575	14·3697	5·0	10·0000
·55	6·7184	3·6332	3·6006	14·5353	4·5	8·1818
·60	6·7069	3·0488	3·0640	14·2967	4·0	6·6667
·65	6·7316	2·5208	2·5566	13·5709	3·5	5·3846
·70	6·8279	2·0422	2·0831	12·3154	3·0	4·2857
·75	7·0816	1·6073	1·6450	10·5186	2·5	3·3333

The general character of the combination is shown in fig. 16.

The radii of the first and fourth surfaces within practical limits are so nearly constant that Herschel lays down the following rule as in all probability sufficiently exact for use. A double object-glass will be free from aberration, provided the radius of the exterior surface of the crown lens be 6·720 and of the flint 14·20, the focal length of the combination being 10·000, and the radii of the interior surface being computed from these data, by the formulæ given in all elementary works on optics, so as to make the focal lengths of the two glasses in the direct ratio of their dispersive powers.

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[1] *Proc. Roy. Soc.*, June 1878.

[2] *Phil. Trans.*, 1821.

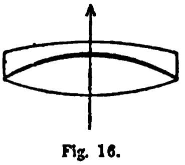

Fig. 16.

Numerous experiments have been made with the view of abolishing the secondary spectrum. Theoretically, if three different kinds of glasses are combined it will generally be possible to make the focal lengths of the combination equal for any *three* selected rays of the spectrum. Or the ingredients of one of the glasses may be mixed in such proportions as to suit the requirements of the problem when combined with crown. In this way Stokes has succeeded in constructing a small object-glass free from secondary colour, but it is doubtful whether the practical difficulties could be overcome in the construction of a large object-glass, where alone the outstanding chromatic aberration is important.

The practical optician is not limited to spherical surfaces, and the final adjustment of the aberration of large object-glasses is controlled by the action of the polishing tool. It is understood that some of the best makers apply a local correction, according to the methods developed by Foucault for mirrors. The light from a natural or artificial star is allowed to fall upon the lens. At the focus is placed a small screen, which is gradually advanced so as to cut off the light. The eye is immediately behind the screen and is focused upon the lens. If there are no imperfections the illumination falls off very suddenly, the surface of the mirror passing from light to dark through a nearly uniform grey tint. If, however, from uniform aberration, or from local defects, any of the light goes a little astray, the corresponding parts of the surface will show irregularities of illumination during the passage of the screen, and in this manner a guide is afforded for the completion of the figuring.

Töppler[1] has developed the idea of Foucault into a general method for rendering visible very small optical differences. Instead of a mere point of light, it is advisable to use as source an aperture (backed by a bright flame) of sensible size, and bounded on one side by a straight edge. An image of this source is formed at a considerable distance by a lens of large aperture and free from imperfections, and in the plane of the image is arranged a screen whose edge is parallel to the straight edge of the image, and can be advanced gradually so as to coincide with it. Behind this screen comes a small telescope through which the observer examines the object placed near the lens. When the light is just cut off by the advancing screen, the apparatus is in the most sensitive state, and the slightest disturbance of the course of the rays is rendered evident. To show the delicacy of the arrangement Töppler introduced into the cone of light a small trough with parallel glass sides containing distilled water. A syphon dipped under the surface and discharged distilled water from another vessel, and it was found almost impossible so to control the temperatures that the issuing jet should remain invisible. Not only were sound-waves in air, generated by electric sparks, rendered visible, but their behaviour when reflected from neighbouring obstacles was beautifully exhibited.

An apparatus on this principle may often be employed with advantage in physical demonstrations,—for instance, for the exhibition of the changes of density in the neighbourhood of the electrodes of a metallic solution undergoing electrolysis. The smallest irregularity that could be rendered visible would be such as would retard transmitted light by a moderate fraction of the wave-length.[2]

In objectives for photographic use the requirements are in many respects different from those most important in the case of telescopes. A flat field, a wide angle of view—in some cases as much as 90°—freedom from distortion, and a great concentration of light are more important than a high degree of definition. As a rule, photographs are not subjected to the ordeal of a high magnifying power. Usually the picture includes objects at various distances from the camera, which cannot all be in focus at once. That the objects at one particular distance should be depicted with especial sharpness would often be rather a disadvantage than otherwise. A moderate amount of "diffusion of focus" is thus desirable, and implies residual aberration. In some lenses an adjustment is provided by means of which the diffusion of focus may be varied according to the circumstances of the case.

For landscapes and general purposes a so-called single lens is usually employed. This, however, for the sake of achromatism, is compounded of a flint and a crown cemented together; or sometimes three component lenses are used, the flint being encased in two crowns, one on each side. To get tolerable definition and flatness of field a stop must be added, whose proper place is some little distance in front of the lens.

For portraiture, especially before the introduction of the modern rapid dry plates, a brilliant image was a necessity. This implies a high ratio of aperture to focal length, which cannot be attained satisfactorily with any form of single lens. To meet the demand, Petzval designed the "portrait-lens," in which two achromatic lenses, placed at a certain distance apart, combine to form the image. This construction is so successful that the focal length is often no more than three times the available aperture. When stops are employed to increase the sharpness and depth of focus they are placed *between* the lenses.

Vision through a Single Lens.—A single lens may be used to improve the vision of a defective eye, or as a magnifying glass. A normal eye is capable of focusing upon objects at any distance greater than about 8 inches. The eyes of a short-sighted person are optically too powerful, and cannot be focused upon an object at a moderate distance. The remedy is of course to be found in concave glasses. On the other hand, persons beyond middle life usually lose the power of seeing near objects distinctly, and require convex glasses.

A not uncommon defect, distinct from mere short or weak sight, is that known as astigmatism. In such cases the focal length varies in different planes, and at no distance is the definition perfect. Many people, whose sight would not usually be considered inferior, are affected by astigmatism to a certain extent. If a set of parallel black lines ruled upon white paper be turned gradually round in its own plane, it will often be seen more distinctly and with greater contrast of the white and black parts in one azimuth than in another. When the focal line on the retina is parallel to the length of the bar, the definition (as in the case of the spectroscope) is not much prejudiced, but it is otherwise when the bars are turned through a right angle so as to be perpendicular to the focal line.

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[1] *Pogg. Ann.*, cxxxi., 1867.

[2] Even when the optical differences are not small it is well to remember that transparent bodies are only visible in virtue of a variable illumination. If the light falls equally in all directions, as it might approximately do for an observer on a high monument during a thick fog, the edge of (for example) a perfectly transparent prism would be absolutely invisible. If a spherical cloud, composed of absolutely transparent material, surround symmetrically a source of light, the illumination at a distance would not be diminished by its presence.

In extreme cases a remedy may be applied in the form of glasses of different curvatures in perpendicular planes, so adjusted both in form and position as to compensate the corresponding differences in the lens of the eye.

The use of a lens as a magnifier has been explained under MICROSCOPE. The simplest view of the matter is that the lens, consistently with good focusing, allows of a nearer approach, and therefore of a higher visual angle, than would otherwise be possible.

Telescope, &c.—In a large class of optical instruments an *image* of the original object is first formed, and this image is examined through a magnifier. If we use a single lens merely for the latter purpose, the field of view is very restricted. A great improvement in this respect may be effected by the introduction of a *field*-lens. The ideal position for the field-lens is at the focal plane of the object-glass. The image is then entirely uninfluenced, and the only effect is to bend round the rays from the margin of the field which would otherwise escape, and to make them reach the eye-lens, and ultimately the eye. If the field-lens and the eye-lens have nearly the same focal length an image of the object-glass will be formed upon the eye-lens, and through this small image will pass every ray admitted by the object-glass and field-lens.

However, to obtain a sufficient augmentation of the field of view it is not necessary to give the field-lens the exact position above mentioned, and other considerations favour a certain displacement. For example, it is not desirable that dust and flaws on the field-lens should be seen in focus. In Huygens's eye-piece the field-lens is displaced from its ideal position *towards* the object-glass. In Ramsden's eye-piece, on the other hand, the focal plane of the object-glass is outside the system. This eye-piece has the important advantage that cross wires can be placed so as to coincide with the image as formed by the object-glass. The component lenses of a Ramsden's eye-piece are sometimes achromatic. For further particulars, with diagrams, on the subject of eye-pieces, see MICROSCOPE.

In large telescopes the object-glass is often replaced by a mirror, which may be of speculum metal, or of glass coated chemically with a very thin layer of polished silver. The mirror presents the advantage (especially important for photographic applications) of absolute achromatism. On the other hand, more light is lost in the reflexion than in the passage through a good object-glass, and the surface of the mirror needs occasional re-polishing or re-coating. For fuller information see TELESCOPE.

The function of a telescope is to increase the "apparent magnitude" of distant objects; it does not increase the "apparent brightness." If we put out of account the loss of light by reflexion at glass surfaces (or by imperfect reflexion at metallic surfaces) and by absorption, and suppose that the magnifying power does not exceed the ratio of the aperture of the object-glass to that of the pupil, under which condition the pupil will be filled with light, we may say that the "apparent brightness" is absolutely unchanged by the use of a telescope. In this statement, however, two reservations must be admitted. If the object under examination, like a fixed star, have no sensible apparent magnitude, the conception of "apparent brightness" is altogether inapplicable, and we are concerned only with the total quantity of light reaching the eye. Again, it is found that the visibility of an object seen against a black background depends not only upon the "apparent brightness" but also upon the apparent magnitude. If two or three crosses of different sizes be cut out of the same piece of white paper, and be erected against a black background on the further side of a nearly dark room, the smaller ones become invisible in a light still sufficient to show the larger. Under these circumstances a suitable telescope may of course bring also the smaller objects into view. The explanation is probably to be sought in imperfect action of the lens of the eye when the pupil is dilated to the utmost. The author of this article has found that in a nearly dark room he becomes distinctly short-sighted, a defect of which there is no trace whatever in a moderate light.[1] If this view be correct, the brightness of the image on the retina is really less in the case of a small than in the case of a large object, although the so-called apparent brightnesses may be the same. However this may be, the utility of a night-glass is beyond dispute.

The general law that (apart from the accidental losses mentioned above) the "apparent brightness" depends only upon the area of the pupil filled with light, though often ill understood, has been established for a long time, as the following quotation from Smith's *Optics* (Cambridge, 1738), p. 113, will show.

> "Since the magnitude of the pupil is subject to be varied by various degrees of light, let NO be its semi-diameter when the object PL is viewed by the naked eye from the distance OP; and upon a plane that touches the eye at O, let OK be the semi-diameter of the greatest area, visible through all the glasses to another eye at P, to be found as PL was; or, which is the same thing, let OK be the semi-diameter of the greatest area inlightened by a pencil of rays flowing from P through all the glasses; and when this area is not less than the area of the pupil, the point P will appear just as bright through all the glasses as it would do if they were removed; but if the inlightened area be less than the area of the pupil, the point P will appear less bright through the glasses than if they were removed in the same proportion as the inlightened area is less than the pupil. And these proportions of apparent brightness would be accurate if all the incident rays were transmitted through the glasses to the eye, or if only an insensible part of them were stopt."

Resolving Power of Optical Instruments.—According to the principles of common optics, there is no limit to the resolving power of an instrument. If the aberrations of a microscope were perfectly compensated it might reveal to us worlds within a space of a millionth of an inch. In like manner a telescope might resolve double stars of any degree of closeness. The magnifying power may be exalted at pleasure by increase of focal length and of the power of eye-pieces; and there are at any rate some objects, such as the sun, in dealing with which the accompanying loss of light would be an advantage rather than the contrary. How is it, then, that the power of the microscope is subject to an absolute limit, and that if we wish to observe minute detail on the over-lighted disk of the sun we must employ a telescope of large aperture? The answer requires us to go behind the approximate doctrine of rays, on which common optics is built, and to take into consideration the finite character of the wave-length of light.

A calculation based upon the principles of the wave-theory shows that, no matter how perfect an object-glass may be, the image of a star is represented, not by a mathematical point, but by a disk of finite size surrounded by a system of alternately dark and bright rings. Airy found that if the angular radius of the central disk (as seen from the centre of the object-glass) be θ, $2R$ the aperture, λ the wave-length, then

$$\theta = 1 \cdot 2197 \frac{\lambda}{2R},$$

showing that the definition, as thus limited by the finiteness of λ, increases with the aperture.

In estimating theoretically the resolving power of a telescope on a double star we have to consider the illumination of the field due to the superposition of the two independent images. If the angular interval between the components of the double star were equal to 2θ, the central disks would be just in contact. Under these conditions there can be no doubt that the star would appear to be fairly resolved, since the brightness of the external ring systems is too small to produce any material confusion, unless indeed the components are of very unequal magnitude. The diminution of star disks with increasing aperture was observed by W. Herschel; and in 1823 Fraunhofer formulated the law of inverse proportionality. In investigations extending over a long series of years, the advantage of a large aperture in separating the components of close double stars was fully examined by Dawes.

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[1] *Camb. Phil. Proc.*, vol. iv.

The resolving power of telescopes was investigated also by Foucault, who employed a scale of equal bright and dark alternate parts; it was found to be proportional to the aperture and independent of the focal length. In telescopes of the best construction the performance is not sensibly prejudiced by outstanding aberration, and the limit imposed by the finiteness of the waves of light is practically reached. Verdet has compared Foucault's results with theory, and has drawn the conclusion that the radius of the visible part of the image of a luminous point was nearly equal to half the radius of the first dark ring.

The theory of resolving power is rather simpler when the aperture is rectangular instead of circular, and when the subject of examination consists of two or more light or dark lines parallel to one of the sides of the aperture. Supposing this side to be vertical, we may say that the definition, or resolving power, is *independent of the vertical aperture*, and that a double line will be about on the point of resolution when its components subtend an angle equal to that subtended by the wave-length of light at a distance equal to the *horizontal aperture*.

The resolving power of a telescope with a circular or rectangular aperture is easily investigated experimentally. The best object is a grating of fine wires, about fifty to the inch, backed by a soda-flame. The object-glass is provided with diaphragms pierced with round holes or slits. One of these, of width equal, say, to one-tenth of an inch, is inserted in front of the object-glass, and the telescope, carefully focused all the while, is drawn gradually back from the grating until the lines are no longer seen. From a measurement of the maximum distance the least angle between consecutive lines consistent with resolution may be deduced, and a comparison made with the rule stated above.

Merely to show the dependence of resolving power on aperture it is not necessary to use a telescope at all. It is sufficient to look at wire-gauze backed by the sky, or by a flame, through a piece of blackened cardboard pierced by a needle and held close to the eye. By varying the distance the point is easily found at which resolution ceases; and the observation is as sharp as with a telescope. The function of the telescope is in fact to allow the use of a wider, and therefore more easily measurable, aperture. An interesting modification of the experiment may be made by using light of various wave-lengths.

In the case of the microscope the wave-theory shows that there must be an absolute limit to resolving power independent of the construction of the instrument. No optical contrivances can decide whether light comes from one point or from another if the distance between them do not exceed a small fraction of the wave-length. This idea, which appears to have been familiar to Fraunhofer, has recently been expanded by Abbe and Helmholtz into a systematic theory of the microscopic limit. See MICROSCOPE.

Similar principles may be applied to investigate the resolving power of spectroscopes, whether dispersing or diffracting. Consider for simplicity any combination of prisms, anyhow disposed, but consisting of one kind of glass. Let a be the width and μ the index of a parallel beam passing through, and let the thicknesses of glass traversed by the extreme rays on either side be t_2 and t_1. It is not difficult to see that, if the index be changed to $\mu+\delta\mu$, the rays will be turned through an angle θ given by

$$\theta=\frac{\delta\mu(t_2-t_1)}{a}.$$

Now, if the two kinds of light correspond to a double line which the instrument can just resolve, we have $\theta=\lambda/a$, and thus

$$t_2-t_1=\lambda/\delta\mu,$$

a formula of capital importance in the theory of the dispersing spectroscope. In a well-constructed instrument, t_1, the smaller thickness traversed, may be small or negligible, and then we may state the law in the following form:—the smallest thickness of prisms necessary for the resolution of a double line whose indices are μ and $\mu+\delta\mu$ is found by dividing the wave-length by $\delta\mu$.

As an example, let it be required to find the smallest thickness of a prism of Chance's "extra dense flint," necessary for resolution of the soda-lines.

By Cauchy's formula for the relation between μ and λ we have

$$\mu=A+B\lambda^{-2}, \qquad \delta\mu=-2B\lambda^{-3}\delta\lambda.$$

From the results given by Hopkinson for this kind of glass we find

$$B=\cdot984\times10^{-10},$$

the unit of length being the centimetre. For the two soda-lines

$$\lambda=5\cdot889\times10^{-5}, \qquad \delta\lambda=\cdot006\times10^{-5};$$

and thus the thickness t necessary to resolve the lines is

$$t=\frac{\lambda^4}{2B\delta\lambda}=\frac{10^{10}\lambda^4}{1\cdot968\delta\lambda}=1\cdot02 \text{ centimetre},$$

the meaning of which is that the soda-lines will be resolved if, and will not be resolved unless, the difference of thicknesses of glass traversed by the two sides of the beam amount to one centimetre. In the most favourable arrangement the centimetre is the length of the base of the prism. It is to be understood, of course, that the magnifying power applied is sufficient to narrow the beam ultimately to the diameter of the pupil of the eye; otherwise the full width would not be utilized.

The theory of the resolving power of a diffracting spectroscope, or grating, is even simpler. Whatever may be the position of the grating, a double line of wave-lengths λ and $\lambda+\delta\lambda$ will be just resolved provided

$$\frac{\delta\lambda}{\lambda}=\frac{1}{mn},$$

where n is the total number of lines in the grating, and m is the order of the spectrum under examination.

If a grating giving a spectrum of the first order and a prism of extra dense glass have equal power in the region of the soda-lines, the former must have about as many thousand lines as the latter has centimetres of available thickness.

The dispersion produced by a grating situated in a given manner is readily inferred from the resolving power. If a be the width of the beam after leaving the grating, the angle $\delta\theta$, corresponding to the limit of resolution, is λ/a, and thus

$$\frac{\delta\theta}{\delta\lambda}=\frac{mn}{a}.$$

Thus the dispersion depends only upon the order of the spectrum, the total number of lines, and the width of the emergent beam.

An obvious inference from the necessary imperfection of optical images is the uselessness of attempting anything like an absolute destruction of aberration. In an instrument free from aberration the waves arrive at the focal point in the same phase. It will suffice for practical purposes if the error of phase nowhere exceeds ¼λ. This corresponds to an error of ⅛λ in a reflecting and ½λ in a (glass) refracting surface, the incidence in both cases being perpendicular.

If we inquire what is the greatest admissible longitudinal aberration in an object-glass according to the above rule, we find

$$\delta f=\lambda\alpha^{-2}$$

α being the angular semi-aperture.

In the case of a single lens of glass with the most favourable curvatures, δf is about equal to $f\alpha^2$; so that α^4 must not exceed λ/f. For a lens of 8-feet focus this condition is satisfied if the aperture do not exceed 2 inches.

When parallel rays fall directly upon a spherical mirror the longitudinal aberration is only about one-eighth as great as for the most favourable-shaped single lens of equal focal length and aperture. Hence a spherical mirror of 8-feet focus might have an aperture of 2⅓ inches, and the image would not suffer materially from aberration.[1]

On general optics the treatises most accessible to the English reader are Parkinson's *Optics* (3d ed., 1870) and Glazebrook's *Physical Optics* (1883). Verdet's *Leçons d'optique physique* is an excellent work. Every student should read the earlier parts of Newton's *Optics*, in which are described the fundamental experiments upon the decomposition of white light. (R.)

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[1] For fuller information on the subject of the preceding paragraphs see Lord Rayleigh's papers entitled "Investigations in Optics," *Phil. Mag.*, 1879, 1880.

ORACLE. It was a universal belief in the ancient world that there is a capacity in the human mind to divine the will of God (*μαντικόν τι ἡ ψυχή*, Plato, *Phædr.*, 242 C). This capacity is not equally developed in all men, and, practically, a very few persons, in whom it is strong, are distinguished from the mass as *μάντεις*. These are able to understand the methods by which the gods reveal their intentions to men. There occur cases where the gods speak directly to men, where a divine voice is heard issuing its commands or warnings, but these instances are confined, except in a few remarkable historical cases (such as the appearance of Pan to the Athenian messenger, 490 B.C., Herod., vi. 105), to the heroic age and to epic poetry. Setting these aside, we find that the divine will was revealed to the interpreting medium in two ways—by inspiration and by signs. In the former case the divine influence overpowers the soul of the medium and takes entire possession of it for the time. The medium cannot himself bring on a revelation, but is at rare intervals affected by the power of the god, his consciousness ceases, and the god speaks through him words which he is himself unable to control or even to understand. So, for example, the *prophetes* of Apollo Ptoios gave a response in the Carian language, which no one except the questioner could understand (Herod., viii. 135). The second method of revelation, by signs, required a distinct art of interpretation; certain events, phenomena in the heavens or in bird or animal life, the conduct of sacrificial animals and the appearance presented by their entrails, &c., presaged the will of the god to him who possessed the art of interpreting them. The second method was called *artificial* (*ἔντεχνος*), in opposition to the first, which is direct and *artless* (*ἄτεχνος*).

In every case the revelation of the divine will is dependent on the direct act of the god; he affects the soul of the *μάντις* when and where he pleases; he sends, when he chooses, the signs from which his intentions can be inferred. There was, however, a belief that at certain places the god gave revelations more frequently than at others. Such places were generally characterized by some marked physical feature. At these places there were established regular institutions, with a staff of priests and prophets, to which the neighbours resorted for counsel; the Latin term "oracle" (in Greek *μαντεῖα*, *χρηστήρια*) is the general name. With regard to these institutions we have to consider (1) their method of interpretation, in so far as this is not most naturally given under the articles treating of the particular localities, and (2) their rank and influence among the Greeks.

1. The methods of interpretation varied greatly. Even at the same oracle several methods were often practised side by side. In the most primitive the spirits of the dead appeared and conversed directly with the inquirer. This method was rare in Greece; but an undoubtedly good example is recorded (Herod., v. 92) in Thesprotia, where Periander sent to consult the shade of his wife Melissa; a Biblical instance is the apparition of the shade of Samuel to Saul. The visit of Odysseus to the lower world is obviously a mere poetical version of the consultation of a Bœotian oracle of Tiresias, where the hero spoke directly to his devotees. In the oracle of Trophonius at Lebadea in Bœotia the method of inquiry was certainly modelled after the idea of a descent to the infernal world. Beside the oracle were the two springs of Memory and Oblivion, which, according to the mystic teaching, were the two fountains of the lower world. The inquirer descended into an underground place, and, it is said, saw such sights that he never smiled again. This method belonged to a very primitive stage of Greek history; and it is certain that Greek religion in general, and many oracles in particular, had experienced a long development before the time which we know best. Probably this method was originally more widely practised than we can actually trace.

The common method of revelation in hero-oracles, and in the oracles of some gods, was through dreams. Hero-oracles were certainly in their earliest form simply oracles of the dead; the word *ἥρως* is a generic term for a dead man. We can trace occasional survivals of the most primitive form of the hero-oracle. The person who seeks advice goes to sleep over the actual grave, and the dead man appears in a dream. A type of the usual method, which was called "incubation" or *ἐγκοίμησις*, is the oracle of Amphiaraus near Oropus, beside the spring where the hero had risen from the earth to become a god. The inquirer, after abstaining from wine for three days and from all food for twenty-four hours, slept in the temple on the skin of a ram which he had sacrificed. The oracles of Gæa or Ge are closely connected with those of the dead and of heroes. The Earth is giver of responses, as being the home of the dead, who sleep in her womb, but who can be called forth to give counsel to their descendants living on earth. Earth-oracles also belong to a primitive stage of Hellenic religion, and had in historical times either given place to oracles of more developed Hellenic type or occupied a very secondary position. In Olympia it is probable that the oracle of Gæa was the oldest institution, and it is universally recognized in ancient and modern times that the Delphic oracle originally belonged to the same goddess. Probably the cleft in the earth in the Delphic adyton was originally conceived as the passage of communication between the dead under the earth and the living on its surface. A uniform tradition (Paus., x. 5, 3; Æsch., *Cho.*, 1 *sq.*) recognizes one most important fact: in the progress of Greek history, as religious thought developed, there was a progressive development in the character of the Delphic oracle. Gæa was replaced by Themis, a more moralized conception of the Earth-goddess, as the incarnation of natural order and law; but Apollo, the highest creation of Hellenic religion, finally occupies Delphi as the prophet and counsellor of his people. The oracles of Apollo work through inspiration. In Delphi the seer was a woman, Pythia, who was thrown into a state of ecstatic frenzy by the influence of a vapour ascending from a cleft in the earth within the adyton, and while in this state uttered words and cries which contained the answer of Apollo. All the methods of interpretation by signs were practised at different oracles in Greece; even in Apolline oracles, such as the Delphic, the artificial method was employed along with that by inspiration.

2. The original purpose of the oracles was not to foretell the future, but to give counsel as to conduct in doubtful and difficult situations. In cases where human prudence and skill seemed to fail, recourse was had to the oracle, and the god gave advice to his people. Now it was the universal practice that the priests should take the answers, usually incoherent and unintelligible, of the seers and reduce them to form, often metrical; practically the oracles were worked by the priests, and it is obvious that their character depended entirely on the character of the priests and of the nation as a whole. The influence of the oracles could be good only so long as the priests were not only honest and of lofty intentions, but also in a more advanced intellectual position than the people. In the early age of Greek history, when there was no education except what was to be gained by wide intercourse, the priests of such an oracle as Delphi occupied a most advantageous position. To Delphi as the *γῆς ὄμφαλος*, the central point of the civilized world, came embassies from every Greek city, and even from great non-Greek states such as Lydia and Phrygia. It was a knot where every strand in civilized

life was united. In accordance with this we find that almost all the great lawgivers and sages of the 8th and 7th centuries B.C. were in close relation with the Delphic oracle. All questions of colonization were referred to the oracle, and it is due a good deal to this central guiding influence that the overflow of the teeming population of Greece was directed so systematically. It is instructive to compare the position of the oracles in Greece with those of the kindred races of Asia Minor. In the latter country the god is supreme over his people, the government is a pure theocracy, and the priests, as interpreters of the divine will, are absolute masters of the servants of the god. In Greece it is wholly different. In both cases the oracles are the creation of the national genius,—in Asia Minor Oriental and stationary, in Greece living and progressive. In the earliest time we can trace the influence of the oracles discouraging the relentless blood-feud, distinguishing classes of murder, and allowing purification and expiation in suitable cases. They make the sanctity of oaths between man and man a special duty; Apollo regards even hesitation to keep a pledge as already a sin (Herod., vi. 86; *cf.* i. 159). They are the centre of unions or amphictyonies which bind their members to observe certain duties and show mercy to their fellow-members; and Delphi, as the oracle of an amphictyony including great part of Greece, had an important share in promoting that ideal unity of the whole country which, though never realized, yet floated always before the Greek mind. The oracles did something towards uniting the efforts of Greeks against foreigners, and towards spreading Greek influence abroad in a systematic way.

As education became more general the qualification of superior knowledge necessary to the proper working of the oracles was more difficult to keep up. At the same time the growth of political life in the states intensified their mutual enmities, and made it impossible for the oracles to maintain an attitude of perfect justice, neutrality, and superiority. Though the custom continued till a late period in Greek history that each state should consult the oracle in difficulties, yet complaints of partiality become frequent. Concurrently with the degradation in this respect there grew a demoralization in the whole tone of the oracles: they were consulted by all in the most trivial matters. It became an object to the priests to facilitate the access of votaries who contributed to the wealth of the temple. Whereas originally the Delphic oracle spoke only once a year, the number of days on which it was open to inquirers was gradually increased; and other oracles in like manner turned their attention to the wants of every applicant. In Dodona a large number of leaden tablets have been discovered containing the questions addressed to the god by inquirers; they range in date from the end of the 5th century B.C. onwards, and do not give any very high idea of the kind of difficulties in which the god was asked to advise his worshipper.

See Carapanos, *Dodone*, also an important article in Fleckeisen's *Jahrbücher* for 1883. The most complete work on oracles is Bouchy Leclerc's *Histoire de la divination dans l'antiquité*. (W. M. RA.)

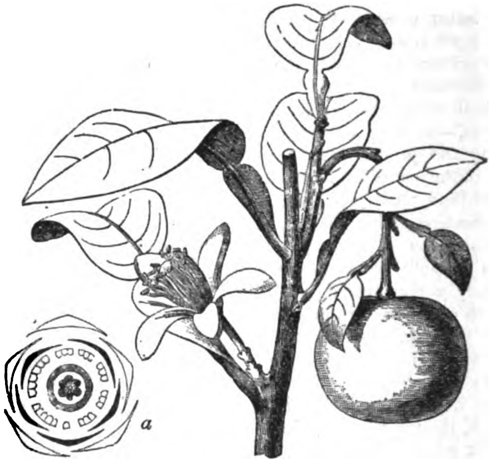
ORAN (Arabic, *Wahrán*), the chief town of the department and military division which form the western part of the French colony of Algeria, lies at the head of a bay on the Mediterranean, in 35° 44′ N. lat., and almost on the meridian of Greenwich. The population of the town in 1881 was 58,530; that of the commune, including town and suburbs, 59,377. In 1876, when the total for the town, besides 3728 in prisons, hospitals, &c. (5030 in 1881), was 45,640, 11,047 were French, 4948 Jews, 4782 natives, and 24,863 foreigners. The town is cut in two by the ravine of Oued Rekhi, now partly covered over by boulevards and buildings. West of the ravine lies the port, and above this the old Spanish town with the ancient citadel looking down on it. On the east side the modern castle and the modern town (built since the Spanish occupation) rise like an amphitheatre, and here, too, are the Moorish houses of the Jews' quarter. Taken altogether, Oran has the shape of a triangle, the sea forming the base, and the angles at north-west, north-east, and south being respectively the Fort de la Moune, the modern castle, and Fort St André. Ramparts and forts are mainly of Spanish construction; to the east they have been rebuilt since the French occupation in advance of their old position. Of the six gates, three are on the west side, two on the south, and one on the east. The modern castle was formerly the seat of the beys of Oran; it is now occupied by the general in command of the military division, and also serves as barracks, and accommodates most of the military departments. The old castle was the residence of the Mohammedan rulers previous to the Spanish conquest, and continued to be the residence of the governors of the town up to the earthquake of 8th and 9th October 1790. The portion of the building which still remains is used as barracks and a military prison. Immediately behind, the Mourdjadjo hill rises to a height of 1900 feet; on the way up are passed Fort St Grégoire, the votive chapel commemorative of the cholera of 1849, and Fort Santa Cruz, crowning at a height of 1312 feet the summit of the Aidour. Lastly, Fort de la Moune (so called from the monkeys which are said to have haunted the neighbourhood) rises between the sea and the road from Oran to Mers al-Kebir. In the Spanish town the streets are steep, sometimes even becoming stairs; the "places" are mere widenings of the street. In the French town the streets are well laid out and fit for carriages, and there are various public squares, notably the Place d'Armes; the houses too, in spite of the risk from earthquakes, are built in the French style, several stories high. It is only in the Jews' quarter that the houses are of a peculiar type,—one-storied, with white-washed or red-washed walls, and enclosing an inner court shaded by a vine. Oran is the see of a bishopric dependent on the archbishopric of Algiers. The cathedral (St Louis) is an ancient mosque which has successively been a Roman Catholic chapel, a synagogue, and again a Catholic church according as the town changed hands. The last restoration was in 1839. A fine picture representing the landing of St Louis at Tunis deserves to be mentioned. The grand mosque (in Rue Philippe) was erected at the end of last century in commemoration of the expulsion of the Spaniards, and with money paid as ransom for Christian slaves. The minaret is one of the prettiest in Algeria. Other mosques have been utilized for military purposes. Permanent quarters have not yet been assigned to the prefecture, the courts of justice, and other civil offices; the bank alone occupies a building of an imposing character. The military hospital contains 1400 beds. Oran is well supplied with water; and a number of beautiful promenades greatly increase its attractions. The main peculiarity of the streets is the mixture of races, each with its own type and costume. Arabs, Spaniards, and Turks, successive masters of the town, have all left descendants; and with these are mingled black-gabardined Jews, Spanish immigrants of recent date in Andalusian garb, French soldiers of all branches of the service, Moors with nonchalant gait, and negroes, who serve as porters and day-labourers for the community. The negroes occupy a whole village on the outskirts of the town. While industrially of no importance, Oran is admirably situated for commerce. From Cartagena to Oran is the shortest passage between Europe and Algeria, and there is regular communication with Marseilles, Cette, and Port Vendres in France, with Barcelona, Valencia, Cartagena, Malaga, and Gibraltar in Spain, and with the various ports on the Barbary coast. A railroad (261 miles) runs to Algiers and is joined at Perregaux by the line from Arzeu to Saida and the Kreider which serves the high halfa (esparto) plateaus. There is also a railway to Sidi Bel-Abbès. Previous to the French occupation there was no port at Oran, vessels anchoring at Mers al-Kebir at the north-west entrance of the bay. Mers al-Kebir is now reserved for the navy, and a harbour of 60 acres has been constructed by means of a pier 3280 feet long from Fort de la Mòune, and two cross piers. A geographical society was founded at Oran in 1878.

If Oran was not already occupied in the time of the Romans, its foundation must be ascribed to the Andalusian seamen who settled there in the beginning of the 10th century. Rapidly rising into importance, it was taken and retaken, pillaged and rebuilt, by the various conquerors of northern Africa. Almoravides, Almohades, and Merinides succeeded each other, and in the space of half a century the town changed hands nine times. At length, in the latter half of the 15th century, it was subject to the sultans of Tlemcen, and reached the height of its prosperity. Active commerce was maintained with the Venetians, the Pisans, the Genoese, the Marseillese, and the Catalans, who imported the produce of their looms, glass-wares, tin-wares, and iron, and received in return ivory, ostrich feathers, gold-dust, tanned hides, grain, and negro slaves from the interior of Africa. Admirable woollen cloth and splendid arms were locally manufactured. The magnificence of its mosques and other public buildings, the number of its schools, and the extent of its warehouses shed lustre on the city; but wealth and luxury began to undermine its prosperity, and its ruin was hastened by the piracy to which the Moorish refugees from Spain betook themselves. Animated by the patriotic enthusiasm of Cardinal Ximenes, the Spaniards determined to put a stop to those expeditions which were carrying off their countrymen, destroying their commerce, and even ravaging their country. Mers al-Kebir fell into their hands on 23d October 1505, and Oran in May 1509. The latter victory, obtained with but trifling loss, was stained by the massacre of a third of the Mohammedan population. From 6000 to 8000 prisoners, 60 cannon, engines of war, and a considerable booty from the wealth accumulated by piracy fell into the hands of the conquerors. Cardinal Ximenes introduced the Catholic religion, with its churches, convents, Inquisition, &c., and also restored and extended the fortifications. Oran became the penal settlement of Spain, but neither the convicts nor the noblemen in disgrace who were also banished thither seem to have been under rigorous surveillance;- fêtes, games, bull-fights, &c., were held. Meanwhile the Turks had become masters of Algeria, and expelled the Spaniards from all their possessions except Oran. The bey, finally settling at Mascara, watched his opportunity; and at length, in 1708, the weakness of Spain and the treason of the count of Vera Cruz obliged the city to capitulate. The Spaniards recovered possession in 1732, but found the maintenance of the place a burden rather than a benefit, all the neighbouring tribes having ceased to have dealings with the Christians. The earthquake of 1790 furnished an excuse for withdrawing their forces. Commencing by twenty-two separate shocks at brief intervals. the oscillations continued from 8th October to 22d November. Houses and fortifications were overthrown, and a third of the garrison and a great number of the inhabitants perished. Famine and sickness had begun to aggravate the situation when the bey of Mascara appeared before the town with 30,000 men. By prodigies of energy the Spanish commander held out till August 1791, when, having made terms with the dey of Algiers, he was allowed to set sail for Spain with his guns and ammunition. The bey Mohammed took possession of Oran in March 1792, and made it his residence instead of Mascara. On the fall of Algiers the bey placed himself under the protection of the conquerors. The French army entered the town 4th January 1831, and took formal possession on the 17th of August.

ORANG. See **Ape**, vol. ii. p. 149.

ORANGE (*Citrus Aurantium*), the plant that produces the familiar fruit of commerce, is closely allied to the citron, lemon, and lime, all the cultivated forms of the genus *Citrus* being so nearly related that their specific demarcation must be regarded as somewhat doubtful and indefinite. Risso and Poiteau have described eighty kinds of orange (including the bergamots), chiefly differing in the external shape, size, and flavour of the fruit; but all may probably be traced to two well-marked varieties—the Sweet or China Orange and the Bitter Orange or Bigarade,—though several of these modifications seem to indicate crossing with the lemon or citron, if, indeed, they do not rather point to a more remote common origin from a primitive citrine type.

The bitter orange, by some made a sub-species (*C. vulgaris*), is a rather small tree, rarely exceeding 30 feet in height. The green shoots are furnished with sharp axillary spines, and alternate evergreen oblong leaves, pointed at the extremity, and with the margins entire or very slightly serrated; they are of a bright glossy green tint, the stalks distinctly winged and, as in the other species, articulated with the leaf. The fragrant white or pale pinkish flowers appear in the summer months, and the fruit, usually round or spheroidal, does not perfectly ripen until the following spring, so that flowers and both green and mature fruit are often found on the plant at the same time. The bitter aromatic rind of the bigarade is rough, and dotted closely over with concave oil-cells; the pulp is acid and more or less bitter in flavour. The sweet orange generally has the shoots destitute of spines, the petioles less distinctly winged, and the leaves more ovate in shape, but chiefly differs in the fruit, the pulp of which is agreeably acidulous and sweet, the rind comparatively smooth, and the oil-cells convex. The ordinary round shape of the sweet orange fruit is varied greatly in certain varieties, in some being greatly elongated, in others much flattened; while several kinds have a conical protuberance at the apex, others are deeply ribbed or furrowed, and a few are distinctly "horned" or lobed, by the partial separation of the carpels. The two sub-species of orange are said by some authorities to reproduce themselves infallibly by seed; and, where hybridizing is prevented, the seedlings of the sweet and bitter orange appear to retain respectively the more distinctive features of the parent plant; but where growing wild for successive generations they show a tendency to degenerate, the progeny of the sweet orange being apt to assume the broadly-winged petioles and spiny shoots of the bigarade.



Orange (*Citrus Aurantium*), from nature, about one-third natural size. *a*, diagram of fruit, after Laurssen, *Med.-Pharm. Botanik*, 1882.

Though now cultivated widely in most of the warmer parts of the world, and apparently in many completely naturalized, the diffusion of the orange has taken place in comparatively recent historical periods. To ancient Mediterranean agriculture it was unknown; and, though the later Greeks and Romans were familiar with the citron as an exotic fruit, their "Median Apple" appears to have been the only form of the citrine genus with which they were acquainted. The careful researches of Gallesio have proved that India was the country from which the orange spread to western Asia and eventually to Europe. Oranges are at present found wild in the jungles along the lower mountain slopes of Sylhet, Kumaon, Sikkim, and other parts of northern India, and, according to Royle, even in the Nilgiri Hills; the plants are generally thorny, and present the other characters of the bitter variety, but occasionally wild oranges occur with sweet fruit; it is, however, doubtful whether either sub-species is really indigenous to Hindustan, and De Candolle is probably correct in regarding the Burmese peninsula and southern China as the original home of the orange. Cultivated from a remote period in Hindustan, it was carried to south-western Asia by the Arabs, probably before the 9th century, towards the close of which the bitter orange seems to have been well known to that people; though, according to Mas'údí, it was not cultivated in Arabia itself until the beginning of the 10th century, when it was first planted in 'Omán, and afterwards carried to Mesopotamia and Syria. It spread ultimately, through the agency of the same race, to Africa and Spain, and perhaps to Sicily, following everywhere the tide of Mohammedan conquest and civilization. In the 12th century the bigarade was abundantly cultivated in all the Levant countries, and the returning soldiers of the Cross brought it from Palestine to Italy and Provence. An orange tree of this variety is said to have been planted by St Dominic in the year 1200, though the identity of the one still standing in the garden of the monastery of St Sabina at Rome, and now attributed to the energetic friar, may be somewhat doubtful. No allusion to the sweet orange occurs in contemporary literature at this early date, and its introduction to Europe took place at a considerably later period, though the exact time is unknown. It was commonly cultivated in Italy early in the 16th century, and seems to have been known there previously to the expedition of Da Gama (1497), as a Florentine narrator of that voyage appears to have been familiar with the fruit. The importation of this tree into Europe, though often attributed to the Portuguese, is with more probability referred to the enterprise of the Genoese merchants of the 15th century, who must have found it growing abundantly then in the Levant. The prevailing European name of the orange is sufficient evidence of its origin and of the line taken in its migration westward. The Sanskrit designation *nagrunga*, becoming *narunge* in Hindustani, and corrupted by the Arabs into *náranj* (Spanish *naranja*), passed by easy transitions into the Italian *arancia* (Latinized *aurantium*), the Romance *arangi*, and the later Provençal *orange*. The true Chinese variety, however, was undoubtedly brought by the Portuguese navigators direct from the East both to their own country and to the Azores, where now luxuriant groves of the golden-fruited tree give a modern realization to the old myth of the gardens of the Hesperides.[1] Throughout China and in Japan the orange has been grown from very ancient times, and it was found diffused widely when the Indian Archipelago was first visited by Europeans. In more recent days its cultivation has extended over most of the warmer regions of the globe, the tree growing freely and producing fruit abundantly wherever heat is sufficient and enough moisture can be supplied to the roots; where night-frosts occur in winter or spring the culture becomes more difficult and the crop precarious.

The orange flourishes in any moderately fertile soil, if it is well drained and sufficiently moist; but a rather stiff loam or calcareous marl, intermingled with some vegetable humus, is most favourable to its growth. Grafting or budding on stocks raised from the seed of some vigorous variety is the plan usually adopted by the cultivator. The seeds, carefully selected, are sown in well-prepared ground, and the seedlings removed to a nursery-bed in the fourth or fifth year, and, sometimes after a second transplantation, grafted in the seventh or eighth year with the desired variety. When the grafts have acquired sufficient vigour, the trees are placed in rows in the permanent orangery. Propagation by layers is occasionally adopted; cuttings do not readily root, and multiplication directly by seed is always doubtful in result, though recommended by some authorities. The distance left between the trees in the permanent plantation or grove varies according to the size of the plants and subsequent culture adopted. In France, when the trunks are from 5 to 6½ feet in height, a space of from 16 to 26 feet is left between; but the dwarfer trees admit of much closer planting. In the West Indies and Azores an interval of 24 or even of 30 feet is often allowed. The ground is kept well stirred between the trunks, and the roots manured with well-rotted dung, guano, or other highly nitrogenous matter; shallow pits are sometimes formed above the roots for the reception of liquid or other manures; in dry climates water must be abundantly and frequently supplied. The trees require regular and careful pruning, the heads being trained as nearly as possible to a spherical form. Between the rows melons, pumpkins, and other annual vegetables are frequently raised. In garden culture the orange is often trained as an espalier, and with careful attention yields fruit in great profusion when thus grown. In favourable seasons the oranges are produced in great abundance, from 400 to 1000 being commonly borne on a single plant in full bearing, while on large trees the latter number is often vastly exceeded. The trees will continue to bear abundantly from fifty to eighty years, or even more; and some old orange trees, whose age must be reckoned by centuries, still produce their golden crop; these very ancient trees are, however, generally of the bitter variety. Oranges intended for export to colder climates are gathered long before the deep tint that indicates maturity is attained, the fruit ripening rapidly after picking; but the delicious taste of the mature China orange is never thus acquired, and those who have not eaten the fruit in a perfectly ripe state have little idea of its flavour when in that condition. Carefully gathered, the oranges are packed in boxes, each orange being wrapped in paper, or with dry maize husks or leaves placed between them. The immense quantities of this valuable fruit imported into Britain are derived from various sources, but those kinds in most esteem are the produce of the Azores, whence, in 1878, 410,101 boxes, each holding 400 "St Michael's" oranges, are said to have been sent to Great Britain alone. Large numbers are also exported to England from Sicily, Portugal, and Spain, and a considerable amount from other Mediterranean countries. North America is largely supplied from Jamaica and the Bahamas; but the extensive and rapidly increasing cultivation of the tree in Florida will probably in a few years supersede the foreign importation. In that State the bitter orange has grown, from an unknown period, in a wild condition, and some of the earlier botanical explorers regarded it as an indigenous tree; but it was undoubtedly brought by the Spanish colonists to the West India Islands, and was probably soon afterwards transplanted to Florida by them or their buccaneering enemies. The climate of Florida seems remarkably adapted for orange culture, and orangeries are becoming yearly more numerous and extensive,—the wild stocks, or those raised from wild seed, being generally employed by the grafter. In the other Gulf States this branch of agricultural industry is pursued to some extent; and in California the orange groves are productive and increasing.

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[1] The modern Arabic name, Bertukán (that is, Portuguese), shows that the China apple reached the Levant from the West.

Orange cultivation has been attempted with success in several parts of Australia, especially in New South Wales, where the orange groves near Paramatta yield an abundant colonial supply. The orangeries of Queensland and South Australia are likewise producing well, though, as yet, Australian fruit is chiefly consumed at home. In many of the Pacific Islands the plant has been long established: Tahiti exports oranges largely to San Francisco, and in Fiji the culture promises to become of considerable importance.

Certain varieties of orange deserve mention, from the peculiar character of their fruit. The Mandarin orange of China, sometimes made a distinct species, *C. nobilis*, is remarkable for its very flat spheroidal fruit, the rind of which readily separates with the slightest pressure; the pulp has a peculiarly luscious flavour when ripe. The small Tangerine oranges, valued for their fine fragrance, are derived from the Mandarin. "Maltese" or "Blood," oranges, much grown in southern Italy, are distinguished by the deep-red tint of the pulp. The Bergamot has been already described (see vol. iii. p. 587). Orange plantations in Europe suffer much at times from a disease called by the French *charbon*, caused by a fungus (*Demathium monophyllum*), which rapidly spreads over stems, leaves, and green fruit. Several insect enemies attack the plant, of which the scale-like *Coccus citri* is the most injurious in Europe; in the Azores *C. Hesperidis* takes its place. Cold weather in winter has sometimes proved destructive in Provence, and many plantations were destroyed by the hard frosts of 1789 and 1820.

Besides the widespread use of the fruit as an agreeable and wholesome article of diet, that of the sweet orange, abounding in citric acid, possesses in a high degree the antiscorbutic properties that render the lemon and lime so valuable in medicine; and the free consumption of this fruit in the large towns of England during the winter months has doubtless a very beneficial effect on the health of the people. The juice is sometimes employed as a cooling drink in fevers, as well as for making a pleasant beverage in hot weather; it is likewise an essential ingredient in "orange wine."

The bitter orange is chiefly cultivated for the aromatic and tonic qualities of the rind, which render it a valuable stomachic. Planted long ago in Andalusia by the Moorish conquerors, it is still extensively grown in southern Spain,—deriving its common English name of "Seville" orange from the abundant groves that still exist around that city, though the plant is now largely cultivated elsewhere. The fruit is imported into Great Britain and the United States in considerable quantities for the manufacture of the favourite confection known as orange marmalade, which is prepared from the pulp and rind, usually more or less mingled with the pulp of the China orange. In medicine the dried peel is largely employed as an aromatic tonic, and often, in tincture and infusion, as a mere vehicle to disguise the flavour of more nauseous remedies. The essential oil of the rind is collected for the use of the perfumer, being obtained either by the pressure of the fresh peel against a piece of sponge, or by the process known as *écuelle*, in which the skin of the ripe fruit is scraped against a series of points or ridges arranged upon the surface of a peculiarly-shaped dish or broad funnel, when the oil flows freely from the broken cells. Another fragrant oil, called in France *essence de petit grain*, is procured by the distillation of the leaves, from which also an aromatic water is prepared. The flowers of both sweet and bitter orange yield, when distilled with water, the "oil of Neroli" of the druggist and perfumer, and likewise the fragrant liquid known as "orange-flower water." The candied peel is much in request by cook and confectioner; the favourite liqueur sold as "curaçoa" derives its aromatic flavour from the rind of the bigarade. The minute immature oranges that drop from the trees are manufactured into "issue-peas"; from those of the sweet orange in a fresh state a sweetmeat is sometimes prepared in France. Orange trees occasionally acquire a considerable diameter; the trunk of one near Nice, still standing in 1789, was so large that two men could scarcely embrace it; the tree was killed by the intense cold of the winter of that year. The wood of the orange is of a fine yellow tint, and, being hard and close-grained, is valued by the turner and cabinetmaker for the manufacture of small articles; it takes a good polish.

Although the bitter "Poma de Orenge" were brought in small quantities from Spain to England as early as the year 1290, no attempt appears to have been made to cultivate the tree in Britain until about 1595, when some plants were introduced by the Carews of Beddington in Surrey, and placed in their garden, where, trained against a wall, and sheltered in winter, they remained until destroyed by the great frost of 1739-40. In the last century the tree became a favourite object of conservatory growth; in the open air, planted against a wall, and covered with mats in winter, it has often stood the cold of many seasons in the southern counties, in such situations the trees occasionally bearing abundant fruit; but in Great Britain the orange can only be regarded as an object of ornamental culture. The trees are usually imported from Italy, where, especially near Nervi, such plants are raised in great numbers for exportation; they are generally budded on the stocks of some free-growing variety, often on the lemon or citron.

For details of orange varieties, cultivation, &c., see Risso and Poiteau, *Histoire et culture des Orangers* (edited by A. Du Breuil, Paris, 1872); for early history and diffusion, G. Gallesio, *Traité du Citrus*, Paris, 1811. (C. P. J.)

ORANGE, a city of France, the chief town of an arrondissement in the department of Vaucluse, is situated 18 miles north of Avignon on the railway from Lyons to Marseilles at some distance from the left bank of the Rhone, in the midst of meadows, orchards, and mulberry plantations, watered by a stream called the Meyne, and overlooked by the majestic summit of Mount Ventoso, which lies 22 miles to the east. The district is highly fertile, and the city deals largely in silks, woollens, and fruits, and also till quite recently in wines and madder. The population of the city numbers 6860. Orange is interesting mainly from its Roman remains. The triumphal arch is not only far finer than any other in France, but ranks third in size and importance among those still extant in Europe. Measuring 72 feet in height, 69 feet in width, and 26 feet in depth, it is composed of three arches supported by four Corinthian columns. On three sides it is well preserved, and displays remarkable variety and elegance in its sculptured decorations. To judge from a partly decipherable inscription, the arch seems to have been erected in the reign of Tiberius. It suffered from being used as a fortification in the Middle Ages. Another most imposing structure is the theatre, built against the hill commanding the town. The façade, which is 118 feet high, 340 feet long, and 13 feet thick, is pierced by three square gates surmounted by a range of blind arches and a double row of far-projecting corbels. Of the seats occupied by the spectators—to the number, it might be, of 7000—only the lower ranges remain. By many this theatre is regarded as the most beautiful, or at least the most imposing, of the Roman monuments of France. The princes of Orange made it an outwork of the castle which they erected on the hill, and which was demolished by De Grignan after he had taken the town for Louis XIV. Up to the beginning of the present century it was filled with hovels and stables; these are now quite swept away, and the preservation of the building assured. In the neighbourhood of the theatre traces have been found of a hippodrome capable of containing 20,000 persons; and statues, bas-reliefs, and ruins of an aqueduct also serve to show the importance of the Roman town. Several of the churches at Orange are very old. Notre Dame, the old cathedral, originally erected by the prefect of Gaul, was ruined by the Barbarians, rebuilt in the 11th century, and damaged by the Protestants. A statue of Rambaud II. count of Orange and that of Gasparin the celebrated agriculturist may also be mentioned.

Orange (*Arausio*), capital of the Cavari, became after Cæsar an important Roman colony. Its ramparts and fine buildings were partly destroyed by the Alemanni and Visigoths, and partly ruined by the erections of the Middle Ages. Orange was included in the kingdom of Austrasia, fell into the hands of the Saracens, and was recovered by Charlemagne. It became an independent countship in the 11th century; and Count Bertrand de Baux (d. 1181) received from Frederick I. the title of prince of Orange. On the death of Philibert of Châlons in 1530 the inheritance fell to his sister's son, René (Renatus) of Nassau Dillenburg, stadholder of the Netherlands, who, dying childless, chose (1544) as his successor his cousin William, afterwards William I. Though Francis I., king of France, whose predecessors had long claimed to be suzerains of the principality, caused it to be declared part of the domain of Provence, Henry II. recognized William's rights in the treaty of Cateau Cambresis, and "prince of Orange" remained the title of the stadholders from Maurice to William III. In 1672 Louis XIV. seized the principality and handed it over to the count of Auvergne in compensation for his loss of the marquisate of Bergen-op-Zoom confiscated by William; but the claims of the house of Nassau were acknowledged by the peace of Ryswick. On William's death there were two claimants, John William Friso of Nassau-Dietz, designated heir by William's will, and Frederick I. king of Prussia, who held that he was nearer of kin and had been appointed by the will of Frederick Henry. Thereupon Louis XIV. declared the principality forfeited to the French crown and bestowed it on the prince of Conti, who also had pretensions. The parlement of Paris decided that this prince should have the *dominium utile*; and its finding was confirmed by the treaty of Utrecht, which, however, left the title and coat of arms to the king of Prussia, who is still styled prince of Orange (Prinz von Oranien). John William Friso, however, also took the title, and his descendants, the stadholders and kings of the Netherlands, have all been designated princes of Orange-Nassau.

ORANGE, a city of the United States, in Essex county, New Jersey, 16 miles west of New York by two lines of railway, and connected by tramway with Newark, 3½ miles distant. Beautifully situated on rolling ground about 190 feet above the sea, Orange has become a favourite place of residence for New York business men. To the west lies Llewelyn Park, an area of 750 acres, studded with villas and laid out in common; and the summit of Orange Mountain (650 feet), a little farther west, is also occupied with villas. Hat-making is largely carried on in the city. The population was 9348 in 1870 and 13,207 in 1880. In 1860 the township of Orange received a town charter; and in 1872 the town, diminished by East Orange and parts of South and West Orange, was raised to the rank of a city.

ORANGEMEN, an association of Irish Protestants, originating and chiefly flourishing in Ulster, but with ramifications in other parts of the United Kingdom, and in the British colonies. Orangemen derive their name from William III., but neglect the example of that tolerant prince. They are enrolled in lodges, and it is said that the initiated can always recognize each other. Much may be learned from their toasts, about which there is no concealment. The commonest form is "the glorious, pious, and immortal memory of the great and good King William, who saved us from popery, slavery, knavery, brass money, and wooden shoes," with grotesque or truculent additions according to the orator's taste. The brass money refers to James II.'s finance, and the wooden shoes to his French allies. The final words are often "a fig for the bishop of Cork," in allusion to Dr Peter Browne, who, in 1715, wrote cogently against the practice of toasting the dead. Orangemen are fond of beating drums and flaunting flags with the legend "no surrender," in allusion to Londonderry.

Orangeism is essentially political, and may be useful in so far as it reminds Irish Protestants of their origin and of their common rights under the British crown. But its original object was the maintenance of Protestant ascendency, and too much of its spirit still survives. By repeating irritating watchwords, and publicly keeping anniversaries painful to their neighbours, Orangemen have done much to inflame sectarian animosity; if their celebrations were private, little could be said against them. The first regular lodges were founded in 1795, but the system existed earlier. The Brunswick clubs, founded to oppose Catholic emancipation, were sprigs from the original Orange tree. The orange-flowers of the *Lilium bulbiferum* are worn in Ulster on the 1st and 12th July, the anniversaries of the Boyne and Aughrim. Another great day is the 5th of November, when William III. landed in Torbay.

ORANGE RIVER FREE STATE, an independent republic adjoining the Cape Colony, South Africa (see vol. vi., Plate I.), is bounded on the N. by the Vaal river, S. by the Orange river, E. by the Caledon river and Drakensberg mountains, and W. by a line dividing it from Kimberley and the diamond fields of Griqualand West. The area is 70,000 square miles, and the population in 1880 was 133,518. Of this total 61,022 were whites or of European extraction (mostly Dutch), and 72.496 coloured or of native races.

The country, which has an average elevation of 4500 feet above the sea, consists of a series of extensive undulating plains, bounded or diversified by detached rocky hills. These plains slope from the central watershed northward and southward respectively to the Vaal and Orange rivers, and are intersected at various intervals by the Wilge, Rhenoster, Valsch, Vet, Modder, and Riet rivers, emptying their waters into the Vaal river, and by the Caledon, which joins the Orange river. The southern and eastern districts are covered with luxuriant grasses, affording excellent pasturage for stock. In the western districts the grasses are gradually being supplanted by a dwarf bush vegetation. The river-banks are fringed with willow, mimosa, and other indigenous trees, and shrubs and trees of larger growth are found on the eastern mountain ranges; but generally the country is woodless, and to remedy this Government offers premiums for the encouragement of tree-planting. The geological characteristics are similar to those of the inland districts of Cape Colony. The south-western portion is an extension of the Karroo or lacustrine formation of South Africa, consisting of sandstone and shales intersected by intrusive igneous rocks. In this formation occurs the diamond mine of Jagersfontein, near the village of Fauresmith, which has been worked for several years past. The north-eastern part, again, consists of sandstones and carbonaceous shales resting conformably on the Karroo formation, and containing horizontal coal-seams, classed as of the Triassic period. The coal outcrops in the Kronstad and Heilbron districts are being utilized. In the Drift deposits along some river-beds, such as the Sand, Caledon, and Vaal rivers, there are accumulations of pebbles, consisting of agate, jasper, chalcedony, carnelian, white quartz, garnets, and occasionally diamonds.

The climate is salubrious, and specially remarkable for its dryness. Thousands of wild game formerly occupied the plains of the state, but their numbers and variety have of late greatly diminished, and some have been entirely exterminated. The lion, giraffe, elephant, and rhinoceros are no longer found. But in a few districts there may still be seen considerable herds of antelopes, such as the springbok, blesbok, and wildebeeste or gnu. The resources of the state are agricultural, pastoral, and mineral. The principal occupations of the inhabitants are the breeding of cattle, horses, goats, merino sheep, and ostriches. Agriculture is attended to on a larger or smaller scale according to the capabilities of the various farms, and vineyards and orchards are planted on many properties. The staple articles of export, however, are wool, skins, ostrich feathers, and diamonds, all of which are shipped from the seaports of the Cape Colony and Natal.

Bloemfontein, the capital and seat of government, is situated about the centre of the state, in 28° 56′ S. lat. and 26° 18′ E. long. It is an agreeable town, with a population of about 3000, and has a handsome range of public offices, where the volksraad or assembly of the people meets, a high court (consisting of a chief-justice and two puisne judges), a municipal burgher council, two banks, two newspapers, two hotels, clubs, a college, schools, and several churches, including the Dutch Reformed church, the Anglican church with a resident bishop, and Wesleyan, Lutheran, and Roman Catholic churches. The Dutch language is officially used in the volksraad and the courts of justice, but English is spoken by the community generally.

The other towns or villages of the state are—Fauresmith, Edenburg, Philippolis, Jacobsdal, Boshoff, Winburg, Hoopstad, Kronstad, Heilbron, Frankfort, Harrismith, Ladybrand, Ficksburg, Bethulie, Bethlehem, Smithfield, Rouxville, and Wepener.

At the commencement of this century the country was inhabited by sections of aboriginal tribes—Bushmen, Korannas, and Bechuanas; and soon afterwards a number of Griquas from the north-west of the Cape Colony came in among them. A chronic state of warfare prevailed between these races. In 1824 nomad farmers from the Colony, seeking pastures for their flocks, crossed the Orange river and settled in the territory. These were followed in 1835-36 by large bodies of Dutch Boer emigrants who left the Colony in order to be beyond British control. They formed a rude government for themselves, and in attempting to exercise authority came into collision with the Griquas, who claimed protection from the Colony, with which they were allied by treaty. The British governor, Sir P. Maitland, intervened in 1845, assisting the Griquas with troops, and defeating the Boers at Zwart Koppies; and, to prevent further collisions, a resident was appointed. In 1848 Governor Sir H. Smith visited the territory, and came to the conclusion that peace could not be maintained among the mixed elements forming the population without the establishment of a regular government. He therefore issued a proclamation, afterwards confirmed by the crown, annexing the territory to the empire under the name of the Orange River British Sovereignty. Thereupon some of the Boers, under their leader Pretorius, took up arms and expelled the British magistrates; but a military force was brought against them by Sir H. Smith in person, and, after a short but sharp encounter at Boomplaats, the Boers were defeated, and the crown's authority re-established and maintained from that time until towards the close of 1853. During this period many Europeans and colonists of European descent took up their abode in the sovereignty. But disturbances again occurred, arising from long-standing disputes between the native tribes; and, in order to chastise the most powerful of them—the Basutos—for certain acts of outrage, Governor Cathcart in 1852 moved a large military expedition against their chief, Moshesh, and the battle of the Berea was fought, after which the chief, on behalf of the tribe, gave in his submission. After this expedition the British Government resolved to withdraw from the territory. Sir George Clerk was deputed as a special commissioner to carry out the abandonment of the country; and, notwithstanding the protests of many inhabitants, he formally handed it over to a body of Boer delegates in terms of a convention entered into on the 23d February 1854. They were released from their allegiance, and permitted to constitute an independent republican community of their own, under the title of the "Orange River Free State." Since that time the government has been in the hands of a president assisted by an executive council, with a volksraad or congress elected by the people, exercising all legislative functions.

In the south-eastern portion of the State, and entirely surrounded by it, is a small independent native territory, of which the principal village is Thaba-Nchu, where 10,000 of the Baralong tribe reside, peaceably ruled by their chief according to their own laws.

ORANIENBAUM, a town of European Russia, with a population of about 4000, lies 100 feet above the sea on the south coast of the Gulf of Finland opposite Cronstadt, and is well known for its imperial palace and as a summer resort for the inhabitants of St Petersburg, from which it is 24 miles distant by rail.

In 1714 Menshikoff, to whom the site was presented by Peter the Great, erected for himself the country seat of Oranienbaum; confiscated, like the rest of his estates, in 1727, it became an imperial residence. In 1743 the empress Elizabeth assigned the place to Peter Theodorovitch, who built there a castle, Peterstadt (now destroyed), for his Holstein soldiers. The rise of the town was fostered by the appointment in 1764 of an official for the reception and entertainment of foreign immigrants entering Russia *via* Cronstadt.

ORATORIANS. See NERI.

ORATORIO. See MUSIC.

ORCAGNA (*c.* 1316-*c.* 1376[1]), whose full name was ANDREA DI CIONE, called ARCAGNUOLO,[2] was the son of a very able Florentine goldsmith, Maestro Cione, said to have been one of the principal artists who worked on the magnificent silver frontal of the high altar of San Giovanni, the Florentine Baptistery. The result of Orcagna's early training in the use of the precious metals may be traced in the extreme delicacy and refined detail of his principal works in sculpture. He had at least three brothers who all practised some branch of the fine arts: Lionardo or Nardo, the eldest, a painter; Matteo, a sculptor and mosaicist; and Jacopo, also a painter. They were frequently associated with Orcagna in his varied labours.

From the time of Giotto to the end of the 14th century Orcagna stands quite pre-eminent even among the many excellent artists of that time. In sculpture he was a pupil of Andrea Pisano; in painting, though indirectly, he was a disciple of Giotto. Few artists have practised with such success so many branches of the arts. Orcagna was not only a painter and sculptor, but also a worker in mosaic, an architect, and a poet. His importance in the history of Italian art rests not merely on his numerous and beautiful productions, but also on his widespread influence, transmitted to his successors through a large and carefully-trained school of pupils. In style as a painter Orcagna comes midway between Giotto and Fra Angelico: he combined the dramatic force and realistic vigour of the earlier painter with the pure brilliant colour and refined unearthly beauty of Fra Angelico. His large fresco paintings are works of extreme decorative beauty and splendour,—composed with careful reference to their architectural surroundings, arranged for the most part on one plane, without the strong foreshortening or effects of perspective with which the mural paintings of later masters are so often marred.

1. *Orcagna as a Painter.*—His chief works in fresco were at Florence, in the church of S. Maria Novella. He first covered the walls of the retro-choir with scenes from the life of the Virgin. These, unfortunately, were much injured by damp very soon after their completion, and towards the end of the following century were replaced by other frescos of the same subjects by Ghirlandaio, who, according to Vasari, made much use of Orcagna's motives and invention. Orcagna also painted three walls of the Strozzi chapel, at the north-east of the same church, with a grand series of frescos, which still exist, though in a much injured and "restored" state. On the northern end wall is the Last Judgment, painted above and round the window, the light from which makes it difficult to see the picture. In the centre is Christ floating among clouds, surrounded by angels; below are kneeling figures of the Virgin and St John the Baptist, with the twelve apostles. Lower still are patriarchs, prophets, and saints, with the resurrection of the blessed and the lost. The finest composition is that on the west wall, unbroken by any window. It represents paradise, with Christ and the Virgin enthroned in majesty among rows of brilliantly-coloured cherubim and seraphim tinged with rainbow-like rays of light. Below are long lines of the heavenly hierarchy mingled with angel musicians; and lower still a crowd of saints floating on clouds. Many of these figures are of exquisite beauty, especially the few that have escaped restoration. Faces of the most divine tenderness and delicacy occur among the female saints; the two central angels below the throne are figures of wonderful grace in pose and movement; and the whole picture, lighted by a soft luminous atmosphere, seems to glow with an unearthly gladness and peace. Opposite to this is the fresco attributed by Vasari to Orcagna's brother Bernardo, or rather Nardo (*i.e.*, Lionardo); it was completely repainted in 1530, so that nothing but the design remains, full of horror and weird imagination. To some extent the painter has followed Dante's scheme of successive circles.

These paintings were probably executed soon after 1350, and in 1357 Orcagna painted one of his finest panel pictures, as a retable for the altar of the same chapel, where it still remains. In the centre is Christ in majesty between kneeling figures of St Peter and St Thomas Aquinas, attended by angel musicians; on each side are standing figures of three other saints. It is a work of the greatest beauty both in colour and composition; it is painted with extreme miniature-like delicacy, and is on the whole very well preserved. This retable is signed, "Añ. dñi. mccclvii Andreas Cionis de Florentia me pinxit."

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[1] The dates of Orcagna's birth and death are not exactly known. According to Vasari, he died in 1389 at the age of sixty; but a document dated 1376 provides a guardian for Tessa and Romola, daughters of Orcagna's widow Francesca (see Bonaini, *Mem. Ined.*, pp. 105-6). Possibly, therefore, 1376 was the year of his death; and if Vasari is right about his age his birth would have been in 1316. Milanesi, the able editor of Vasari, is inclined to think that Orcagna died in 1368, when he is known to have been seriously ill.

[2] Of this form, sometimes spelt Orcagnuolo, Orcagna is a corruption.

Another fine altar-piece on panel by Orcagna, dated 1363, is preserved in the Cappella de' Medici near the sacristy of Sta Croce; it represents the four doctors of the Latin church. According to Vasari, Orcagna also painted some very fine frescos in Sta Croce, similar in subjects to those attributed to him in the Campo Santo of Pisa, and full of fine portraits. These do not now exist. In the cathedral of Florence, on one of the northern piers, there hangs a nobly-designed and highly-finished picture on panel by Orcagna, representing S. Zanobio enthroned, trampling under his feet Cruelty and Pride; at the sides are kneeling figures of SS. Eugenius and Crescentius,—the whole very rich in colour. The retable mentioned by Vasari as having been painted for the Florentine church of S. Pietro Maggiore is now in the National Gallery of London. It is a richly decorative composition of the Coronation of the Virgin, between rows of saints, together with nine other subjects painted in miniature. Other paintings on panel by Orcagna were sent by the Pope to Avignon, but cannot now be traced. The frescos also have been destroyed with which, according to Vasari, Orcagna decorated the façade of S. Apollinare and the Cappella de' Cresci in the church of the Servi in Florence.[1]

2. *Orcagna as a Sculptor and Architect.*[2]—In 1355 Orcagna was appointed architect to the chapel of Or San Michele in Florence. This curiously-planned building, with a large upper room over the vaulting of the lower part, had been begun by Taddeo Gaddi as a thank-offering for the cessation of the plague of 1348. It took the place of an earlier oratory designed by Arnolfo del Cambio, and was the gift of the united trade-guilds of Florence. As to the building itself, it is impossible to say how much is due to Taddeo Gaddi and how much to Orcagna, but the great marble tabernacle was wholly by Orcagna. This, in its combined splendour of architectural design, sculptured reliefs and statuettes, and mosaic enrichments, is one of the most important and beautiful works of art which even rich Italy possesses. It combines an altar, a shrine, a reredos, and a baldacchino. In general form it is perhaps the purest and most gracefully designed of all specimens of Italian Gothic. It is a tall structure of white marble, with vaulted canopy and richly-decorated gables and pinnacles, reaching almost to the vaulted roof of the chapel. The detail is extremely delicate, and brilliant gem-like colour is given by lavish enrichments of minute patterns in glass mosaic, inlaid in the white marble of the structure. It is put together with the greatest care and precision; Vasari especially notes the fact that the whole was put together without any cement, which might have stained the purity of the marble, all the parts being closely fitted together with bronze dowels. The spire-like summit of the tabernacle is surmounted by a figure of St Michael, and at a lower stage on the roof are statuettes of the apostles. The altar has a relief of Hope between panels with the Marriage of the Virgin and the Annunciation. On the right side, looking east, of the base of the tabernacle are reliefs of the Birth of the Virgin and her Presentation in the Temple; on the left, the Nativity and the Adoration of the Magi; and behind, the Presentation of Christ in the Temple, and the Angel warning the Virgin to escape into Egypt. Above the last two subjects are large reliefs of the Death of the Virgin, surrounded by the apostles, and higher still her Assumption; she stands in a vesica, and is borne by angels to heaven. On the base of the Virgin's tomb is inscribed "Andreas Cionis pictor Florentinvs oratorii archimagister extitit hvjvs mccclix." Orcagna's own portrait is given as one of the apostles. In addition to these richly-composed subject-reliefs the whole work is adorned with many other single figures and heads of prophets, angels, and the Virtues, all executed with wonderful finish and refinement. The shrine, which forms an aumbry in the reredos, contains a miraculous picture of the Madonna. A fine bronze screen, with open geometrical tracery, encloses the whole. No work of sculpture in Italy is more magnificent than this wonderful tabernacle, both in general effect and in the delicate beauty of the reliefs and statuettes with which it is so lavishly enriched. It cost the enormous sum of 96,000 gold florins. Unfortunately it is very badly placed and insufficiently lighted, so that a minute examination of its beauties is a work of difficulty.

No mention is made by Vasari of Orcagna's residence in Orvieto, where he occupied for some time the post of "capo-maestro" to the duomo.[1] He accepted this appointment on 14th June 1358 at the large salary (for that time) of 300 gold florins a year. His brother Matteo was engaged to work under him, receiving 8 florins a month. When Orcagna accepted this appointment at Orvieto he had not yet finished his work at Or San Michele, and so was obliged to make long visits to Florence, which naturally interfered with the satisfactory performance of his work for the Orvietans. The result was that on the 12th of September 1360 Orcagna, having been paid for his work up to that time, resigned the post of "capo-maestro" of the duomo, though he still remained a little longer in Orvieto to finish a large mosaic picture on the west front. When this mosaic (made of glass tesseræ from Venice) was finished in 1362, it was found to be uneven in surface, and not fixed securely into its cement bed. An arbitration was therefore held as to the price Orcagna was to receive for it, and he was awarded 60 gold florins.

Vasari mentions as other architectural works by Orcagna the design for the piers in the nave of the Florentine duomo, a secca or mint, which appears not to have been carried out, and the Loggia dei Lanzi in the Piazza della Signoria. It is, however, more than doubtful whether Orcagna had any hand in this last building, a very graceful vaulted structure, with three semicircular open arches on the side and one at each end, intended to form a sheltered meeting-place for the Priori during elections and other public transactions. This loggia was ordered by the General Council of Florence in 1356, but was not actually begun till the year 1376, after Orcagna's death. The architects were Benci di Cione (possibly a brother of Orcagna) and Simone di Francesco Talenti, both men of considerable reputation in Florence. The sculptured reliefs of the seven Virtues in the spandrels of the arches of the loggia, also attributed to Orcagna by Vasari, were later still. They were designed by Angelo Gaddi (1383-1386), and were carried out by three or four different sculptors.

Pupils of Orcagna named by Vasari are Bernardo Nello, a Pisan, Tommaso di Marco, a Florentine, and, chief of all, Francesco Traini, whose grand painting on panel of St Thomas Aquinas enthroned with the arch-heretics at his feet still hangs in the church for which it was painted,—Sta Caterina at Pisa. Orcagna had, in addition to the two daughters mentioned above, a son named Cione, who was a painter of but little eminence. Some sonnets attributed to Orcagna exist in MS. in the Strozzi and Magliabecchian libraries in Florence. They have been published by Trucchi (*Poesie inedite*, ii. p. 25, Prato, 1846). They are graceful in language, but rather artificial and over-elaborated.

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[1] The magnificent but much injured frescos of the Last Judgment, Hell, and the Triumph of Death in the Pisan Campo Santo, described with great minuteness and enthusiasm by Vasari, are attributed by him to Orcagna, but internal evidence seems to show that they are productions of the Sienese school. Crowe and Cavalcaselle attribute them to the two brothers Lorenzetti of Siena, but they have been so injured by wet, the settlement of the wall, and repeated retouchings that it is difficult to come to any clear decision as to their authorship. It appears, however, much more probable that they are the work of Bernardo Daddi.

[2] Orcagna was admitted as a member of the Sculptors' Guild in 1352. His name occurs in the roll as "Andreas Cionis vocatus Arcagnolus, pictor."

[1] See Milanesi, *Storia dell' Arte Toscana*, p. 238 (Siena, 1873); Luzi, *Duomo d' Orvieto*; and Vasari, ed. Milanesi, i. p. 617 (Florence, 1878).

Authorities.—Vasari, ed. Milanesi, i. p. 593 (Florence, 1878); *Giornale degli Archivi Toscani*, iii. p. 282, &c.; Passerini, *Curiosità storico-artistiche*; Gaye, *Carteggio inedito*, i. pp. 500-513, ii. p. 5; Rosini, *Storia della pittura*, vol. ii.; Baldinucci, *Professori del disegno*, vol. i.; Rumohr, *Ricerche Italiane*, ii., and *Antologia di Firenze*, iii.; Crowe and Cavalcaselle, *Painting in Italy*, i. p. 425 (London, 1864); Perkins, *Tuscan Sculptors*, p. 77 (London, 1865). (J. H. M.)

ORCHESTRA. See MUSIC, *supra*, p. 98.

ORCHHÁ, or TEHRI, a native state in Bundelkhand, Central India, lies between 24° 26′ and 25° 34′ N. lat., and between 78° 28′ 30″ and 79° 23′ E. long., to the south of the British district of Jhánsí. The area is about 2000 square miles; the population in 1881 was 311,514. A great portion of the area is covered with hill jungle and poor soil, and is thinly peopled. The present capital, Tehri, situated in the south-west corner of the state, is a poor ill-built town, the only good house being the palace of the rájá. Orchhá is the oldest and highest in rank of all the Bundelá principalities, and was the only one not held in subjection by the peshwá. The chief received the title of mahárájá in 1865.

ORCHIDS. The word *Orchis* is used in a special sense to denote a particular genus of the Orchid family (*Orchidaceæ*); very frequently, also, it is employed in a more general way to indicate any member of that large and very interesting group. It will be convenient here to use the word *Orchis* as applying to that particular genus which gives its name to the order or family, and to employ the term "orchid" in the less precise sense.

The flowers of all orchids, though extremely diverse within certain limits, and although superficially very different from those of other monocotyledons, are all formed upon one common plan, which is only a modification of that observable in such flowers as those of the narcissus or snowdrop (*Galanthus*). The conformation of those flowers consists essentially in the presence of a six-parted perianth, the three outer segments of which correspond to a calyx, the three inner ones to a corolla. These segments spring apparently from the top of the ovary,—the real explanation, however, being that the end of the flower-stalk or "thalamus," as it grows, becomes dilated into a sort of cup or tube enclosing and indeed closely adhering to the ovary, so that the latter organ appears to be beneath the perianth instead of above it as in a lily, an appearance which has given origin to the term "inferior ovary." Within the perianth, and springing from its sides, or apparently from the top of the ovary, are six stamens whose anthers contain pulverulent pollen-grains. These stamens encircle a style which is the upward continuation of the ovary, and which shows at its free end traces of the three originally separate but now blended carpels of which the ovary consists. An orchid flower (disregarding for the moment a very small number of exceptions) has an inferior ovary like that just described, but with the ovules on the walls of the cavity (not in its axis or centre), a six-parted perianth, a stamen or stamens, and a style or styles. The main distinguishing features consist in the fact that one of the inner pieces of the perianth becomes in course of its growth much larger than the rest, and usually different in colour, texture, and form. So different is it that it receives a distinct name, that of the "lip" or "labellum." In place of the six stamens we commonly find but one (two in *Cypripedium*), and that one is inseparably blended with the style to form the "column," bringing about the condition technically called "gynandrous." Moreover, the pollen, instead of consisting of separate cells or grains, consists of cells aggregated into "pollen-masses," the number varying in different genera, but very generally two, four, or eight, and in many of the genera provided at the base with a strap-shaped stalk or "caudicle" ending in a flattish gland or "viscid disk" like a boy's sucker. The style has very generally at its upper part a peculiar pouch-like process called the "rostellum," in which the viscid disk of the pollen-masses is concealed till released in the manner presently to be mentioned. It would appear, then, that the orchid flower differs from the type in the irregularity of the perianth, in the suppression of five out of six stamens and of two out of three styles, and in the union into one column of the one stamen and the one style which remain in the adult flower. In addition to these modifications, which are common to nearly all orchids, there are others generally but not so universally met with; among them is the displacement of the flower arising from the twisting of the inferior ovary, in consequence of which the flower is so completely turned round that the "lip," which originates in that part of the flower, conventionally called the posterior or superior part, or that nearest to the supporting stem, becomes in course of growth turned to the anterior or lower part of the flower nearest to the bract, from whose axil it arises. Other common modifications arise from the union of certain parts of the perianth to each other, and from the inordinate outgrowths from the lip.

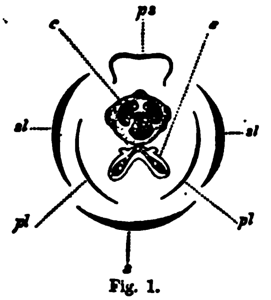


Fig. 1.

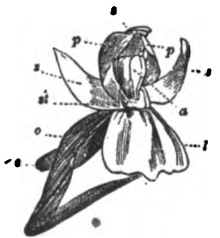


Fig. 2.

FIG. 1.—Diagram of the flower of Orchis. *s, sl, sl*, the three divisions of the outer perianth; *pl, pl*, the two lateral divisions of the inner perianth; *ps*, the superior division or the labellum, which may become inferior by the twisting of the ovary; *e*, the fertile stamen, with its two pollen-masses in the anther-lobes; *c*, the one-celled ovary cut transversely, having three parietal placentas.

FIG. 2.—Flower of an Orchid. *s, s, s*, the three outer divisions of the perianth; *p, p, l*, the three inner, *l* being the labellum, here inferior by the twisting of the ovary; *s*, spur of the labellum; *o*, the twisted ovary; *st*, the stigma; *a*, the anther, containing pollen-masses.

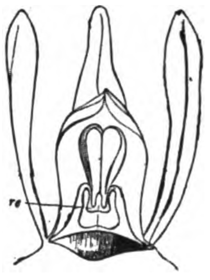


Fig. 3.

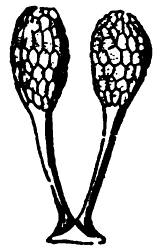


Fig. 4.

FIG. 3.—Upper part of an Orchid flower. The outer divisions of the perianth are seen, and two of the inner, the third or labellum being removed. The two anther lobes are seen with pollen-masses attached to the upper part of the stigma by viscid matter, *re*.

FIG. 4.—Pollen-masses of an Orchid, with their caudicles and common gland.

These statements are borne out by evidence derived from a variety of sources, such as that afforded by the progressive development of the parts of the flower from their earliest to their most complete condition, by the anatomy or internal organization of the parts of the flower, by the number and distribution of the vascular bundles which run through the cellular tissue, by the comparative morphology of the floral organs of the different genera of the order, and by teratology, or the study of unusual or monstrous formations, which reveals the existence of a complete series of intermediate forms constituting a regular gradation from the ordinary irregular gynandrous flower to regular flowers with six separate stamens such as we have taken as the type.

What brings about—what has brought about—this extraordinary series of changes, by virtue of which a flower typically as regular as a snowdrop becomes transmuted into the forms often more grotesque and extraordinary than can be found in any other group of plants? To the first part of the question the reply is that the present form has been inherited from generation to generation of orchids; to the second part the answer most in accordance with the present state of knowledge is that these modifications are associated with the structure and habits of insects and their visits to the flowers. Cross fertilization, or the impregnation of any given flower by pollen from another flower of the same species on the same or on another plant, has been proved to be of great advantage to the plant by securing a more numerous or a more robust offspring, or one better able to adapt itself to the varying conditions under which it has to live. This cross fertilization is effected by the agency of insects. They are attracted to the flower by its colour or its perfume; they seek, collect, or feed on its honey, and while so doing they remove the pollen from the anther and convey it to another flower, there to germinate on the stigma when its tubes travel down the style and their contents ultimately come in near apposition, perhaps in actual confluence, with the "oosphere" or immature egg, which becomes in consequence fertilized, and thereafter gradually develops into a new plant. To facilitate the operations of such insects, by compelling them to move in certain lines so as to secure the due removal of the pollen and its subsequent deposit on the right place, the form of the flower and the conformation of its several parts are modified in ways as varied as they are wonderful. Other insects visit the flower with more questionable result. For them the pollen is an attraction as food, or some other part of the flower offers an inducement to them for a like object. Such visitors are clearly prejudicial to the flower, and so we meet with arrangements which are calculated to repel the intruders, or at least to force them to enter the flower in such a way as not to effect mischief. It would be quite impossible within the limits of this article to go into detail on this subject. All we can do is to give one or two illustrations, referring the reader desirous of fuller information to Darwin's *Fertilisation of Orchids*.

In the common orchids of British meadows, *Orchis Morio*, *mascula* (Shakespeare's long purples), &c., the general structure of the flower is as we have described it. In addition there is in this particular genus, as indeed in many others, a long tubular spur or horn projecting downwards from the back of the lip, whose office it is to secrete and store a honeyed juice; the forepart of the lip forms an expanded plate, usually larger and more brightly coloured than the other parts of the flower, and with hairs or ridges and spots of various kinds according to the species. The remaining parts of the perianth are very much smaller, and commonly are so arranged as to form a hood overarching the "column." This column stands up from the base of the flower, almost at right angles to the lip, and it bears at the top an anther, in the two hollow lobes of which are concealed the two pollen-masses, each with its caudicle terminating below in a roundish gland, concealed at first in the pouch-like rostellum at the front of the column. Below the anther the surface of the column in front is hollowed out into a greenish depression filled with viscid fluid,—this is the stigma. The other parts of the flower need not detain us. Such being in general terms the mechanism of the flower of a common orchis, let us now see how it acts. A bee, we will assume, attracted by the colour and perfume of the flower, alights on that part of it which is the first to attract its attention,—the lip. There, guided by the hairs or ridges before-mentioned, it is led to the orifice of the spur with its store of honeyed juice. The position of this orifice, as we have seen, is at the base of the lip and of the column, so that the insect, if of sufficient size, while bending his head to insert his proboscis into the spur, almost of necessity displaces the pollen-masses. Liberated from the anthers, these adhere to the head or back of the insect by means of the sticky gland at the bottom of the caudicle. Having attained his object the insect withdraws, taking with him the pollen-masses, and visits another flower. And now occurs another device or adaptation no less marvellous than those of which mention has been made. The two anther-cases in an orchis are erect and nearly parallel the one to the other; the pollen-masses within them are of course in like case, as may be thus represented ‖, but immediately the pollen-masses are removed movements take place in the caudicle so as to effect the bending of this stalk and the placing the pollen-mass in a more or less horizontal position, thus ═, or, as in the case of *O. pyramidalis*, the two pollen-masses originally placed parallel ‖ diverge from the base like the letter V. The movements of the pollen-masses may readily be seen with the naked eye by thrusting the point of a needle into the base of the anther, when the disks adhere to the needle as they would do to the antenna of an insect, and may be withdrawn. Sometimes the lip is mobile and even sensitive to impressions, as are also certain processes of the column. In such cases the contact of an insect or other body with those processes is sufficient to liberate the pollen often with elastic force, even when the anther itself is not touched. In other orchids movements take place in different ways and in other directions. The object of these movements will be appreciated when it is remembered that, if the pollen-masses retained the original direction they had in the anther in which they were formed, they would, when transported by the insect to another flower, merely come in contact with the anther of that flower, where of course they would be of no use; but, owing to the divergences and flexions above alluded to, the pollen-masses come to be so placed that, when transplanted to another flower of the same species, they come in contact with the stigma and so effect the fertilization of that flower. These illustrations are comparatively simple; it would have been easy to select others of a more complicated nature, but all evidently connected with the visits of insects and the cross fertilization of the flower. In some cases the form of the male flowers is so different from that of the female that before the different flowers had been found on the same spike, and before the facts of the case were fully known, they were taken to be representatives of distinct genera.

The floral structure is so curious that perhaps less attention has been paid to the vegetative organs than the peculiarities of their organization demand. We can only allude to some of these points. The orchids of British fields are all of terrestrial habit, and their roots are mostly tuberous (fig. 5), the tubers being partly radical partly bud-like in their character. There is often a marked alternation in the production of vegetative and flowering shoots respectively; and, sometimes, from various circumstances, the flowering shoots are not produced for several years in succession. This fact will account for the profusion with which

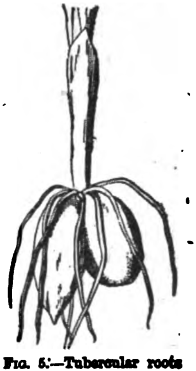


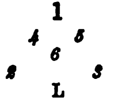
Fig. 5.—Tubercular roots of *Orchis mascula*, a terrestrial Orchid.

some orchids, like the common bee orchis for instance, are found in some seasons and their scarcity in others. Tropical orchids are mostly epiphytal,—that is, they grow upon trees without deriving nourishment from them. They are frequently provided with "pseudo-bulbs," large solid swellings of the stem, in the tissues of which water and nutritive materials are stored. Very generally, too, such plants have aerial roots, of thick or thin wire-like form, covered with a spongy white investment, the constituent cells of which are found under the microscope to contain spiral fibres tightly coiled up within them. By these "air-roots" the plants are able to absorb watery vapour and perhaps actual water.

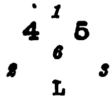
The number of species of orchids is greater than that of any other monocotyledonous order—not even excepting grasses—amounting to between 4000 and 5000 at least. This large number is partly accounted for by the diligent search in all countries that has been made for these plants for purposes of cultivation,—they being held at present in the greatest esteem by plant-lovers, and prices being paid for new or rare varieties which recall the days of the tulipomania. It must be admitted, however, that orchid-lovers have better reasons to support their fancy than had the speculative growers and barterers of tulips.

The economic uses of orchids are not remarkable. When we have mentioned vanilla, which consists of the pods of an orchid, we have mentioned about the only economic product that now comes into market. Salep, still used in the Levant, consists of the dried tubers of some terrestrial orchid, and contains a relatively large amount of nutritious matter.

Cypripedium demands notice, inasmuch as it, with one or two other genera, constitutes a tribe of the order in which two stamens are present, one on each side of the column instead of one only at the top. What may be considered the normal number of stamens is, as has been said, six, arranged in two rows. In most orchids the only stamen developed to maturity is the posterior one of the three opposite to the lip (anterior before the twisting of the ovary), the other two, as well as all three inner ones, being entirely absent, or present only in the form of rudiments. In *Cypripedium* all three of the outer stamens are wanting, but the two lateral ones of the inner series are present, the third being undeveloped. This arrangement may be understood by reference to the following diagram, representing the relative position of the stamens in orchids generally and in *Cypripedium*. The letter L indicates the position of the labellum; the large figures indicate the developed stamens; the italic figures show the position of the suppressed stamens.



Arrangement of stamens in *Orchis*.



Arrangement of stamens in *Cypripedium*.

(M. T. M.)

ORCHIL. See ARCHIL.

ORCHOMENUS, the name borne by two cities of ancient Greece.

I. A Bœotian city, situated in the angle between the Cephissus and its tributary the Melas, on a long narrow hill which projects south from Mount Acontium. Its position is exceedingly strong, being defended on every side by precipice or marsh or river, and it was admirably suited to be the stronghold of an early kingdom. The acropolis is at the north end of the hill, on a peak which is overhung by Acontium, but at a distance sufficient to be safe from an enemy with the weapons of early warfare posted on the mountain. At the foot of the acropolis are the springs of the Melas. Orchomenus was the capital of the Minyæ, a race famous in the half-legendary history of early Bœotia; the sway of the Minyæ once extended over Bœotia, including even Thebes, but the Æolic Bœotians who made Thebes their stronghold broke the power of the Orchomenian kings. The most remarkable relic of the early power of Orchomenus is the so-called "treasury," which is said to be the oldest in Greece. It was larger than the buildings of similar style at Mycenæ (see MYCENÆ), and the admiration which Pausanias expresses for it is justified by the beautiful ornamentation, especially of the roof, which has been brought to light by Schliemann's excavations. The monument, undoubtedly the tomb of some ancient ruler, or of a dynasty, lies outside the city walls. The worship of the Charites (see GRACES) was the great cultus of Orchomenus, and the site of the temple is now occupied by a chapel, the Κοίμησις τῆς Παναγίας. The Charites were worshipped under the form of rude stones, which had fallen from heaven during the reign of Eteocles; and it was not till the time of Pausanias that statues of the goddesses were placed in the temple. Near this was another temple dedicated to Dionysus, in whose festival, the Ἀγριοίνια, are apparent the traces of human sacrifice in early times. The city was destroyed by the Thebans in the 4th century; the men were slain, and the women and children sold as slaves. About thirty years later, after the battle of Chæronea (338 B.C.), Philip of Macedon restored the city. The name is spelt on the dialectic inscriptions and coins Ἐρχόμενος. It is mentioned in the Homeric catalogue.

II. An Arcadian city, situated in a district of the same name, north of Mantinea and west of Stymphalus. The district was mountainous, but embraced two valleys,—the northern containing a lake which is drained, like all Arcadian lakes, by a *katabothron*; the southern lying under the city, separated from Mantinea by a mountain ridge called Anchisia. The old city occupied a strong and lofty situation; in the time of Strabo it was a ruin, but Pausanias mentions that a new town was built below the old. A primitive wooden image of Artemis Cedreatis stood in a large cedar tree outside the city. Orchomenus is mentioned in the Homeric catalogue with the epithet πολύμηλος.' It sent soldiers to Thermopylæ and to Platæa. The native form of the name was Ἐρχόμενος.

ORDEAL (Anglo-Saxon *ordál*, *ordæl*, judgment) corresponds to modern German *urtheil*, but bears the special sense of the mediæval Latin *Dei judicium*, a miraculous decision as to the truth of an accusation or claim. The word is adopted in the late Latin *ordalium*, French *ordalie*. The ordeal had existed for many ages before it was thus named in Europe. In principle, and often in the very forms used, it belongs to ancient culture, thence flourishing up to the mediæval European and modern Asiatic levels, but dying out before modern civilization. Some ordeals, which possibly represent early stages of the practice, are simply magical, being processes of divination turned to legal purpose. Thus in Burmah suits are still determined by plaintiff and defendant being each furnished with a candle, equal in size and both lighted at once,—he whose candle outlasts the other being adjudged, amid the acclamations of his friends, to have won his cause (Shway Yoe, *The Burman*, vol. ii. p. 254). Even quainter is a Dyak ordeal in Borneo, where the two parties are represented by two shell-fish on a plate, which are irritated by pouring on some lime-juice, and the one first moving settles the guilt or innocence (as has been before arranged) of its owner (St John, *Forests of the Far East*, vol. i. p. 89). The administration of ordeals has been much in the hands of priests, and they are more often than not worked on a theological basis, the intervention of a deity being invoked and assumed to take place even when the process is in its nature one of symbolic magic. For instance, an ancient divining instrument consisted of a sieve held suspended by a thread or by a pair of shears with the points stuck into its rim, and considered to move at the mention of the name to be discovered, &c. Thus girls consulted the "sieve-witch" (κοσκινόμαντις) about lovers (Theocr., *Idyll.*, iii. 31). This *coscinomancy* served in the same way to discover a thief, when, with prayer to the gods for direction, the names of the suspected persons were called over to it (Potter, *Greek Antiquities*, vol. i. p. 352). When a suspended hatchet was used in the same way to turn to the guilty, the process was called *axinomancy*. The sieve-ordeal remained popular in the Middle Ages (see the description and picture in Cornelius Agrippa, *De Occ. Phil.*); it is mentioned in Hudibras (ii. 3):

> ". . . th' oracle of sieve and shears
> That turns as certain as the spheres."

From this ancient ordeal is evidently derived the modern Christian form of the key and Bible, where a Psalter or Bible is suspended by a key tied in at Psalm l. 18: "When thou sawest a thief, then thou consentedst with him"; the bow of the key being balanced on the fingers, and the names of those suspected being called over, he or she at whose name the book turns or falls is the culprit (see Brand, *Popular Antiquities*, ed. Bohn, vol. iii. p. 351).

One of the most remarkable groups of divinations passing into ordeals are those which appeal to the corpse itself for discovery of its murderer. The idea is rooted in that primitive state of mind which has not yet realized the full effect of death, but regards the body as still able to hear and act. Thus the natives of Australia will ask the dead man carried on his bier of boughs who bewitched him; if he has died by witchcraft he will make the bier move round, and if the sorcerer who killed him be present a bough will touch him (Eyre, *Australia*, vol. ii. p. 344). That this is no isolated fancy is shown by its recurrence among the negroes of Africa, where, for instance, the corpse causes its bearers to dash against some one's house, which accuses the owner of the murder (J. L. Wilson, *Western Africa*, p. 231; Waitz, vol. ii. p. 193). This somewhat resembles the well-known ordeal of the bier in Europe in the Middle Ages, which, however, seems founded on a different principle, the imagination that a sympathetic action of the blood causes it to flow at the touch or neighbourhood of the murderer. Apparently the liquefaction of the blood which in certain cases takes place after death may have furnished the ground for this belief. On Teutonic ground, this ordeal appears in the *Nibelungenlied*, where the murdered Siegfried is laid on his bier, and Hagen is called on to prove his innocence by going to the corpse, but at his approach the dead chief's wounds bleed afresh. The typical instance in English history is the passage of Matthew Paris, that after Henry II.'s death at Chinon his son Richard came to view the body, "Quo superveniente, confestim erupit sanguis ex naribus regis mortui; ac si indignaretur spiritus in adventu ejus, qui ejusdem mortis causa esse credebatur, ut videretur sanguis clamare ad Deum." In Shakespeare (*Rich. III.*, act 1, sc. 2):

> "O gentlemen, see, see! dead Henry's wounds
> Open their congeal'd mouths, and bleed afresh!"

At Hertford assizes (4 Car. I.) the deposition was taken as to certain suspected murderers being required to touch the corpse, when the murdered woman thrust out the ring finger three times and it dropped blood on the grass (Brand, vol. iii. p. 231); and there was a case in the Scottish High Court of Justiciary as late as 1668 (T. F. Thiselton Dyer, *Folklore of Shakespeare*, p. 487). Durham peasants, apparently remembering the old belief, still expect those who come to look at a corpse to touch it, in token that they bear no ill-will to the departed (W. Henderson, *Folklore of Northern Counties*, p. 57).

Certain ordeals are closely related to oaths, so that the two shade into one another. Let the curse which is to fall on the oath-breaker take effect at once, it then becomes a sign condemning the swearer,—in fact, an ordeal. Thus the drinking of water on which a curse or magical penalty has been laid is a mere oath so long as the time of fulfilment is unfixed (see OATH). But it becomes an ordeal when, as in Brahmanic India, the accused drinks three handfuls of water in which a sacred image has been dipped; if he is innocent nothing happens, but if he is guilty sickness or misfortune will fall on him within one to three weeks (for accounts of these and other Hindu ordeals see Ali Ibrahim Khan in *Asiatic Researches*, vol. i. p. 389, and Stenzler's summary in *Z. D. M. G.*, vol. ix.). The earliest account of such an ordeal is in Numbers v., which describes the mode of administering to a woman charged with unfaithfulness the bitter water mixed with the dust of the tabernacle floor, with the curse laid on it to cause her belly to swell and her thigh to fall if guilty. Ewald (*Antiquities of Israel*, 236) regards the draught as in itself harmless, and the operation of this curse on the guilty as due to the influence of the mind on the body. But the term "bitter" is applied to the water before it has been cursed, which suggests that it already contained some drug, as in the poison-water ordeal still in constant use over a great part of Africa. Thus the red water of Guinea is a decoction made by pounding in a wooden mortar and steeping in water the inner bark of one of the mimosas, producing a liquor like that of a tan-vat, astringent, narcotic, and when taken in sufficient quantity emetic. The accused, with solemn ceremony and invocation, drinks freely of it; if it nauseates him and he throws it up he is triumphantly acquitted, but if he becomes dizzy he is guilty, and the assembly fall on him, pelt him with stones, and even drag him over the rocks till he is dead. Here the result of the ordeal depends partly on the patient's constitution, but more on the sorcerer who can prepare the proper dose to prove either guilt or innocence. Among the various drugs used in different parts of Africa are the *mbundu* root, the Calabar bean, the tangena nut (*Tanghinia veneniflua*, a strong poison and emetic). The sorcerers who administer this ordeal have in their hands a power of inflicting or remitting judicial murder, giving them boundless influence (details in J. L. Wilson, *Western Africa*, pp. 225, 398; Burton, *Lake Regions of Central Africa*, vol. ii. p. 357; Bosman, "Guinea," in *Pinkerton's Voyages*, vol. xvi. pp. 398, &c.). The poison-ordeal is also known to Brahmanic law, decoction of aconite root being one of the poisons given, and the accused if not sickening being declared free (Stenzler, *l.c.*). Theoretically connected with the ordeal by cursed drink is that by cursed food, which is, however, distinguished among this black catalogue by being sometimes an effectual means of discovering the truth. The ordeal by bread and cheese, practised in Alexandria about the 2d century, was practically the same as that known to English law five to ten centuries later as the *corsnæd* or "trial slice" of consecrated bread and cheese which was administered from the altar, with the curse that if the accused were guilty God would send the angel Gabriel to stop his throat, that he might not be able to swallow that bread and cheese. In fact, if guilty and not a hardened offender he was apt to fail, dry-mouthed and choking through terror, to get it down. The remembrance of this ancient ordeal still lingers in the popular phrase, "May this bit choke me if I lie!" In India the corresponding trial by rice is prescribed in the old laws to be done by suspected persons chewing the consecrated grains of rice and spitting them out, moist and untinged with blood, on a banyan leaf; this or the mere chewing and swallowing of a mouthful of rice-grains is often used even by the English as a means of detecting a thief. A classical mention of the ordeals by carrying hot iron in the hands and by passing through the fire is made more interesting by the guards who offer to prove their innocence in this way offering further to take oath by the gods, which shows the intimate connexion between oaths and ordeals (Soph., *Ant.*, 264, see also Æschyl., *fr.* 284).

> ἦμεν δ' ἕτοιμοι καὶ μύδρους αἴρειν χεροῖν
> καὶ πῦρ διέρπειν, καὶ θεοὺς ὁρκωμοτεῖν
> τὸ μήτε δρᾶσαι μήτε τῷ ξυνειδέναι
> τὸ πρᾶγμα βουλεύσαντι μήτ' εἰργασμένῳ.

The passing through the fire is described in the Hindu codes of Yâjnavalkya and others, and is an incident in Hindu poetry, where in the *Râmâyana* the virtuous Sitâ thus proves her innocence to her jealous husband Râma (Stenzler, p. 669; Pictet, *Origines Indo-Européennes*, part ii. p. 457). It was not less known to European law and chronicle, as where Richardis, wife of Charles the Fat, proves her innocence by going into a fire clothed in a waxed shift, and is unhurt by the fire (Grimm, *Deutsche Rechtsalterthümer*, p. 912). Yet more minutely prescribed in the Hindu ordeal-books is the rite of carrying the glowing hot iron seven steps, into the seven or nine circles traced on the ground, the examination of the hands to see if they show traces of burning, and the binding them up in leaves. The close historical connexion of the Hindu ordeal laws with the old European is shown by the correspondence of minute details, as where in a Scandinavian law it is prescribed that the red-hot iron shall be carried nine steps (Grimm, *op. cit.*, p. 918). In Anglo-Saxon laws the iron to be carried was at first only one pound weight, but Athelstan's law (in *Ancient Laws and Institutes of England*, iv. 6) enacts that it be increased to weigh three pounds. Another form well known in old Germany and England was the walking barefoot over glowing ploughshares, generally nine. The law-codes of the early Middle Ages show this as an ordinary criminal procedure (see the two works last referred to), but it is perhaps best remembered in two non-historical legends. The German queen Kunigunde, "hæc dicens stupentibus et flentibus universis qui aderant, vomeres candentes nudo vestigio calcavit et sine adustionis molestia transiit" (*Vita Henrici*, ap. Canisium, vi. 387). Queen Emma, mother of Edward the Confessor, accused of familiarity with Alwyn bishop of Winchester, triumphantly purges herself and him by the help of St Swithin,—each of the two thus acquitted giving nine manors to the church of Winchester, in memory of the nine ploughshares, and the king being corrected with stripes (John Bromton; see Freeman's *Norm. Conq.*, vol. ii. App.). To dip the hand in boiling water or oil or melted lead and take out a stone or ring is another ordeal of this class. The traveller may find some of these fiery trials still in use, or at least in recent memory, in barbaric regions of Africa or further Asia,—the negro plunging his arm into the caldron of boiling oil, the Burman doing feats with melted lead, while the Bedouin will settle a conflict of evidence by the opposing witnesses licking a glowing hot-iron spoon (Burckhardt, *Arabien*, pp. 98, 233). This latter feat may be done with safety by any one, provided the iron be clean and thoroughly white hot, while if only red-hot it would touch and burn the tongue. Probably the administerers of the ordeal are aware of this, and of the possibility of dipping the hand in melted metal; and there are stories of arts of protecting the skin (see the recipe in Albertus Magnus, *De Mirabilibus*), though it is not known what can be really done beyond making it horny like a smith's, which would serve as a defence in stepping on hot coals, but not in serious trials like that of carrying a heavy red-hot iron. The fire-ordeals are still performed by mountebanks, who very likely keep up the same means of trickery which were in official use when the accused was to be acquitted. The actual practice of the fire-ordeal contrasts shamefully with its theory, that the fire rather than harm the innocent restrained its natural action. Thus it stands in the Hindu code of Manu (viii. 115): "He whom the flame does not burn, whom the water does not cast up, or whom no harm soon befals, is to be taken as truthful in his oath." The water-ordeal here referred to is that well known in Europe, where the accused is thrown bound into the water, which receives him if innocent, but rejects him if guilty. The manner of carrying out this test is well explained in the directions given by Archbishop Hincmar in the 9th century: he who is let down into the water for trial is to be fastened by a rope, that he may not be in danger if the water receives him as innocent, but may be pulled out. In the later Middle Ages this ordeal by "swimming" or "fleeting" became the most approved means of trying a suspected witch: she was stripped naked and cross bound, the right thumb to the left toe, and the left thumb to the right toe. In this state she was cast into a pond or river, in which it was thought impossible for her to sink. (Brand, vol. iii. p. 21.) The cases of "ducking" witches which have occurred in England within the last few years are remains of the ancient ordeal.

If there is one thing that may be predicated of man in a state of nature it is that two disputants tend to fight out their quarrel. When in the warfare of Greeks and Trojans, of Jews and Philistines, of Vandals and Alamans, heroes come out from the two sides and their combat is taken to mark the powers of the opposing war-gods and decide the victory, then the principle of the ordeal by battle has been practically called in. Among striking instances of the Teutonic custom which influenced the whole of mediæval Europe may be cited the custom of the Franks that the princes, if they could not quell the strife, had to fight it out between themselves, and Wippo's account of the quarrel between the Christian Saxons and the Pagan Slavs as to which broke the peace, when both sides demanded of the emperor that it should be settled by duel, which was done by choosing a champion on each side, and the Christian fell. The Scandinavian term "holmgang" refers to the habit of fighting duels on an island. A passage from old German law shows the single combat accepted as a regular legal procedure: "If there be dispute concerning fields, vineyards, or money, that they avoid perjury let two be chosen to fight, and decide the cause by duel" (Grimm, *Rechtsalterth.*, p. 928). In England, after the Conquest, trial by combat superseded other legal ordeals, which were abolished in the time of Henry III. Among famous instances is that of Henry de Essex, hereditary standard-bearer of England, who fled from a battle in Wales, in 1158, threw from him the royal standard, and cried out that the king was slain. Robert de Montfort afterwards, accusing him of having done this with treasonable intent, offered to prove his accusation by combat, and they fought in presence of Henry II. and his court, when Essex was defeated, but the king spared his life, and, his estate being confiscated, he became a monk in Reading Abbey. A lord often sent his man in his stead to such combats, and priests and women were ordinarily represented by champions. The wager of battle died out so quietly in England without being legally abolished that in the Court of King's Bench in 1818 it was claimed by a person charged with murder, which led to its formal abolition (Ashford *v.* Thornton in Barnewall and Alderson, 457; see details in H. C. Lea, *Superstition and Force*, ii.). A distinct connexion may, however, be traced between the legal duel and the illegal private duel, which has disappeared from England in our own time, but still flourishes in France and Germany. (E. B. T.)

ORDER, or ORDINATION (Ordo seu sacra ordinatio), one of the seven sacraments of the Roman Catholic Church (see SACRAMENT), is the rite by which the ministers of that church, in their respective ranks as priests, deacons, subdeacons, acolytes, exorcists, lectors, and doorkeepers (ostiarii), receive power and grace for the discharge of their several functions. The nature of these functions is stated in separate articles (see ACOLYTE, &c.). The sacrament of order or ordination cannot be administered except by a bishop. The seven ranks just mentioned are themselves called "orders," the first three being distinguished as the "major" or "holy" orders (ordines majores, sacræ): the others are "minor" (ordines minores). Within the order of the priesthood itself there are various degrees of power and dignity:—(1) that of priest, pure and simple; (2) that of bishop; (3) that of archbishop; (4) that of patriarch (see BISHOP, &c.). For a brief statement of the points of difference as to ecclesiastical orders between the Roman Catholic and the Orthodox Greek Churches, see vol. xi. p. 159. The Church of England expressly recognizes the diaconate and the priesthood, but no others, as distinct orders; bishops and archbishops are "ordained and consecrated." In the 25th Article the name of sacrament is deliberately withheld from orders. Compare the articles CLERGY, EPISCOPACY INDEPENDENTS, MONACHISM, PRESBYTERIANISM.

ORDERICUS VITALIS, the author of a *History* of considerable value in relation to England and Normandy in the 11th and 12th centuries, was born in the year 1075 at Atcham near Shrewsbury. His father, Odeler of Orleans, was one of the followers of Roger Montgomery, a powerful baron who had accompanied William the Conqueror from Normandy, and in whom that monarch reposed especial confidence. Roger had at one time cruelly despoiled the abbey of St Evroul en Ouche, and in his latter years sought to make reparation by bestowing large gifts of benefices and lands on the society. In this manner Odeler also became interested in St Evroul. He was a married priest, and Orderic, the eldest of his three sons, who had at first been sent by him to receive his education at Shrewsbury, was now at the age of ten years dedicated to the monastic life and sent to St Evroul. It was a Benedictine foundation, and at this time perhaps the most celebrated of all the schools in Normandy (*Gallia Christiana*, xi. 814-6). On the 21st of September 1085 the youthful Orderic received the tonsure and was admitted one of the oblates of the monastery. It was the feast of St Maurice, the commander of the legendary Theban legion, and Orderic's name, which seems to have been displeasing to the Norman ear, was now changed into that of Vitalis, one of Maurice's lieutenants. In March 1093 he was ordained a deacon, but was not admitted to priestly orders until 1107. We have it on his own testimony that he was treated with kindness in his new home, and his uneventful life was chiefly passed in a routine of religious observances and of such studies as the Benedictine rule was then interpreted to admit; but from this number, he tells us, pagan history was excluded. The discipline of the society at St Evroul was well maintained, and not a few of its members were worthy representatives of that spirit of devotion to learning by which their order was long so honourably distinguished. Orderic's superiors appear to have soon discerned his aptitude for literary labours, and at the suggestion of two of their number (Roger and Guérin) he first commenced to write the history of the foundation. Among his fellow-monks were men who had taken part in the expeditions of the Normans in Italy and Sicily, in the Crusades, and in the wars waged by William the Conqueror and his sons, and to such associations, as well as to the advantages which a resident at St Evroul would enjoy owing to its being a great centre of intercommunication, we must attribute much of the remarkably varied and minute information with which the *Historia* abounds. Travel, again, appears to have had for Orderic a special charm; and, notwithstanding the difficulties interposed by his monastic vow, he twice revisited his native country, Croyland and Worcester having been his principal places of sojourn. We also find him at Cambrai, and in 1132 at Cluny at a great gathering of its celebrated order. In the year 1141, being, as he tells us, worn out with age and infirmities, he was fain to bring his historical labours to a close, and it is inferred that his death occurred soon after. Although compelled to quit his native country at so early an age, Orderic seems always to have felt himself an exile. In the title of his work he is careful to describe himself as "Angligena," and throughout the narrative he gives special prominence to whatever relates to England.

The *Historia Ecclesiastica* is divided into three parts. Of these the first, in two books, gives an outline of the history of the church from the commencement of the Christian era to the death of Pope Leo IV. in 855, a list of the popes from that date to Innocent II. being appended. The second part—the first in order of composition (see *supra*)—is the *Historia Uticensis*, or history of the monastery of St Evroul from its foundation by Abbot Ebrulf in the year 560 to the narrator's own time; it contains many interesting sketches of the abbots and other members or benefactors of the society. The third part—the only genuinely historical portion of the work—is in seven books, and is devoted to a general account of events in Western Christendom from Carolingian times down to the year 1141. With the year 1084 (after a considerable break in the narrative) the work begins to assume its peculiar value as a storehouse of information with respect to the history and social condition of England and Normandy in the latter part of the 11th and first half of the 12th century. In striking contrast to the ordinary chroniclers of his age, Orderic collected and recorded with scrupulous care numerous facts and incidents which others would have deemed too insignificant for notice. But there is no work relating to the same period, says Guizot, which throws so much light on the political, civil, and religious aspects of society in the West, and the conditions of feudal, monastic, and ordinary life. These merits, however, are in no slight degree obscured by Orderic's singularly involved style and turgid diction, while his absolute disregard of method renders his narrative at times difficult to comprehend and follow.

In addition to the *Historia* there exists in the library at Rouen a manuscript edition of the Norman history of William of Jumièges, which M. Leopold Delisle feels no hesitation in assigning to Orderic (see his *Lettre à M. Jules Lair*, 1873).

The best edition of the *Historia* is that edited by M. Auguste Le Prévost, in five volumes (1838-55). In the concluding volume (pp. i.-cvi.) there is an admirable account and criticism of Orderic by M. Leopold Delisle. The edition in Migne's *Patrologia*, vol. clxxxviii., though a later publication, is a reprint of the less accurate text of Duchesne. A French translation by M. Guizot, in 4 vols., 8vo, was published at Caen in 1821-27; and there is an English version (with Guizot's preface) by Thomas Forester, 4 vols., 1853-56, in Bohn's *Antiquarian Library*.

ORDERS OF KNIGHTHOOD. See KNIGHTHOOD.

ORDINARY is the legal name for a bishop or other person with original ecclesiastical jurisdiction when exercising the functions of his office. He is so called "quia habet ordinariam jurisdictionem in jure proprio et non per deputationem" (Coke upon Littleton, 96 *a*). The word is also used in a non-ecclesiastical sense. By the Divorce Act, 1857, 20 and 21 Vict. c. 85 *sq.*, the judge appointed by that Act had the title of Judge Ordinary. This title has now, however, become obsolete owing to the incorporation of the Divorce Court with the High Court of Justice by the Judicature Act, 1873. In Scotland the judge before whom a cause depends in the Outer House is called the Lord Ordinary in that cause, and the judge who officiates in the Bill Chamber is called the Lord Ordinary on the Bills. In the United States the ordinary possesses, in the States where such an officer exists, powers vested in him by the constitution and acts of the legislature. In South Carolina he is a judicial officer.

ÖREBRO, one of the most important cities in Sweden, the chief town of a province of its own name, lies on both sides of the Svartå about a mile above its entrance into Lake Hjelmar, and 160 miles by rail west of Stockholm. In great part rebuilt since the fire of 1854, it has quite a modern appearance. Besides the principal church, dating from the close of the 14th or beginning of the 15th century, but modernized in the 19th, the more conspicuous buildings are the castle, on an island in the middle of the stream, the new Gothic town-house, the theatre, and the hospital. In front of the town-house stands a statue by Qvarnström, erected in 1865, representing Engelbrecht, the nobleman who was elected administrator of the kingdom in 435; and in front of the principal hotel is an obelisk in honour of the Swedish Reformers Olaus and Laurentius Petri. Örebro has railway connexion with the mining districts round about, and carries on a trade with Stockholm by means of the Hjelmar Canal. The population was 2147 in 1749, 4227 in 1840, 9056 in 1865, and 11,785 in 1880.

Örebro was in existence in the 11th century. Its castle, erected by Birger Jarl in the 13th century, plays an important part in the early annals of Sweden; and no fewer than twenty diets or important assemblies have been held either in castle or town. It is sufficient to mention the Örebro concilium of 1537, the diet of 1540 in which the crown was declared hereditary, and that of 1810 when Bernadotte was elected crown prince.

OREGON, one of the Pacific States of the American Union, is bounded N. by Washington Territory, E. by Idaho Territory, S. by Nevada and California, and W. by the Pacific, and lies between 42° and 46° 15′ N. lat. and 116° 45′ and 124° 30′ W. long. It has an area of 94,560 square miles, besides 1470 square miles of water-surface; its average width from east to west is 345 miles, and from north to south 276 miles.

The State is divided by the Coast, Cascade, and Blue Mountains into well-marked sections. The Cascade range extends in an almost due north and south direction, parallel with the Pacific coast, and a little over 100 miles from it, entirely across the State, and thence northerly through Washington Territory into British Columbia; still farther north it forms the undefined boundary between the latter province and Alaska. In Oregon the range is heavily timbered, chiefly with coniferous evergreens, the principal trees being yellow, sugar, and scrub pine, yellow and white fir, several varieties of spruce, red and white cedar, yew, juniper, tamarack, and cypress; there is also a considerable quantity of maple, ash, and alder, and some oak in the western foot-hills to the south. Its most striking feature is the number of beautiful cone-shaped peaks, rising above the line of perpetual snow. Several quite low passes exist, which, however, are very little used. Commencing at the southern boundary of Oregon, the first of these peaks is Mount Pitt (9818 feet), flanked on all sides by outlying spurs and foot-hill ranges. Forty miles to the north stands Mount Scott (9016 feet), the eastern slope of which, covered with ashes and light débris, is comparatively easy of ascent; on the west the bluffs are almost perpendicular walls of igneous rock, sheltering great masses of snow. Mount Scott overlooks Mystic or Crater Lake, an elliptically-shaped basin of water about 5 miles long by 3 miles broad, entirely surrounded by unbroken cliff-walls ranging from 500 to 2000 feet; this occupies the crater of a gigantic old volcano of which Mount Scott is a portion of the eastern rim, all the rest having been carried away by erosion and other causes. Forty miles farther north is Diamond Peak (8807 feet high), which also gives evidence of being the south-eastern portion of an old crater rim. The portion of the mountain-chain from Mount Scott to Diamond Peak was a region of numerous volcanoes and of very extensive local lava-flows. It has a very high average elevation, and in it all the principal rivers of western Oregon have their sources: the Willamette, running to the north-west; the Des Chutes, running to the north-east; the head-water streams of Klamath river, flowing to the south, and breaking through the range to the west; the Rogue river, flowing to the south-west; and the Umpqua to the west and north. The Three Sisters (in reality five) are the next marked peaks (about 9000 feet); they seem to be portions of an old crater rim, 12 miles in diameter, now broken and worn away. Mount Jefferson (about 10,200 feet) comes next, and then Mount Hood, the highest of all (11,225 feet). To the north of this the Columbia breaks through the range, having cut for itself a cañon, 4000 feet in depth, through the overlying lava and far into the previously-formed conglomerate on which it rests.

Eastern Oregon is in its southern part a vast volcanic plateau, rocky and sterile, lacking water, and possessing few natural attractions. The great interior basin, without outlet to the ocean, extends far up into the State. In this region are a few lakes, generally alkaline and marshy sinks, fed by little streams which have their origin in the small neighbouring mountain masses. The principal vegetation consists of several varieties of sage brush, dwarf pine, and juniper, the last furnishing the winter food of immense numbers of deer, which, during the summer, range through the highlands and glens of the Cascades. Many small peaks and ranges rise from the plateau, all probably of volcanic origin, and some of them made up almost exclusively of blocks and masses of obsidian. From near its junction with the Boisée to the northern line of the State the Snake river forms the eastern boundary of Oregon, and nowhere in the world is there to be found a more perfect and impassable barrier than is formed by this river and its tremendous cañon, of which the walls (consisting of basaltic and kindred rocks) are from 2000 to 5000 feet in height, and so steep and precipitous that the most skilful mountaineer can scarcely find a place to ascend or descend them. In several cases the columnar black basalt takes wonderful shapes and produces most fantastic effects. The Snake in this part of its course is not navigable, and can never be made so. The northern portion of eastern Oregon is far superior in all its physical characteristics to the southern. Confused masses, known as the Blue and Powder River Mountains, lie in the north-east, modifying the climate for the better, and giving many rich valleys and table-lands to the agriculturist. The Grande Ronde, Umatilla, John Day, Burnt, and Powder rivers are the principal streams, and their main and tributary valleys are very lovely. The mountains are covered with pine of a very fair quality, with fir, cedar, and some maple, all of which is being rapidly cleared away. In the valleys cottonwood, willow, birch, aspen, and poplar grow freely. The hills are well stocked with the larger game, as bear, deer, mountain sheep, grey wolves, panthers, foxes, &c., the valleys and lakes with feathered game in considerable variety, and the streams with trout and salmon. Many mines of gold and silver have been found in the Blue and Powder River Mountains, but none of remarkable richness. Nearly all the untimbered plains and valleys of north-eastern Oregon are covered with a rich growth of the hardy and nutritious "bunch grass." The soil is very deep, and, coming, as it does, from the disintegration of volcanic rocks, is very fertile. The Des Chutes river drains most of the eastern slope of the Cascades, flowing in a wild turbulent stream through a deeply-cut cañon. The river is so swift, crooked, and with such rugged banks and so many jagged rocks that it is deemed impracticable even for the lumberman's use in floating logs to the Columbia.

The warm oceanic current from Japan, flowing south along the coast, is the cause of the mild climate of western Oregon, and of the heavy and incessant rains with which it is visited. These rains, continued through the centuries, have chiselled away the mountains, and, with other geological agencies, produced the three principal valleys into which this portion of the State may be considered as divided,—the Willamette, Umpqua, and Rogue river valleys. The Willamette valley has an area of about 8000 square miles, and contains more than half the population and wealth of the entire State. Its lower portions are level loamy plains, covered with rank grass, and here and there great areas of lowland timber, such as alder, maple, ash, cottonwood, poplar, &c., and a vast profusion of

shrubbery. All about these lower plains are well-marked terraces, composing the higher levels, and from these, east, west, and south to the encircling mountains, are spread away the rolling fertile uplands, gradually merging into the dense fir and pine forests which crown the higher summits. Many things attest the former presence of an arm of the sea extending from Puget Sound to the southern end of the valley. Many basaltic ridges yet remain, but this rock has been largely washed away. Western Oregon is well supplied with the ordinary building stones, as granite, syenite, and sandstone. Marble and limestone are found in the extreme south-west, and a valuable cement stone in the valley of the Umpqua. The Umpqua is a rapid mountain stream, and its valley is narrow but extremely fertile. This and Rogue river break through the Coast range in cañons, deep, rugged, and heavily timbered. The valley of Rogue river is beautiful, with a delightful climate, but it has always been very difficult of access, and has only now been reached for the first time from the north by the railroad. Much gold has been taken from the placer mines of the valley, and the sands and gravels of nearly all the tributary valleys carry the precious metal. The country lying between the Coast range and the ocean is narrow and very rugged, with some small cultivable valleys very difficult of access. There are no good harbours on the coast, but the Government is making efforts to improve Coos and Yaquina bays and Port Orford.

The Columbia river enters the Pacific Ocean near the 46th degree of north latitude; it drains by means of its tributaries the western slope of the Rocky Mountains, from about the 42d to the 53d parallel, a distance of 900 miles. The area of its drainage-basin is nearly 245,000 square miles. The route of communication by the Columbia has been of the greatest importance in the early development of Oregon, and its value increases daily. The head of navigation for sea-going ships is at Portland, about 100 miles up the Columbia and 12 miles up the Willamette. From this point up to the Cascades, river craft go freely with plenty of water at all seasons of the year, with, generally, the exception of a short time each winter when the river is frozen. The cascades of the Columbia are due north from Mount Hood, just on the central line of the range where it is cut through by the river. The obstruction to navigation here is complete; but the Government has for several years been engaged in the construction of a canal which will make navigation continuous 45 miles farther, up to the Dalles, at the eastern base of the Cascades. Here there is another total obstruction, the river flowing swiftly through intricate channels, which seem to have been originally great cracks in a field of lava; surveys have been made, however, and plans prepared for improvements. Above the Dalles the Columbia is navigable for 190 miles and the Snake for 180. The Northern Pacific Railroad passes down on the Oregon side, through the cañon of the Columbia. The Columbia is noted for its beautiful scenery, for the great quantity of salmon taken from its waters, and for the dreaded bar at its mouth. The dangers from this bar have been greatly lessened of late years by improved pilotage and more accurate knowledge of the phenomena; and further ameliorations by the general Government are in contemplation.

The south-west warm winds from the Pacific distribute vapours over western Oregon abundantly in autumn, winter, and spring in dews, fogs, rains, and occasional snows, and over eastern Oregon in less amounts. The north-west summer winds are cool. The average temperature in western Oregon is—in spring 52°, in summer 67°, in autumn 53°, and in winter 39° Fahr. The thermometer seldom rises above 90° in the hottest days of the summer, and rarely falls below 20° in the winter. In the thirteen years 1849-51 and 1858-68, two-thirds of the days were pleasant, and only one-third were either showery or rainy or snowy in the north-west part of the State. In the Willamette valley the average yearly rainfall is 44 to 54 inches, which is about the same as at Philadelphia and at Davenport (Iowa). In the Umpqua and Rogue river valleys it is somewhat less. Thunder-storms seldom occur in the State, and cyclones and tornadoes are unknown.

Geology.—The geological history of the Cascade and Coast ranges of Oregon is very interesting. For an immense period before these ranges existed the primeval ocean washed the western shores of the great Rocky Mountain chain, and throughout the Palæozoic era and the whole Triassic and Jurassic periods of the Mesozoic era numerous rivers kept bringing down débris until an enormously thick mass of off-shore deposits had accumulated. This marginal sea-bottom became the scene of intense aqueo-igneous action in its deeply-buried strata, producing a line of weakness, which, yielding to the horizontal thrust produced by the secular contraction of the interior of the earth, was crushed together and swollen up into the Sierra Nevada and Cascade Mountains at the end of the Jurassic period. The range thus produced, as far as can be ascertained, was not of very great height, though probably higher to the south than to the north. It existed for unknown centuries, and in its turn was the theatre of erosion and plant-growth, and was roamed over by the now extinct fauna of the Cretaceous and Tertiary periods. It was not yet covered by the great lava-flow and mountain range of the modern Cascades, but by forests of conifers and oaks. Beneath the overlying lava, where the Columbia breaks through the range, there is found along the water's edge, and for about 15 feet upwards, a very coarse conglomerate of rounded porphyritic pebbles and boulders of all sizes up to 6 feet in diameter, held together by an imperfectly-lithified earthy paste. Above this conglomerate is a very distinct irregular old ground-surface bed, in which are found silicified stumps with roots extending over a diameter of 20 feet and penetrating into the boulder material beneath, evidently *in situ*. Resting directly on this forest ground-surface, and therefore enclosing the erect stumps, is a layer of stratified sandstone, 2 or 3 feet thick, filled with beautiful and perfect impressions of leaves of several kinds of forest trees, possibly of the very trees about whose silicified bases they are found; this layer is not continuous, like the ground-surface on which it rests. Above this leaf-bearing stratum rests a coarse conglomerate similar to that beneath at the water-level. Scattered about in the lower part of this upper conglomerate and in the stratified sandstone, and sometimes lying in the dirt-bed beneath it, fragments of silicified drift-wood are found. Above this last conglomerate, and resting upon it, rise the layers of lava, mostly columnar basalt, one above another, to a height of more than 3000 feet. The following order of events has been deduced from these facts by Professor Le Conte, their first observer.

The region of the Columbia river was a forest, probably a valley, overgrown by conifers and oaks. The subsoil was a coarse boulder drift produced by erosion of some older rocks. An excess of water came on, either by floods or changes of level, and the trees were killed, their leaves shed and buried in mud, and their trunks rotted to stumps. Then came on a tumultuous and rapid deposit of coarse drift, containing drift-wood, which covered up the forest ground and the still remaining stumps, to a depth of one, perhaps several, hundred feet. The surface thus formed was eroded into hills and dales, and then followed the outburst of lava in successive flows, and the silicification of the wood and cementation of the drift by the percolation of the hot alkaline waters containing silica. Finally followed the process of erosion by which the present stream, channels, and valleys, whether main or tributary, have been cut to their enormous depths. The great masses of sediment sent down to the sea by the erosion of the primary Cascade range, forming a thick off-shore deposit, gave rise in turn at the end of the Miocene to the upheaval of the Coast range, the Cascade Mountains being at the same time rent along the axis into enormous fissures, from which outpoured the grand lava-floods, building the mountains higher, and covering the country for great distances. This is probably the grandest lava-flow known to geology, covering as it does an area of about 200,000 square miles. Commencing in middle California as separate streams, in northern California it becomes a flood, completely mantling the smaller and flowing around the greater inequalities. In northern Oregon and Washington it becomes an absolutely universal flood, beneath which the whole original face of the country, with its hills and dales, mountains and valleys, lies buried several thousand feet. It covers the greater portion of northern California and north-western Nevada, nearly the whole of Oregon, Washington, and Idaho, and runs far into British Columbia on the north. The average thickness is probably not far from 2000 feet, and the greatest (shown where the Columbia, Des Chutes, Snake, Salmon, and other rivers cut through it) about 4000 feet. To produce this many successive flows took place, and a very long period of time must have elapsed during which the volcanic actions were going on. During the period of these Cascade eruptions the Coast range was being slowly elevated, and became in its turn the scene of local volcanic action, which was, however, not very severe. At last the great fissure eruptions in the Cascades drew to a close by the fissures becoming blocked up; the volcanic action was concentrated in a few localities, and the period of crater-eruptions followed. These eruptions continued for a long time, almost to our own day, and to them the upbuilding of the snow-clad peaks is due. By the formation of the Cascade range there came into existence a grand interior basin, the waters of which collected into secondary reservoirs, some of very large extent, and were carried off by the rivers which have cut their way from the interior to the sea. The Columbia and its tributaries drained the northern part of this immense basin, and it was at this period, doubtless, that the Great Salt Lake of Utah assumed its once colossal proportions and found its outlet to the sea by the Snake and Columbia rivers. Then came the lava-floods, since denuded in places, exposing the Tertiary and Cretaceous beds, and furnishing evidence of the former condition of the region by the fossils found therein. At the end of the Miocene the Coast range was upheaved, and the lava-flows from the Cascade fissures commenced, but it was long before these reached the entire extent of the basins of Oregon, which continued to exist and to be endowed with life well into the Pliocene. The principal fossil beds of the State are those of the John Day, Des Chutes, and Grande Ronde countries, and near Christmas Lake in southern Oregon. The Glacial, Champlain, and Terrace epochs are very well illustrated in several places, and have left marked evidences of their existence.

Fauna and Flora.—Since the occupation of the State by civilized men the grizzly, black, and cinnamon bears, grey wolf, coyote, panther, catamount, wild cat and polecat, deer, antelope, elk, and mountain sheep have slowly retreated from the settlements to the recesses of the hills. Fur-bearing animals have increased since the Hudson's Bay Company withdrew from the country. Silver foxes, martens, hares, rabbits, squirrels, raccoons, porcupines, beaver, otter, musk-rats, and seals are found in greater or less abundance within the State. Salmon, sturgeon, trout, holibut, smelt, and other fish in countless numbers exist in the Columbia and its branches and in the bays and coast rivers, and oysters, shrimps, crabs, and clams along the shores. Eagles, hawks, cormorants, pelicans, gulls, cranes, albatross, vultures, buzzards, ravens, crows, jays, robins, swallows, sparrows, rice-birds, yellow-birds, humming-birds, swans, geese, ducks, pigeons, and many other varieties of birds are found. Reptiles and insects are numerous.

The trees of Oregon include—*Rhamnus Purshiana* (bearberry), *Acer circinatum* (vine maple), *A. macrophyllum* (large-leaved maple), *Prunus* (*Cerasus*) *emarginata*, var. *mollis* (wild cherry), *P.* (*C.*) *demissa* (choke-cherry), *Nuttallia cerasiformis* (seam-berry, or squaw-berry), *Cercocarpus ledifolius* (mountain mahogany), *Pyrus rivularis* (Oregon crab-apple), *P. sambucifolia* (mountain ash), *Crataegus Douglasii* (black haw), *C. rivularis*, *Amelanchier canadensis* (service-berry), *Cornus Nuttallii* (dog-wood), *Sambucus glauca* (elder), *Arbutus Menziesii* (laurel, madroño), *Arctostaphylos pungens* (manzanita), *Fraxinus oregana* (Oregon ash), *Umbellularia* (*Oreodaphne*) *californica* (myrtle), *Myrica californica*, *Quercus chrysolepis* (live oak), *Q. densiflora*, *Q. Garryana* (white oak), *Q. Kelloggii* (black oak), *Castanopsis chrysophylla* (chinquapin), *Betula occidentalis* (birch), *Alnus rhombifolia* (alder), *Salix lasiandra* (willow), *Populus tremuloides* (quaking asp), *P. trichocarpa*, *Taxus brevifolia* (yew), *Juniperus occidentalis* (juniper), *Cupressus* (*Chamaecyparis*) *Lawsoniana* (Port Orford cedar), *C.* (*Chamaecyparis*) *Nutkaensis* (Sitka cedar), *Thuya gigantea*, *Libocedrus decurrens* (thick-barked cedar), *Sequoia sempervirens* (redwood), *Abies concolor*, *A. grandis* (white fir), *A. nobilis*, *A. amabilis*, *A. subalpina*, *A.* (*Pseudotsuga*) *Douglasii*, *A.* (*Tsuga*) *Mertensiana* (hemlock), *A.* (*Tsuga*) *Pattoniana* (mountain hemlock), *A.* (*Picea*) *Engelmanni*, *A.* (*P.*) *Sitchensis*, *Larix Lyallii* (larch), *L. occidentalis* (larch, or tamarack), *Pinus contorta* (black pine, or jack pine), *P. albicaulis*, *P. Lambertiana* (sugar pine), *P. monticola* (silver pine), *P. ponderosa*, *P. tuberculata*.[1]

Agriculture, Manufactures, Commerce.—Wheat is the chief crop for home use and for export. All the smaller cereals are grown and produce largely. Flax is indigenous in southern and eastern Oregon; it is cultivated both for seed and for lint. Maize gives a fair harvest, though the nights are too cool for the best results. Vegetables of all kinds common to the temperate zone flourish, and orchard and garden fruits are sure. One species of clover is indigenous, but all varieties grow and spread rapidly over fields, pastures, and burnt forest lands.

Subjoined are the agricultural statistics for the years specified.

	1850.	1860.	1870.	1880.
Farm Produce.				
Wheat, bushels	211,943	826,776	2,340,746	7,480,010
Oats, „	61,214	885,073	2,029,909	4,385,650
Barley, „	....	36,254	210,736	880,977
Indian corn, „	2,918	76,122	72,138	136,803
Rye, „	106	2,704	3,890	12,305
Buckwheat, „	....	2,749	1,645	6,215
Potatoes, „	91,326	308,319	481,710	1,859,930
Hay, tons	373	27,986	75,357	266,187
Hops, pounds	8	493	9,745	244,371
Tobacco. „	325	405	3,847	17,325
Live Stock and their Products				
Value of live stock	$1,876,189	$5,946,263	$6,828,675	$12,808,302
Number of horses	8,046	36,772	51,702	124,107
„ mules and asses	420	960	2,581	2,894
„ working oxen	8,114	7,469	2,441	4,132
„ milch cows	9,427	53,170	48,325	89,549
„ other cattle	24,188	93,492	69,431	352,561
„ sheep	15,382	86,052	318,123	1,083,162
„ swine	30,235	61,615	119,455	166,222
Pounds of butter	211,464	1,000,157	1,418,373	2,443,725
„ cheese	36,980	105,397	79,333	158,196
„ wool	29,686	219,012	1,080,638	5,718,824
Farm Lands and Machinery.				
Number of farms	1,164	5,806	7,587	16,217
Acres in „	432,808	2,060,539	2,389,252	4,214,712
Ratio of improved land in farms to total farm area	30·7	43·5	46·7	52·2
Value of farms	$2,849,170	$15,200,593	$22,352,989	$56,908,575
„ implements and machinery	$183,423	$952,313	$1,293,717	$2,956,173

The statistics of manufactures are as follows:—

Manufactures.	1850.	1860.	1870.	1880.
Establishments	52	309	969	1,080
Capital	$843,600	$1,337,238	$4,376,849	$6,312,056
Hands employed (average)	285	978	2,884	3,473
Wages	$388,620	$635,256	$1,120,173	$1,677,046
Value of materials	$809,560	$1,431,952	$3,419,756	$6,954,436
„ products	$2,236,640	$2,976,761	$6,877,387	$10,931,232

The principal industries ranked as follows in 1880:—

Selected Industries.	Establishments.	Capital.	Value of Material.	Value of Product.
Flouring and grist mill products	106	$1,286,200	$2,978,714	$3,475,531
Lumber, sash, doors, and blinds	248	1,808,275	1,475,822	2,294,155
Woollen goods	10	566,800	227,486	349,030
Foundry and machine-shop products	16	260,500	121,211	252,300
Tin-ware, copper-ware, and sheet-iron ware	46	233,150	151,475	311,650
Other industries	654	2,157,131	1,999,528	3,988,566
Total of all industries	1080	$6,312,056	$6,954,436	$10,931,232

Oregon has three ports of entry—Astoria on the Columbia, Portland on the Willamette, and Coos Bay on the southern coast. The exports to foreign ports for the twelve months ending 31st July 1882 were $9,970,410; exports to domestic ports, $5,899,738; total exports, $15,870,148; wheat, $6,677,418; flour, $2,858,792; salmon, $2,484,761; wool, $1,488,360; oats, $417,640; lumber, $228,392. The salmon-canning business began in 1866 with a product of 4000 cases, valued at $64,000; the average annual value for the six years 1878-83 exceeded $2,000,000. Between Astoria and the cascades of the Columbia river there are about forty canneries. Over 1500 boats are employed in the fishery.

Railroads and Steamers.—In 1866 there were in Oregon 19 miles of railway open; in 1875, 248; in 1880, 582; on 1st March 1884, 900 miles. Steamers ply twice a week between Portland and San Francisco (670 miles), and at frequent intervals on the Columbia river for 725 miles, on the Willamette 138 miles, and on the Snake river 180 miles.

Government and Finance.—The statutes of Iowa and New York were the models of the provisional government of Oregon, and legislation has continued generally on these lines. The courts consist of a supreme court, with appellate jurisdiction, situated in Salem, the capital, and five circuit or district courts, with county courts and justices' courts in every precinct of city and county. Cities have police courts also. There is a United States district court for Oregon, and a United States circuit court for Oregon with California and Nevada. The State debt in 1880 was $511,376, and local, county, city, and school debt was $377,126. The gross value of all property, as compiled from records in the office of the secretary of state in 1882, was $85,531,716; indebtedness, $22,300,912; exemption, $4,973,058; taxable property, $59,257,746; State tax, $325,917·38; wealth per head, $493·90.

Education.—In 1848 Congress granted to Oregon one-eighteenth of all the public domain for free schools. This area (3,387,520 acres) was received by the State on its admission to the Union for the education of all its youth of both sexes. Congress also granted about twenty-six townships (500,000 acres) for a State university, and 90,000 acres for an agricultural college. A portion of these lands has been sold, and the proceeds have been made an irreducible fund for the objects named. The free-school system has been established in every county and almost every settlement. In Portland and other cities grades have been established from "primary" to "high school." The State university is established at Eugene City, and an agricultural college at Corvallis. This public-school system is supplemented by many corporate academies, seminaries, and colleges, and by parochial and private schools representing different denominations. A school for mutes and one for the blind have been established at Salem by the legislature. Ten institutions report as endowments $290,132, yielding an annual income of $16,050, and thirteen report $35,166 from tuition, and a total annual income of $61,070. The number of children of school age (four to twenty years) is 65,216; enrolled in public schools 37,748, in private schools 5101. Public school expenses for the year ending 1st March 1882 amounted to $338,386; the public schoolhouses numbered 1061, of the value of $684,298. The United States Indian Industrial Training School at Forest Grove, which numbers 146 pupils, taken from schools on the reservation, has become a marked success. Of 119,482 white persons over ten years of age in 1880 only 3·6 per cent. were unable to write.

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[1] See *List of the Trees of Oregon*, published by Prof. G. H. Collier.

Charitable and Penal Institutions.—A State asylum for the insane at Salem has over 300 inmates. The State penitentiary is at Salem; the convicts are employed under contractors in various industries, subject to constant watch of officials.

Religion.—The statistics of 1875 report 351 religious organizations of all denominations, with 242 church edifices, 320 clergymen, 14,324 communicants, and 71,630 adherents. The estimated value of church property was $654,000. The rank of the several denominations in respect to numbers is approximately as follows: Methodists, Baptists, Roman Catholics, Presbyterians, Episcopalians, Congregationalists, and five minor sects. The increase in seven years by immigration and other gains has been at least 35 per cent.

The Press.—Oregon has 74 newspapers—72 in English and 2 in German. A weekly newspaper is published in every shire town, and in many of the larger villages. Four daily papers are issued in Portland.

Cities and Chief Towns.—PORTLAND (*q.v.*), on the Willamette, 115 miles from the ocean, is the chief city of the Pacific coast north of San Francisco (population in 1880, 17,577); Astoria is a commercial city of 3000 inhabitants, with large salmon-canning establishments, which do an annual business of over $2,000,000; Oregon City, at the falls of the Willamette, is a flourishing manufacturing town; Salem (the capital), Albany, Corvallis, Eugene City, Roseburg, The Dalles, Pendleton, Union, and Baker City are places of rapidly-growing importance.

Population.—The following statistics show the growth of the State during the last three decades:—

Census.	Males.	Females.	Total.	Density per square mile.
1850	8,278	5,016	13,294	0·1
1860	31,646	20,819	52,465	0·6
1870	53,131	37,792	90,923	0·9
1880	103,381	71,387	174,768	1·8

Of the total population in 1880 17½ per cent. (30,503) were of foreign birth, 9472 being Chinese, 5034 Germans, 1557 Scandinavians, 7918 British, and 3019 British Americans.

History.—Oregon at first included all the United States territory between the Pacific Ocean and the Rocky Mountains north of the 42d parallel, and thus had a total area of over 300,000 square miles. The Greek pilot De Fuca, in the service of Spain, in 1592, Admiral Fonte in 1640, and others had visited and mapped the coast as far as the 55th parallel. In 1792 Captain Robert Gray of Boston, in the ship "Columbia," discovered and ascended the river as far as Gray's Bay, and named the river after his vessel. Oregon was afterwards held by the United States Government to have been included in the sale of "Louisiana" by France in 1803. In 1804-5 Lewis and Clark explored the Columbia to its mouth and reported the great resources of the country. In 1810 Captain Winship, a New Englander, built the first house in Oregon, on the Columbia; and in 1811 John Jacob Astor of New York established a fur-trading post 15 miles from the ocean at Astoria on that river. In 1813, during the war, his agent sold it to the North-Western Fur Company, who called it Fort George. Though restored to the United States after the war, it was held by the company, and in 1821 it passed, with their other possessions, into the hands of the Hudson's Bay Company. The British laid claim to Oregon by virtue of Drake's discovery of the coast in 48° N. lat. in 1558, of Cook's visit to De Fuca Strait in search of a north-west passage in 1778, and of the survey of the coast from 30° to 60° N. lat., by order of the British Admiralty, made by Vancouver (who was with Cook in 1778), to find a north-west passage, and his discovery and ascent of the Columbia to the site of the present city of Vancouver in 1792. A treaty of "joint occupation" was made in 1818 between the United States and Great Britain which left these conflicting claims for future settlement and only served to prolong and increase the disagreement. The British finally offered to compromise on the Columbia. In 1824 some employees of the Hudson's Bay Company set out a few fruit trees and cultivated a garden at Fort George (Astoria). In 1832 Captain Nathaniel Wyeth of Wenham, Massachusetts, established a fishery on Savrie's Island. In 1834 the Revs. Jason and Daniel Lee and others came to Oregon on Captain Wyeth's second trip, to establish a mission of the Methodist Episcopal Church, east of the Cascade Mountains, but they were persuaded by the superintendent of the Hudson's Bay Company to settle in the Willamette valley. They soon collected some dozens of Indian children near the present site of Salem, and established the "Oregon Manual Labour School." Others came, until, in 1840, their mission families numbered fifty-two adults and twenty children. Their mission closed in 1847, and the families became settlers. In 1835 Rev. Samuel Parker and Dr Marcus Whitman were commissioned to explore and plant a mission in Oregon. Under convoy of the yearly expedition of the American Fur Company, Dr and Mrs Whitman, Rev. H. H. Spalding and Mrs Spalding, and Mr W. H. Gray "crossed the plains" in 1836, travelling 2300 miles from the Missouri line, and began a mission among the Indians of eastern Oregon. These two ladies were the first white women who crossed the Rocky Mountains. The missionaries formed the nuclei of settlements; trappers, adventurers, and western pioneers followed; cattle were secured from California, and in 1842 steps were taken for a government, by a choice of officers. The whites numbered only about 240. Western pioneers having been told that waggons could not be taken to the Columbia, and induced to exchange them at Fort Hall for horses, Dr Whitman, to remove the bar thus put up against immigration, recrossed the plains in the winter of 1842-43. He published his plan to help emigrants through to Oregon with their families and waggons, hastened to Washington to arouse Government officials to retain their hold of Oregon and care for it, and then returned, overtaking nearly 1000 emigrants at the North Platte river. A provisional government was organized that year by the people. More immigrants followed. In 1846 a treaty was concluded between Great Britain and the United States fixing the boundary at 49° N. lat. In 1848 Congress established a Territorial government, and the governor, General Joseph Lane, arrived in March 1849. United States courts were then established. On 28th November 1847, Dr and Mrs Whitman, along with twelve others, were murdered by the Indians. War followed, and again broke out in 1855. Other wars against the Indians occurred in 1877 and 1878, but the tribes have mostly been placed upon reservations, under educational and industrial training. They have become peaceable and partially self-supporting, though paid in annuities for their lands. The Territory was admitted into the Union as a State on 14th February 1859. (T. W. S.—G. H. A.)

OREL, or **ORLOFF**, a government of central Russia, bounded by Smolensk, Kaluga, and Tula on the N., and by Voronezh, Kursk, and Tchernigoff on the S., with an area of 18,040 square miles. The surface is an undulating plateau gently sloping towards the west; the highest hills do not reach 900 feet, and none of the valleys are less than 450 feet above the sea. Geologically Orel consists principally of Lower Devonian limestones, marls, and sandstones, covered with Jurassic clays, the last appearing at the surface, however, only as isolated islands, or in the valleys, being concealed for the most part under thick beds of cretaceous chalk, marls, and sands. The Carboniferous limestones and clays (of the so-called Moscow basin) appear in the north-west only at a great depth. The Jurassic clays and marls are covered at several places with a stratum of clay containing good iron-ore, while the Devonian sandstones and limestones are worked for building purposes. The whole is buried under a bed, from 30 to 40 feet thick, of boulder-clay and loess, the last covering extensive areas besides the valleys. The soil—a mixture of "black earth" with clay—is fertile, except in the Desna region, which is covered with sands and tough clays. The principal rivers are the Don, which forms the eastern boundary of the government and has many tributaries, the chief being the Sosna; the Oka, which rises in the district of Orel and receives the navigable Zusha and many smaller streams; and the Desna, with the Bolva, draining the marshy lowlands in the west. On the Oka, Zusha, Desna, and Bolva there is a brisk traffic in corn, oil, hemp, timber, metal, glass, china, paper, and building-stone. Marshes occupy large areas in the basin of the Desna, as also in several parts of that of the Oka; they are mostly covered with forests, which occupy from 50 to 65 per cent. of the districts of Bryansk, Trubtchevsk, and Karatcheff, while towards the east, in the basin of the Don, wood is so scarce that straw is used for fuel. The climate is moderate, the average yearly temperature at Orel being 41°·2 (14°·8 in January and 67°·0 in July).

The population, 1,596,900 in 1870, and 1,877,100 in 1881, consists almost exclusively of Great Russians belonging to the Greek Church; the Nonconformists are reckoned at about 12,000, the Catholics at 3000, and the Jews at 1000. The chief occupation is agriculture, which is most productive in the east and towards the centre of the government. In 1877 59 per cent. of the province was under crops, the estimated yield being 7,196 000 quarters of corn and 1,212,000 quarters of potatoes. Of the grain not used in the distilleries a large proportion is exported to the Baltic. Hemp and hemp-seed oil are extensively exported from the west to Riga, Libau, and St Petersburg. Tobacco is also cultivated with profit. Cattle-breeding and horse-breeding, though somewhat depressed within the last twenty years, are still in a better condition than in neighbouring governments,—the Orel breeds, both of carriage and of cart horses, being held in estimation throughout Russia. In 1881 there were 500,000 horses, 340,000 cattle, and 790,000 sheep. Bee-culture is widely diffused in the forest districts, as are also the timber-trade and the preparation of tar and pitch. Manufactures are rapidly increasing; in 1879 there were 540 larger industrial establishments, employing 14,130 hands, and producing cast-iron rails, machinery, locomotive engines and railway waggons, glass, hemp-yarn and ropes, leather, timber, soap, tobacco, chemical produce, &c. There are also distilleries and a great many smaller oil-works and flour-mills. Karatcheff and Syevsk are important centres for hemp-carding; Bolkhoff and Elets are the chief centres of the tanning industry; while the districts of Elets, Dmitroff, and partly Mtsensk supply flour and various food-pastes. At Bryansk a Government cannon-foundry employs 700 hands. The so-called "Maltsoff's works" in the district of Bryansk are worthy of mention as an industrial colony comprising several iron, machinery, glass, and rope works, where thousands of peasants find temporary or permanent employment; they have their own technical school, employ engineers of their own training, and have their own narrow-gauge railways and telegraphs, both managed by boys of the technical school. Numerous petty trades are carried on by peasants, along with agriculture. The fairs held in many villages are animated, and have some importance for the cattle trade. Orel is divided into twelve districts, the chief towns of which are Orel (76,700 inhabitants), Bolkhoff (29,020), Bryansk (12,660), Dmitrovsk (6360), Elets (41,450), Karatcheff (11,200), Kromy (3050), Livny (21,170), Maloarkhanghelsk (3920), Mtsensk (14,200), Syevsk (9650), and Trubtchevsk (5170).

In the 9th century the country was inhabited by the Syeveryanes on the Desna and the Vyatichees on the Oka, who both paid tribute to the Khazars. The Syeveryanes recognized the rule of the princes of the Rurik family from 884, and the Vyatichees from the middle of the 10th century; but the two peoples followed different historical lines, the former entering into the Suzdal principality, while the latter fell under the rule of that of Tchernigoff. In the 11th century both had wealthy towns and villages; during the Tartar invasion these were all burned and pillaged, and the whole territory, lying as it did on the two chief lines of the Tartar advance, became a desert, where the Nogays encamped with their herds. With the fall of the Great Horde the western part of the country fell under Lithuanian rule and was the subject of repeated struggles between Lithuania and Moscow. In the 16th century the Russians began to erect new forts or to fortify the old towns, and the territory was rapidly colonized by immigrants from the north. In 1610 the towns of the present government of Orel (then known as the Ukrayna or "border-region") had an active share in the insurrection against Moscow under the pseudo-Demetrius, and suffered much from the civil war which ensued. They continued, however, to be united with the rest of Russia, and in the next century formed a basis for further Russian advance towards the south.

Orel, capital of the above government, lies at the confluence of the Oka with the Orlik, on the great line of railway to the Crimea, 238 miles south-south-west from Moscow. It has railway connexion also with Smolensk and the Baltic ports in the west, and with Saratoff, Tsaritsyn, and Novotcherkassk in the south-east. It was founded in 1566, but developed slowly, and had only a very few houses at the beginning of the last century. The cathedral, begun in 1794, was finished only in 1861. The town now possesses a military gymnasium (corps of cadets), a few secondary schools, a public library, and a theatre; large storehouses for grain and timber, a spacious *gostinoy dvor* with numerous shops, and the offices of the municipal bank are perhaps its best buildings. The manufactures are rapidly increasing; in 1879 the hemp-carding, hemp-spinning, and rope-making industries produced 1,020,000 roubles, the flour-mills about 300,000 roubles, and the aggregate from all the manufactures exceeded 2,000,000 roubles. Orel is one of the chief markets of central Russia for the trade in corn and hemp, as also in hemp-seed oil and tallow, which are shipped down the Oka or sent by rail. Metal wares, tobacco, kaolin, and glass ware are also exported, while salt, groceries, and manufactured goods are imported for distribution throughout the villages of the government, or to be sent to the Don Cossacks. The population, 45,000 in 1875, was 76,700 in 1881.

ORENBURG, a government of south-eastern Russia, bounded on the N. by Ufa and Perm, on the S. and E. by the steppe of the Orenburg Kirghiz, and on the W. by Samara, has an area of 73,890 square miles. Situated at the southern extremity of the Urals and extending to the north-east on their eastern slope, Orenburg consists of a hilly tract bordered on both sides by steppes. The central ridge occasionally reaches an elevation of about 5000 feet; there are several parallel ridges, which, however, nowhere exceed 2600 feet, and gradually sink towards the south. A great variety of geological formations are represented within the government. Diorites and granites enter it from the north and appear at many places from under the Silurian and Devonian deposits. The Carboniferous limestones and sandstones, as also softer Permian, Jurassic, and Cretaceous deposits, have a wide extension in the south and east. Magnetic iron, copper, silver, and lead ores, auriferous sands, and salt from the lakes constitute the mineral wealth of Orenburg, along with its very fertile "black earth," which covers wide areas around the Urals. It is traversed from north to south by the Ural river, which also forms its southern boundary; the chief tributaries are the Sakmara and the Ilek. The upper courses of the Byelaya and the Samara, tributaries of the Kama and the Volga, also lie within the government, as well as the affluents of the Tobol on the eastern slope of the Ural range. Numerous salt lakes occur in the district of Tchelabinsk; but several parts of the flat lands occasionally suffer from want of water. Thirteen per cent. of the surface is under wood. The climate is continental and dry, the average temperature at Orenburg being 37°·4 Fahr. (4°·5 in January, 69°·8 in July). Frosts of −38°, and heats of 98° are not uncommon.

The population (900,550 in 1870) numbered 1,120,700 in 1881. The increase is largely due to immigration, an extensive tract of uncultivated land which formerly belonged to the Bashkirs having recently been purchased by the Government officials and leased to immigrants from the interior of Russia. The inhabitants are mainly Great Russians, Bashkirs (26 per cent.), and Kirghiz (about 5 per cent.). The majority belong to the Greek Church, or are Nonconformists; 27 per cent. are Mohammedans. The chief occupations are agriculture and cattle-breeding. Although only 3·2 per cent. of the area is under crops, grain is both distilled and exported. In 1881 there were in the province 581,000 horses, 441,000 cattle, 880,000 sheep, and 65,000 pigs. Notwithstanding the abundance of iron and copper ore, mining is but little developed. The industrial establishments (distilleries, tanneries, flour-mills, &c.) are few, and their aggregate production in 1879 was only 5,195,000 roubles, employing about 2200 workmen. The export trade in corn, skins, and tallow is of some importance, and the fairs at Orenburg, Troitsk, and Tchelabinsk yield large returns. There are five districts, the chief towns of which are Orenburg (35,600 inhabitants), Orsk (14,350), Tchelabinsk or Tchelaba (9000), Troitsk (8300), and Verkhneuralsk (10,350).

The territory of the Orenburg Cossacks, which extends as a narrow strip up the Ural river, occupies the whole of the government east of the Ural mountains, and joins, by a narrow line of posts, the former line of blockhouses of the Siberian Cossacks, has an area of 35,820 square miles, with a population in 1880 of 290,800 Cossacks and 16,460 peasants; 25,000 were Moslem Bashkirs.

Orenburg, capital of the above government, is situated on the right bank of the Ural river, 933 miles by rail south-east from Moscow. The fortress, which has eleven bastions and a circumference of 6300 yards, has lost its importance since the recent advances of Russia towards the south-east, and is falling into decay. The town, on the other hand, is rapidly increasing, and now includes the former suburbs of Golúbinaya and Novaya. The population is 35,600. Orenburg has a military cadet school, two lower military schools, a lyceum, and various primary schools,—one of them for Kirghiz children. The inhabitants are chiefly occupied in agriculture and trade. The manufactures are few, but the trade is steadily increasing; the imports include cotton, silk, furs, wool, cattle, and horses, while cotton and woollen stuffs, cotton yarn, leather, colours, sugar, and grain are exported. Orenburg is connected by rail with Samara on the Volga and with Moscow.

The government of Orenburg was formerly inhabited by the Kirghiz in the south and the Bashkirs in the north. The latter were brought under the rule of Russia in 1557, and the fort of Ufa was erected a few years later in order to protect them against the raids of the Kirghiz. The frequent risings of the Bashkirs and the continuous attacks of the Kirghiz led the Russian Government in the 18th century to erect a line of forts and blockhouses on the Ural and Sakmara rivers, which was afterwards extended south-westwards towards the Caspian, and eastwards towards Omsk. The central point of these military lines was the fort of Orenburg, originally founded at the confluence of the Or with the Ural (now Orsk), and afterwards removed (in 1740) 120 miles lower down the Ural river to its present site. In 1773 it was besieged by Pugatchoff, the leader of the great revolt of the peasantry, supported by the Bashkirs. The government of Orenburg was created in 1774, embracing a wide territory which reached to the Volga, to the Caspian, and to Perm, the limits to the eastward being undefined. In 1865 this was divided into two governments,—Ufa in the north and Orenburg in the south. The steppe of the Kirghiz, which extends south of the Ural river towards the Caspian and the Sea of Aral, continued under the jurisdiction of the governor-general of Orenburg. Recently the steppe of the Orenburg Kirghiz has been incorporated with the newly-created provinces of Turgay and Uralsk; and the territory of the Orenburg Cossacks, formerly independent, has been brought within the government of Orenburg, and subdivided into districts.

ORENSE, an inland province of Spain, is bounded on the N. by Pontevedra and Lugo, on the E. by Leon and Zamora, on the S. by Portugal (Tras oz Montes), and on the W. by Portugal (Entre Douro e Minho) and Pontevedra, and has an area of 2738 square miles. Its general character is mountainous, and its products are those common to all GALICIA (*q.v.*), of which historical province it formed a part. The principal rivers are the Minho and the Sil. The population in 1877 was 388,835; only one town (Orense) had a population exceeding 10,000.

Orense, capital of the above province, and the see of a bishop, suffragan to Santiago, stands on the western slope of Montealegre, on the left bank of the Minho. The river is here crossed by a bridge—one of the most remarkable in Spain—of seven arches, 1319 feet in length, and at its highest point 135 feet above the bed of the river, built by Bishop Lorenzo in 1230 and repaired about the middle of the 15th century. The principal feature of the town is the Gothic cathedral, also dating from Bishop Lorenzo's time (1230); it is a comparatively small and unimportant building, but has a miraculous image, "El Santo Cristo," of wide celebrity in Spain, which was brought from Cape Finisterre in 1330. The three warm springs to the west of the town, known as Las Burgas, attract a considerable number of summer visitors; the waters are similar to those of Carlsbad. The trade and manufactures of the place are unimportant. Orense—the *Aquæ Originis*, or perhaps *Salientis*, of the Romans—in 1877 had a population, within the ayuntamiento, of 12,586.

ORESTES, son of Agamemnon and Clytæmnestra. According to the legend in Homer, he was absent from Mycenæ when his father returned from the Trojan War, and was murdered by Ægisthus. Eight years later Orestes returned, and revenged his father's death by slaying his mother and her paramour. Pindar mentions that his nurse saved him and conveyed him out of the country when Clytæmnestra wished to kill him. The tale is told much more fully and with many variations in the tragedians. He was preserved by his sister Electra, and conveyed to Phanote on Mount Parnassus, where king Strophius took charge of him. In his twentieth year he was ordered by the oracle to return home and revenge his father's death. According to Æschylus, he met his sister Electra before the tomb of Agamemnon, whither both had gone to perform rites to the dead; a recognition takes place, and they arrange how Orestes shall accomplish his revenge. Orestes, after the deed, goes mad, and is pursued by the Erinnyes, whose duty it is to punish any violation of the ties of family piety. He takes refuge in the temple at Delphi; but, though Apollo had ordered him to do the deed, he is powerless to protect his suppliant from the consequences. At last Athena receives him on the acropolis of Athens and arranges a formal trial of the case before twelve Attic judges. The Erinnyes demand their victim; he pleads the orders of Apollo; the votes of the judges are equally divided, and Athena gives her casting vote for acquittal. The Erinnyes are propitiated by a new ritual, in which they are worshipped as Eumenides (the Kindly), and Orestes dedicates an altar to Athena Areia. Such is the account in which authorities generally agree, but Euripides introduces a different series of adventures after Orestes has taken refuge at Delphi. Apollo orders him to go to Tauris, carry off the statue of Artemis which had fallen from heaven, and bring it to Athens. He repairs to Tauris with Pylades, and the pair are at once imprisoned by the people, among whom the custom is to sacrifice all strangers to Artemis. The priestess of Artemis, whose duty it is to perform the sacrifice, is Iphigeneia, the daughter of Agamemnon, who had been transported hither by the goddess when her father was about to offer her (see IPHIGENEIA). She offers to release Orestes if he will carry home a letter from her to Greece; he refuses to go, but bids Pylades take the letter while he himself will stay and be slain. After a conflict of mutual affection, Pylades at last yields, but the letter brings about a recognition between brother and sister, and all three escape together, carrying with them the image of Artemis.

Orestes appears also as a central figure in the legends of many other places. In Cappadocia he introduced the worship of Artemis Tauropolos at Comana and Castabala. Near Gythium in Laconia was a stone called Zeus Cappotas; here the madness left Orestes. In Trœzen there was before the temple of Artemis a stone on which Orestes was purified, and a hut in front of the temple of Apollo Thearius in which he stayed till the purification was accomplished. Seven stadia from Megalopolis, on the left of the road to Messene, was a shrine of the Maniæ, *i.e.*, the Erinnyes. Immediately beyond it was a tumulus, on the summit of which was an upright stone like a finger, *Δακτύλου Μνῆμα*, where Orestes bit off his own finger in his madness. Beyond the mound was another shrine of the Erinnyes, worshipped now as Eumenides in association with the Charites (see GRACES). Here the Erinnyes, who had hitherto appeared black to Orestes, appeared white to him, and the madness left him. Then he cut off his hair as an offering at a place *Κουρεῖον*. The name of the tumulus is clearly connected with the belief still frequently occurring that a hand appears out of the tomb of any person who has murdered a mother or been murdered by her. The tumulus itself was obviously one of those graves, which were especially common in Lydia, a tumulus with a pillar on the apex; such tumuli were found in Laconia, where, as Athenæus says, they were called "the graves of the Phrygians who came with Pelops."

In these legends it is apparent that Orestes is the guilt-laden mortal who is purified from his sin by the grace of the gods; his purification is a type of the merciful justice which the gods intend should be shown to all persons whose crime is mitigated by extenuating circumstances. These legends belong to an age when higher ideas of law and of social duty were being established; the implacable blood-feud of primitive society gives place to a fair trial of the culprit, and in Athens, when the votes of the judges are evenly divided, mercy prevails. In the religion of Delphi similar ideas underlie the ancient festival Septerion: in it Apollo himself is the murderer, and his example sets forth to mankind the method of purification which heaven opens to such sinners, if they are not entirely and wilfully guilty. Orestes is not a figure of the Apollo religion, but is clearly connected with the cultus of the Erinnyes; and his relation to these goddesses, and the intention of the myth, are very plain in the Megalopolitan legend above mentioned. The Trœzenian legend has no appearance of being really ancient, just as the tales that connect Orestes with the district Orestea in Arcadia, or Orestias in Epirus, are obviously fictions of a later time. On the other hand, the Orestes of Tauric and Cappadocian legend is a different person, connected with the spread of Artemis-worship; it is not improbable that a similarity of name caused the identification of two heroes belonging respectively to the cultus of Artemis and of the Erinnyes.

Orestes had an historic part assigned to him as Greek mythology became systematized. Phocian auxiliaries restored him to the throne of his father, and, according to Hellanicus, he began the Æolic migration to Asia Minor. He was buried on the road from Tegea to Thyrea, and Herodotus (ii. 67) tells a quaint story of the manner in which the Spartans discovered his bones and, in obedience to an oracle, carried them to Sparta.

ORFA. See Edessa, vol. vii. p. 652.

ORFILA, Mathieu Joseph Bonaventure (1787-1853), the founder of modern toxicology, and one of the most eminent of the French school of medicine during its brightest period, was by birth a Spaniard, having been born at Mahon in Minorca on 24th April 1787. An island merchant's son looked naturally first to the sea for a profession; but a voyage at the age of fifteen to Sardinia, Sicily, and Egypt did not prove satisfactory. He next took to medicine, which he studied at the universities of Valencia and Barcelona with so great applause that the local authorities of the latter city granted him a pension to enable him to follow his studies at Madrid and Paris, preparatory to appointing him professor. He had scarcely settled for that purpose in Paris when the outbreak of the Spanish war, in 1807, threatened destruction to his prospects. But he had the good fortune to find a parent in a merchant uncle at Marseilles, and a patron in the good and great Vauquelin the chemist, who braved the wrath of Napoleon against the Spaniards, claimed him as his pupil, guaranteed his conduct, and saved him from expulsion from Paris. Four years afterwards he graduated, and immediately became a private lecturer on chemistry in the French capital. In 1819 he was appointed professor of medical jurisprudence, and four years later he succeeded Vauquelin as professor of chemistry in the faculty of medicine at Paris. In 1830 he was nominated dean of that faculty, a high medical honour in France. Under the Orleans dynasty, honours were lavishly showered upon him: he became successively member of the council of education of France, member of the general council of the department of the Seine, and commander of the Legion of Honour. The republic of 1848 put an end to these adventitious distinctions; and chagrin at the treatment he experienced at the hands of the Governments which succeeded that of Louis Philippe is supposed to have shortened his life. He died, after a short illness, in March 1853.

Orfila's chief publications are four in number:—*On General Toxicology* (1814), *On Medical Jurisprudence* (1823), *A Treatise on Chemistry* (1817), and *Medico-legal Exhumations* (1836); but he also wrote many valuable papers, chiefly on subjects connected with medical jurisprudence. His fame will rest mainly on the first-named (*Traité de Toxicologie Générale*), published when he was only in his twenty-seventh year. It is a vast mine of experimental observation on the symptoms of poisoning of all kinds, on the appearances which poisons leave in the dead body, on their physiological action, and on the means of detecting them. Few branches of science, so important in their bearings on every-day life and so difficult of investigation, can be said to have been created and raised at once to a state of high advancement by the labours of a single man.

ORFORD, Earls of. See Walpole.

ORGAN. The notes of the organ are produced by *pipes*, which are blown by air under pressure, technically called *wind*. Pipes differ from one another in two principal ways—(1) in *pitch*, (2) in *quality* of tone. (1) Consider first a series of pipes producing notes of similar quality, but differing in pitch. Such a series is called a *stop*. Each stop of the organ is in effect a musical instrument in itself. (2) The pipes of different stops differ, musically speaking, in their quality of tone, as well as sometimes in their pitch. Physically, they differ in shape and general arrangement. The sounding of the pipes is determined by the use of *keys*, some of which are played by the hands, some by the feet. A complete stop possesses a pipe for every key of some one row of manuals or pedals. If one stop alone is caused to sound, the effect is that of performance on a single instrument. There are such things as incomplete stops, which do not extend over a whole row of keys; and also there are stops which have more than one pipe to each key. Every stop is provided with mechanism by means of which the wind can be cut off from its pipes, so that they cannot sound even when the keys are pressed. This mechanism is made to terminate in a *handle*, which is commonly spoken of as the *stop*. When the handle is pushed in, the stop does not sound; when the handle is pulled out, the stop sounds if the keys are pressed. An organ may contain from one to four *manuals* or *keyboards* and one set of pedals. There are exceptional instruments having five manuals, and also some having two sets of pedals. The usual compass of the manuals is four and a half octaves, from C to g''' inclusive. The compass of the pedal is two and a half octaves, from C to f. This represents the pitch in which the notes of the pedal are written; but the pedal generally possesses stops sounding one octave lower than the written note, and in some cases stops sounding two octaves below the written note. Each manual or pedal has as a rule one *soundboard*, on which all its pipes are placed. Underneath the soundboard is the *windchest*, by which the wind is conveyed from the bellows, through the soundboard, to the pipes. In large organs there may be two or more soundboards for one manual or pedal. The windchest contains the mechanism of valves by which the keys control the admission of wind to the soundboard. The soundboard contains the grooves which receive the wind from the valves, and the slides by which the handles of the stops control the transmission of the wind through the soundboard to the pipes of the different stops.

The *grooves* of the soundboard are spaces left between wooden bars glued on to the *table* of the soundboard. There is usually one groove for every key. The grooves of the bass notes, which have to supply wind for large pipes, are broader than those of the treble. The bass bars are also thicker than those of the treble, that they may the better support the great weight which rests on the bass portion of the soundboard. The table

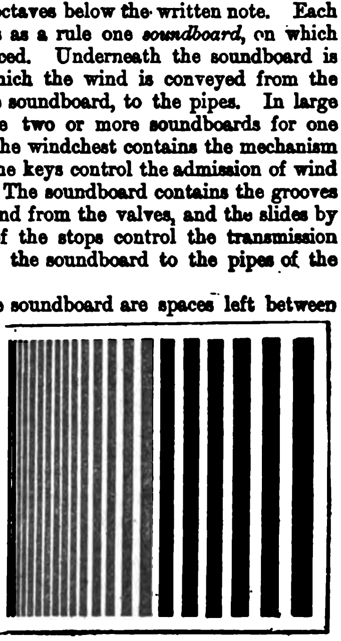

Fig. 1.—A portion of the table with the open grooves seen from below.

forms the top of the grooves. The grooves are generally closed below with leather, except the opening left in each, which is closed by the key-valve or *pallet*.

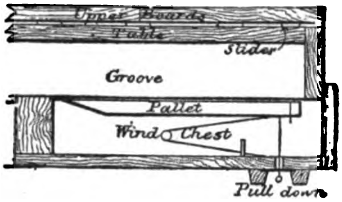

FIG. 2.—A section of a groove, with the table, windchest, and pallet.

The sliders are connected with the draw-stops or stop-handles, which are covered in with stout *upper boards*, on which the pipes stand. The stop-handles are pulled out, and holes are then bored straight down through the upper boards, sliders, and table to admit the wind from the grooves to the pipes. When the sliders are shifted by pushing in the handles, the holes no longer correspond, and the pipes are silenced.

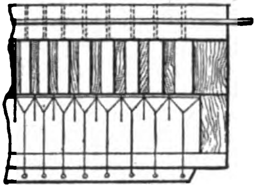

FIG. 3.—A section at right angles to fig. 2.

Pipes are divided first into *flue-pipes* and *reed-pipes*. Flue-pipes are blown by a wind mouthpiece characteristic of the organ, while in reed-pipes the wind acts on a metal tongue vibrating on a reed, and the motion of the tongue determines the speech of the pipe.

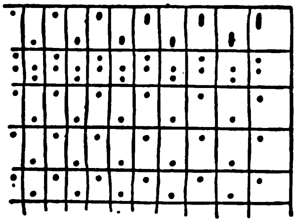

FIG. 4.—A portion of the table as it appears from above, with the places for the sliders of the stops; the small circles show the holes for the wind.

Pipes are made either of wood or of metal. Wood flue-pipes are generally of the form of a rectangular parallelepiped, metal flue-pipes of a cylindrical shape. Reed-pipes are conical or pyramidal, and widen towards the top. Some flue-pipes are made with stopped ends; these as a rule sound a note about an octave lower than the corresponding open pipes of the same length. Such are the stopped diapason, bourdon, and stopped flute.

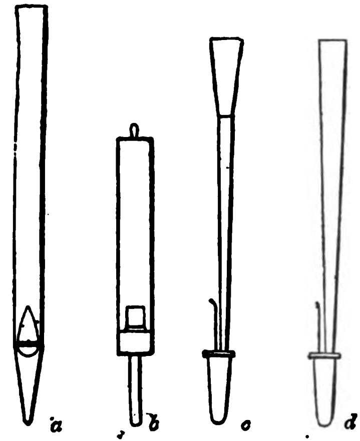

FIG. 5.—*a*, an open diapason; *b*, a stopped diapason; *c*, an oboe; and *d*, a trumpet,—*c* and *d* being forms of reed-pipes.

The general elementary theory of the resonance of a pipe is tolerably simple. The effective length of the pipe is determined by measuring from the upper lip to the open end in open pipes, and from the upper lip to the stopper and back again in stopped pipes. To this is added an allowance for the effect of each opening, since the condition of perfect freedom from constraint does not subsist at the opening itself. The corrected length is traversed twice (backwards and forwards) by sound, in the time of one vibration of the resultant note. This describes in a rough and general manner the way in which any disturbance gives rise to the note of the pipe; but the theory of the mouthpieces is a much more difficult matter, into which we cannot here enter.

In reed-pipes which are simply conical the resonance of the body is nearly the same as that of an open pipe of the same length. Where the form is irregular no simple rule can be given. But the resonance of the body of the pipe is generally the same as the note produced. The tongue of a reed-pipe alternately opens and closes the aperture of the reed. In this way it admits pulses of wind to the body of the pipe; these, if they recur at the proper intervals, maintain its vibration, which takes place when the note produced corresponds to the resonance of the pipe. The reed itself has its vibrating length determined by a wire which presses against it. The free end of this wire is touched with the tuning tool until a satisfactory note is produced.

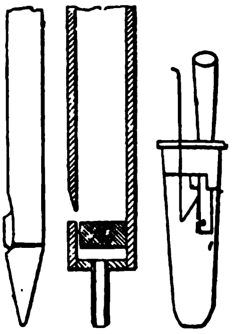

FIG. 6.—Mouthpieces in somewhat greater detail.

The pitch of the different stops is commonly denoted by the conventional approximate length of the pipe sounded by C, the lowest key of the manual. Even in incomplete stops which have no bass, the length of the pipe which C would have if the stop were extended down serves to indicate the pitch.

The conventional length of the C-pipe for stops having the normal pitch of the keys is 8 feet; a pipe having twice this length sounds the octave below, a pipe having half that length the octave above, and so on. Thus stops which sound the octave below the normal pitch of the keys are spoken of as 16-foot stops. Even where the pipes are stopped so that the actual length is only 8 feet, they are spoken of as having "16-foot tone." Similarly 32-foot stops sound two octaves below the normal pitch of the keys. But if these notes are produced by stopped pipes, whose actual length is only 16 feet, they are spoken of as having "32-foot tone." Sixteen-foot and 32-foot stops are specially characteristic of the pedal, where the names also signify the length of the open pipe which would sound the note actually produced by the lowest C. In old organs, where the modern compass was not adopted, it was not unusual to find stops spoken of as of 12 feet or of 24 feet. In these cases the lowest note was frequently F. Old English organs, however, more often had G for their lowest note. The designation of the stops in these cases had become rather anomalous, and need not be entered into. Of stops higher than the normal pitch of the keys, the octave is denoted by 4 feet if made with open pipes, 4-foot tone if stopped; the twelfth is commonly spoken of as 2⅔, the fifteenth or double octave as 2 feet. Higher-sounding stops are occasionally used, but these generally form part of "mixtures," and the foot-lengths of the separate ranks are not usually given.

The true or accurate lengths of the pipes vary within considerable limits. The base of the scales (dimensions) varies according to the standard of pitch, and the voicing and the complicated natural laws of pipes produce other deviations from simple relations, so that the conventional dimensions can only be regarded as a simple means of classifying the stops according to their pitch-relations. For this purpose they are essential; they are continually appealed to in discussion and description; and they are almost invariably marked on the stop-handles in all countries, so that a moderate knowledge of foreign nomenclatures, combined with the habit of seizing the meaning of the figures such as 16, 8, 4, on the stop-handles, will frequently suffice as a key to the complexities of a foreign organ.

Each of the manuals, or rows of keys, of an organ constitutes a separate organ, which is more or less complete in itself. The names of the different manuals or organs are *great organ*, *swell organ*, *choir organ*, and *solo organ*. The fifth manual, where it occurs, is the *echo organ*. The above is the usual order in point of development and frequency of occurrence, although the solo is sometimes preferred to the choir organ. The great organ is in a certain sense the principal department of the organ. It may be regarded as formed by a completely developed series of those fundamental stops which constitute the solid basis of the tone of the instrument. If an instrument be constructed with only a single manual this necessarily assumes, in general, the characteristics of a great organ. The great organ is called "grande orgue" in French, and first manual or "hauptwerk" in German

It is proposed to describe the principal organ-stops under the heads of the manuals to which they belong. The enumeration will not be exhaustive, but will include all the usual types.

The great organ commences generally with stops of 16-foot length or tone in large instruments. In some cases a 32-foot sounding stop is introduced, but this cannot be said to be a proper characteristic of the great organ. The foundation tone is of 8 feet; the stops of higher pitch serve to add brilliancy; those of 16 feet, which sound the octave below the normal pitch, serve to add gravity and weight to the tone. Sixteen-foot stops are commonly spoken of as "doubles," their conventional length being twice that of stops of normal pitch.

The 16-foot stops are the 16 double open diapason, and the 16 bourdon or double stopped diapason, to which, in very large instruments, there may be added a 16 double trumpet. The double open diapason on the great organ consists usually of metal pipes, having moderate "scale" or transverse dimensions. These are of the same general character as the pipes of the ordinary open diapason, though they are made somewhat less powerful. In the better instruments of the second class as to size this stop alone would probably be regarded as representing suitably and sufficiently the class of doubles on the great organ. It gives great body to the general tone, and appears decidedly preferable to the bourdon, which frequently takes its place. The 16 double dulciana may be regarded as a variation of the double open diapason. It is sometimes used where the full effect of a double open is not considered desirable. It possesses the light and not full tone of the dulciana. It does not appear to be peculiarly suitable for the purposes of a double.

The 16 bourdon or double stopped diapason, when used on the great organ, is made of rather small scale and light tone. It gives great body to a large great organ, and affords interesting combinations with other stops, such as the 4-foot flute. It is used either alone in smaller organs of the second class or in addition to a double open in larger instruments. The notes are produced from wooden pipes of rectangular section, stopped at the end, and having half the conventional length.

The 16 double trumpet is a trumpet (large reed stop) sounding the octave below the normal pitch. It is used generally in instruments of the largest size, but is somewhat more common in Germany. It is useful in giving a massive character to the tone of the full great organ, which is otherwise apt to become disagreeable on account of the great development of stops of a piercing character. If, however, the double trumpet is rough in tone, it is apt to communicate to the whole a corresponding impression. The judicious balancing of such elements as the double trumpet and the piercing stops such as mixtures is one of the principal features of a good German great organ.

We now proceed to the 8-foot stops (the reeds come at the end according to ordinary usage). An ordinary great organ may contain 8 stopped diapason, 8 open diapason (one or more), 8 gamba, and 8 hohlflöte. The 8 stopped diapason on the great organ is usually of wood, of moderate scale, and some considerable fulness of tone. The actual lengths are about half the conventional lengths. These pipes are sometimes made of metal. Few stops admit of more variety and individuality in their quality of tone than the stopped diapason; but too frequently the great organ stopped diapason fails to attract attention on its merits, being regarded simply as an inconsiderable portion of the foundation tone.

If there is any one stop which in itself represents the organ as a whole it is the open diapason. The pipes of this stop are the typical metal pipes which have always been characteristic of the appearance of the organ. A single open diapason stop is capable of being used as an organ of sufficient power for many purposes, though of course without variety. The pipes of this stop are called "principal" in German, this appellation apparently corresponding to the fact that they are the true and original organ-pipes. The English appellation of "diapason" has been taken to mean that these are the normal pipes which run through the whole compass. This, however, does not appear to be the actual derivation of the term; originally it is technically applied to the organ-builder's rule, which gives the dimensions of pipes; and it appears that the application to the stop followed on this meaning.

The scales, character, and voicing of the open diapason vary with fashion, and are different in different countries. We may distinguish three principal types. The old English diapasons of the days before the introduction of pedal organs into England were characterized by a rich sweet tone, and were not very powerful. They were generally voiced on a light wind, having a pressure equivalent to that of a column of water of from 2 to 2½ inches. The scale was in some cases very large, as in Green's two open diapasons in the old organ at St George's, Windsor; in these the wind was light and the tone very soft. In other cases the scale was smaller and the voicing bolder, as in Father Smith's original diapasons in St Paul's Cathedral. But on the whole the old English diapasons presented a lovely quality of tone. English travellers of those days, accustomed to these diapasons, usually found foreign organs harsh, noisy, and uninteresting. And there are many still in England who, while recognizing the necessity of a firmer diapason tone in view of the introduction of the heavy pedal bass, and the corresponding strengthening of the upper departments of the organ tone, lament the disappearance of the old diapason tone. However, it is possible with care to obtain diapasons presenting the sweet characteristics of the old English tone, combined with sufficient fulness and power to form a sound general foundation. And there can be no doubt that this should be one of the chief points to be kept in view in organ design.

The German diapason was of an entirely different character from the English. The heavy bass of the pedals has been an essential characteristic of the German organ for at least two or three centuries, or, as it is said, for four. The development of the piercing stops of high pitch was equally general. Thus foundation work of comparatively great power was required to maintain the balance of tone; the ordinary German diapason was very loud, and we may almost say coarse, in its tone when compared with the old English diapason. The German stop was voiced as a rule on from 3½ to 4 inches of wind not quite twice the pressure used in England.

The French diapason is a modern variety. It may be described as presenting rather the characteristics of a loud gamba than of a diapason. In other words, the tone tends towards a certain quality which may be described as "tinny" or metallic, or as approaching to that of a string instrument of rather coarse character. Some modern English builders appear to aim at the same model, and not without success.

The tone of a diapason must be strong enough to assert itself. It is the foundation of the whole organ tone. It is the voicer's business to satisfy this condition in conjunction with the requirement that the tone shall be full and of agreeable quality.

The 8 spitzflöte may be regarded as a variety or open diapason. The pipes taper slightly towards the top, and the quality is slightly stringy. This stop was much used at one time in place of a second open diapason. But it appears better that, where two open diapasons are desirable, they should both be of full diapason quality, though possibly of different strengths and dimensions. The admixture of stringy qualities of tone with the diapasons is always to be deprecated.

The 8 gamba was originally an imitation of the viola da gamba, a sort of violoncello. When made of a light quality of tone it is a pleasing stop; but its use in the great organ instead of a second open diapason is greatly to be deprecated for the reasons just stated. It is frequently found that, where a gamba is provided on the great organ, it is necessary to remove it from the compositions (mechanical arrangements for pulling out the stop-handles in different combinations), as the tone does not blend.

The 8 hohlflöte is an open flute, usually of wood, and of small scale. If made to a moderate scale and fully voiced it possesses a full pleasant tone, which is a useful support to the foundation tone of the great organ. The 8 clarabella differs from the hohlflöte in being usually of rather large scale, and having the open pipes only in the treble. In old organs a separate bass was generally provided; now it is more usual to supply the stop with a stopped bass. The dulciana and keraulophon, though sometimes found on the great organ, are regarded as more appropriately placed elsewhere.

The 4-foot stops of the great organ comprise the 4 principal and the 4 flute. The 4 principal is the octave of the open diapason, generally of somewhat reduced scale and light but bright quality of tone. The use of the word "principal" in connexion with this stop is purely English, and is said to be connected with the use made of it as the standard of tuning for the whole organ. The Germans and French both designate this stop as "octave."

Of the 4 flute there are several varieties,—open, stopped, wood, metal, and harmonic. The harmonic flute has open metal pipes of double the conventional length, which speak their octave. This is determined partly by the voicing, partly by making a small hole about the middle of the length, which determines the motion as that of the two separate lengths between which the hole lies. Harmonic flutes have a sweet but full and powerful tone. Other flutes are generally rather light, except the waldflöte, which is a powerful stop of a somewhat hooting quality.

The great organ flute is frequently used to give brilliancy to light combinations. Thus it may be used with the stopped diapason alone, or with the 16 bourdon alone, or with any of these and either or both of the open diapasons. Where the diapasons are scarcely strong enough to assert themselves in accompaniment, it is a very common practice to put the 4 flute into the diapason composition. If any such use is made of the flute it is desirable that it should not be too strong; but its habitual use to give point to the diapasons is in every way to be deprecated. If the diapasons are not strong enough, let them be altered; but that the diapasons of any organ should never be heard without the accompaniment of a 4 flute is a barbarism.

The ordinary use of the 4-foot stops is to add a degree of loudness to the diapasons. This is accompanied with a certain measure of keenness, which may become disagreeable if the 4-foot tone is disproportionately strong. The ordinary practice is to use the 4-foot tone very freely.

The 2⅔ twelfth stop sounds fiddle *g* on the C key. It is composed of diapason pipes, rather small and gently voiced. Its use is said to be to thicken the tone, which it certainly does. But how far the particular effect produced is desirable is another question. It is generally necessary that this stop should be accompanied by the fifteenth or other octave sounding stop of higher pitch. But in some cases the twelfth can be used with notes of lower pitch only. One such combination is—twelfth, full-toned 8-foot harmonic flute, soft reed in 16-foot pitch. This combination is sometimes used in single notes for solo purposes. The sound of the twelfth appears to be masked or absorbed by the volume of tone of lower pitch. These combinations require careful handling, as the effect of the twelfth is offensive if it remains distinctly perceptible.

The 2 fifteenth, or superoctave, of the great organ consists of diapason pipes sounding notes two octaves above the normal pitch of the keys. The 2 piccolo is a fluty stop of less power, having the same pitch. The 2-foot tone is commonly used as giving a degree of loudness to the great organ beyond that obtainable with the 4-foot tone.

The modern great organ fifteenth is generally a very powerful stop, and requires great caution in its use in organs of moderate size, or in limited spaces. The old English high pitched stops had little power, and their brilliancy was capable of pleasing without offence. The modern great organ up to fifteenth can only be heard with comfort in very large spaces. Under such suitable circumstances the fifteenth is capable of giving to the whole tone a ringing or silvery character, which lends itself specially to contrast with the tone of reeds. This peculiar keen tone, however, requires for its full development the mixtures.

Mixture, sesquialtera, furniture, cymbal, scharf, cornet, are various names applied to a description of stop which possesses several ranks, or several pipes to each note. The pipes of each note sound a chord, which is generally composed of concordant notes of the harmonic series whose fundamental is the proper note of the key. Modern mixtures generally consist of fifths and octaves. Their composition is not the same throughout the whole range of the keyboard. A three-rank mixture may consist of the following (the numbers signify intervals, reckoned along the scale)—

C — *c* (tenor) 15 — 19 — 22
c♯ to top 8 — 12 — 15.

For a somewhat larger full mixture this may be modified as follows—

C — *c′* (middle) 15 — 19 — 22
c′♯ to top 1 — 8 — 12 — 15.

A sharp mixture suitable for a large instrument may be as follows—

Five Ranks.
C — *c′* 15 — 19 — 22 — 26 — 29
c′♯ — *f″*♯ 8 — 12 — 15 — 19 — 22
g″ — *c‴* 1 — 8 — 12 — 15 — 19
c‴ to top 1 — 5 — 8 — 12 — 15.

The last two compositions are given by Hopkins in his great treatise on the organ.

The early mixtures generally included the tierce (17th, or two octaves and a third). The German practice was to unite this with a twelfth, carrying the combination 12-17 throughout the keyboard under the name of sesquialtera. It is agreed that there is no direct derivation of this use from the word, and that the name should be sexta. The combination is, however, not now usually provided. The old English sesquialtera was ordinarily simply a form of mixture, as was the furniture. The mounted cornet consisted usually of five ranks—

1 — 8 — 12 — 15 — 17.

It extended from middle *c* upwards. The pipes were raised on a small soundboard of their own; they were of very large scale and horn-like tone. The stop was used for reinforcing a melody. It is now obsolete.

The question of the employment and composition of mixtures is of the greatest importance with respect to the good effect of the full organ proper, *i.e.*, without reeds. With reference to the whole question of keen-toned stops it may be laid down that their free employment in the great organ does not produce a good effect unless the organ is situated in a very large space. If this is the case, properly proportioned mixtures are capable of giving to the tone of the full diapason work a character which is brilliant without being overpowering. The contrast between this class of tone and that afforded by the reeds is one of the most charming and legitimate effects within the range of the instrument.

We now pass to the reeds. The 16-foot trumpet has been already alluded to, and there remain 8 trumpet and 4 clarion or octave trumpet. These are both stops of great power. The best trumpets possess also richness and smoothness of tone. Stops of this class can be used with the diapasons only, producing what may be described as a rich-toned blare of moderate strength. The more usual employment of the reeds is in connexion with the entire great organ, the whole forming the ordinary fortissimo of the instrument.

The second department of the English organ is the swell organ. The whole of the swell pipes are enclosed in a box, faced on one or more sides with a set of balanced shutters. When these are closed the tone is almost completely muffled. When the shutters are opened, by means of a pedal usually, the sound bursts out. In order that the use of the swell may be effective, it is necessary that the shutters should close tightly, and that there should be a sufficient volume of tone to produce an effect when they are opened. The swell is of entirely English origin; it has been introduced in Germany to a very small extent, but more widely in France. It is usually called "recitatif" on the Continent. The chief characteristic of the swell is the rich and powerful volume of reed-tone of a peculiar character which it contains. But other stops are also of importance. We consider them in order. The 16 bourdon, small scale, is very commonly used in swells. It assists in giving body to the tone. It occupies, however, a large space within the swell box; and where the choice between it and a 16-foot reed has to be made there can be no doubt that the reed should be preferred, as it contributes so much more to the development of the characteristic swell tone. The 16 contra fagotto and the 16 bass oboe are two alternative forms of 16-foot reed. The first is the more powerful of the two. Either of these stops imparts great richness to the tone of the other swell reeds, giving specially to the bass the peculiar quality which suggests great power.

The 8-foot diapason work is principally valuable for the soft effects obtained from it. The diapasons are voiced less loudly than for the great organ; and within the shutters they sound very soft indeed. The dulciana is the softest stop generally available; and either this or some similar stop is introduced into the swell for the purpose of obtaining effects of the most extreme softness. Space within the swell box has generally to be economized. The complete bass of the open diapason or dulciana requires an 8-foot swell box, whereas even a 16-foot reed can be bent round so as to go within a smaller box if necessary. The open diapason and the dulciana are therefore often cut short at tenor *c*, and completed, if desired, with stopped pipes. The 4 principal and the 4 flute stops are similar to the corresponding stops in the great organ, but are somewhat lighter in tone. As in the case of the great diapasons and the 4-foot flute, it sometimes happens that the first reed combination (oboe) is not strong enough. Then the principal is sometimes put into its composition. This almost invariably spoils the effect entirely.

The 2 fifteenth and mixtures are much more pleasing in the swell than in the great organ. The shutters tone them down, so that they cannot easily become offensive. Added to the reeds, they give a peculiar brilliancy to the full swell. But perhaps their most pleasing use is when all the diapason work of the swell is used alone, and as a contrast to the reeds.

The usual reeds are as follows, besides the doubles already mentioned:—8 oboe, 8 cornopean, 8 trumpet, and 4 clarion (octave trumpet). The oboe (hautboy) is a conventional imitation of the orchestral instrument. It is a stop of delicate tone, and perhaps is at its best in solo passages, softly accompanied on another manual. The cornopean has a powerful horn-like tone. It is the stop which, more than any other, gives to the English swell its peculiar character. The trumpet is used in addition to the cornopean in large instruments. The clarion serves to add brightness and point to the whole.

The third department is the choir organ. The 8-foot work may contain 8 stopped diapason, 8 open diapason, 8 gamba, 8 keraulophon, and 8 hohlflöte.

As a rule no open diapason is provided for choir organs, unless they are larger than usual; but a small open is most useful as a means of obtaining a better balance than usual against the other manuals. The stopped diapason is generally made to contrast in some way with that on the great organ. The hohlflöte, or its representative, is generally a lighter stop than what would be put on the great organ. The gamba is better placed in the choir organ than in the great or the swell. Such stops as the gamba and the keraulophon are frequently placed in the swell with the idea of adding to the reediness of the tone. But this is fallacious. Their tone is not strong enough to assert itself through the shutters, and their peculiar character is therefore lost. On the choir organ, on the other hand, the sort of strength required is just about what they possess, and they show to advantage. The keraulophon is a stop invented by Gray and Davison, and has been widely adopted for many years. It has a hole made in each pipe near the top, and gives a peculiar tone very well described by its name (horn-flute). Though not very like the gamba, its tone is so far of the same type of quality that the two stops would hardly be used together. It is generally the case that similar stops of exceptional characters do not combine well, whereas stops of opposed qualities do combine well. Thus a gamba and a keraulophon would not combine well, whereas either of them forms an excellent combination with a stopped diapason or a hohlflöte.

The 4 principal is sometimes very useful. A light combination on the choir, with excess of 4-foot tone, may often be advantageously contrasted with the more full and solid tone of the great diapasons, or with other attainable effects. The 4 flute is constantly used. The 2 piccolo is frequently found on the choir organ, but is not particularly useful.

In organs which have no solo manual there is usually a clarionet (cremona, cromorne, or krummhorn, in old organs sometimes corno di bassetto) on the choir, and often an orchestral oboe (real imitation of the instrument). These are reed-stops. The dulciana and another soft stop, the salicional, salcional, or salicet (of similar strength, but slightly more pungent quality), are often placed on the choir. They are, however, hardly strong enough to be of much use there, and in the swell they are useful for effects of extreme softness. In very large instruments a fifteenth and a mixture are sometimes placed on the choir, which in this case has a complete series of diapason work. If the fifteenth and the mixtures are light enough the result is a sort of imitation of the tone of the old English organ. It also forms a useful echo to the great organ, *i.e.*, a passage played on the great may be repeated on the similar but fainter tone of the choir with the effect of an echo. In instruments of the largest size the choir is sometimes provided with a very small bourdon of 16-foot tone, which helps to give to the tone the character of that of a small full organ without reeds.

The solo organ is comparatively modern, at all events in its present usual form. A fourth manual was not unknown in old German organs; but the contents of all four resembled each other in a general sort of way, and there was nothing like the English swell or the modern solo. The solo appears to have arisen with Cavaillé-Coll in France, and Hill in England, as a vehicle for the powerful reed-stops on heavy wind introduced by these builders. Thus the French term for the solo is "clavier des bombardes"; and in the earlier English solos the "tuba mirabilis" was usually prominent. A solo organ may suitably contain any of the following stops:—8 tromba (a powerful reed on heavy wind), 8 harmonic flute (powerful tone and heavy wind), 8 clarionet and 8 orchestral oboe (real imitations of the instruments), and 8 vox humana (conventional imitation of the human voice).

The vox humana is sometimes placed in the swell. The last three stops are reeds. They may be with advantage enclosed in a swell box, having a separate pedal. In very large instruments a complete series of both diapason and reed stops is occasionally placed on the solo. But there does not seem to be much advantage in this arrangement.

We now come to the pedal. This forms the general bass to the whole organ. Thirty-two foot stops only occur in the largest instruments; they are as follows:—32 open diapason (wood or metal), 32-foot tone bourdon, and 32 contra trombone, posaune, bombarde, sackbut (reed). The 32-foot open diapason, whether wood or metal, is usually made of large scale, and produces true musical notes throughout. Its musical effect in the lower part of its range is, however, questionable, so far as this depends on the possibility of recognizing the pitch of the notes. It adds great richness to the general effect, particularly in large spaces. The 32-foot tone bourdon is not usually a successful stop. It rarely produces its true note in the lower part of its range. The 32-foot reed on the pedal has long been a characteristic of the largest instruments. With the old type of reed it was rarely pleasant to hear. The manufacture has been greatly improved lately, and these large reeds are now made to produce a fairly smooth effect. Deep reed notes, when rich and good, undoubtedly form one of the principal elements in giving the impression of power produced by large organs. From this point of view they are of great importance. Nevertheless the effect of large pedal reeds is generally more satisfactory to the performer than to the listener.

The 16-foot pitch may be regarded as the normal pitch of the pedal; the principal stops are as follows:—16 open diapason (wood or metal), 16-foot tone bourdon, 16 violone (imitation of double bass), and 16 trombone or posaune (reed). The 16-foot open diapason on the pedal assumes different forms according to circumstances. As a rule the character is sufficiently indicated by the stop being of wood or metal. The wooden open is generally of very large scale, and produces a ponderous tone of great power and fulness, which is only suitable for the accompaniment of the full organ, or of very powerful manual combinations. Such a stop is, as a rule, unsuitable in organs of moderate size, unless supplemented by lighter 16s for ordinary purposes. The metal open is of considerably smaller scale (in fact all metal pipes are effectively of much smaller scale than wooden pipes of similar diameter). The metal gives a clear tone, lighter than that of large wooden pipes, and pleasanter for ordinary purposes. The metal open combines advantageously with a bourdon. In the largest organs both wood and metal open 16s may be suitably provided. Where metal pipes are made a feature in the organ-case, both the double open diapason in the great organ and the metal 16 of the pedal may be properly made of good metal (polished tin or spotted metal), and worked in to the design of the organ-case.[1] The same applies to the 32-foot metal opens of the largest instruments. This saves space in the interior, and gives the large pipes room to speak, which is apt to be wanting when they are placed inside. The 16-foot tone bourdon on the pedal may be made of any scale according to circumstances. If it is the chief bass of the organ it is made very large and with great volume of tone. Such stops are unsuitable for soft purposes, and a soft 16, usually a violone, is required in addition. If the loud department of the 16 tone is otherwise provided for the bourdon may be made of moderate strength. It may also be made very soft, like a manual bourdon. These three different strengths ought always to be provided for in an instrument of a complete character. The violone is also made of all three strengths. In a few cases it furnishes the principal bass; frequently it furnishes the moderate element; and it is often applied to obtain a very soft 16-foot tone. The 16-foot reed is very common. The observations made as to the effect of 32-foot reeds are applicable also in this case.

The 8-foot department of the pedal is only less important than the 16, because it is possible to replace it to a certain extent by coupling or attaching the manuals to the pedals. The usual 8-foot pedal-stops are as follows:—8 principal bass (metal or wood), 8 bass flute (stopped), 8 violoncello (imitation of the instrument), and 8 trumpet. The remarks made above as to the scale of open 16s apply with little change to the pedal principal. Only, since the manuals are generally coupled, it is perhaps best to provide the large scale wood-stop, which presents the powerful class of tone in which the manual diapasons are deficient. The bass flute is almost a necessity in combination with the light 16-foot tone. A composition ought to be provided by which the pedal can be reduced to these two elements by a single movement. The violoncello is sometimes used instead of the bass flute for the last-named purpose, for which, however, it is not so suitable. It is a favourite stop for some solo purposes, but is not of much general utility. The 8-foot trumpet serves to give clearness and point to the tone of the 16-foot reed.

In the short preface to Mendelssohn's *Organ Sonatas* it is stated that everywhere, even in pianissimo, it is intended that the 16-foot tone of the pedal should be accompanied by 8-foot tone. For the purpose of realizing this as a general direction the soft 16-foot and 8-foot stops are required; large instruments are, however, occasionally found which possess nothing of the kind.

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[1] Anything down to one-third tin and two-thirds lead is called tin. But "pure tin" should have over 90 per cent. of tin. Absolutely pure tin could not be worked. Spotted metal is said to have from one-third to two-thirds tin. Under one-third tin no spots are said to rise, and the mixture has the general characters of lead.

The following stops of higher pitch are occasionally found on the pedal:—5⅓ twelfth bass, 4 fifteenth bass, mixture, and 4 clarion. These serve to make the pedal tone practically independent of coupling to the manual, which is a matter of great importance, especially in the performance of certain compositions of Bach and other writers, who appear to have been independent of couplers.

The 8-foot and 4-foot reeds on the pedal afford the best, indeed almost the only means of performing some types of composition best known in the works of Bach, in which the pedal sounds a chorale in the 8-foot or 4-foot pitch, whilst an elaborate accompaniment is executed on the manuals. Where these pedal reeds are not present it is necessary to couple to the pedal an 8-foot or a 4-foot manual reed. The corresponding manual ceases to be available for the manual part of the composition; and, as this generally involves two manuals, one of which must possess a 16-foot stop, the performance is sometimes impracticable, even on large organs.

In some foreign instruments two sets of pedals are provided, which may be described as great and choir pedals. The great pedal is in the usual position; the choir pedal is in front of the other, and sloping. It is so placed that the feet rest on it naturally when stretched out in front of the performer. There is a choir pedal of this kind in the organ in the minster at Ulm, built by Walcker of Ludwigsburg. It is a very large instrument, having 100 sounding stops. It has no compositions, which indeed are but little known in Germany; and without some arrangement such as this a soft pedal would hardly be obtainable. There are a few other instruments which have choir pedals, but they have not been introduced into England.

In organs which have a single manual the characteristics of the great and choir organs are usually united. In organs which have two manuals the lower usually represents the united great and choir, the upper is the swell. In organs which have three manuals the lower is usually the choir, but sometimes combines choir and solo, the middle is the great, and the top is the swell. In organs which have four manuals the order is—solo, swell, great, choir, the solo being at the top and the choir at the bottom.

Compositions are mechanical contrivances for moving the stop-handles in groups at a time. The ordinary form consists of pedals, which project from the front just above the pedal keys. The arrangements are various. We may refer to the arrangement in the organ at Windsor, given later on. A species of composition was introduced by Willis some years ago, and has been adopted in many large English instruments, which acts by means of a series of brass disks placed just under the front of the keys of each manual, within reach of the thumb. These act by means of pneumatic levers. A slight pressure on one of the disks sets the machine attached to it in action, and the required change in the stops is made without any exertion on the part of the performer.

The connexion between the keys and their pallets is made by various mechanisms, some of which are very ancient. In *square and trackerwork* (fig. 7) the old squares were made of wood. They resemble in function the squares used for taking bell-wires round a corner. The trackers are slight strips of wood, having screwed wires whipped on to their ends, which hold by leather buttons. The trackers play the part of the bell-wires. Where pressure has to be transmitted instead of a pull, thin but broad slips of wood are used, having pins stuck into their ends to keep them in their places. These are *stickers* (fig. 8). *Backfalls* (fig. 9) are narrow wooden levers turning on pins which pass through their centres. The *fan frame* (fig. 10) is a set of backfalls having one set of ends close together, usually corresponding to the keys; the other ends are spread widely apart. The *roller board* (fig. 11) is a more general mode of shifting the movements sideways. The roller is a slip of wood, or a bit of metal tube, which turns on two pins inserted into its ends. It has two arms projecting at right angles to its length. One of these receives the pull at one point, the other gives it off at another. In case a pull has to be transmitted to more than one quarter, a roller will sometimes have more than two arms. The name of *couplers* (fig. 12) is given to the mechanical stop by which the keys of one manual are made to take down those of another, or those of the pedal to take down those of the manuals. Some old forms of the mechanism could not be put on while any of the keys were depressed; others had a tendency to throw the fingers off the keys. These forms have been entirely superseded. That now used consists of a series of backfalls centred on a movable support. The one set of ends is connected with the moving keys; the other set of ends is pierced by the wires of the trackers or stickers from the keys to be moved. In the one position of the support these ends play freely over the wires; in the other they are brought up against the buttons of the trackers or against the stickers to be moved. The usual couplers are—each of the manuals to the pedal, swell to great, swell to great octave, swell to great sub-octave, swell to choir, choir to great sub-octave, and solo to great. The swell octave and sub-octave couplers are sometimes placed on the swell itself. The objection to this is, that, if they are used when the swell is coupled to the great organ, as is very commonly the case, the octaves are reached through two couplers. And, as couplers are not generally screwed up quite tight, the octaves are often not sufficiently put down to sound in tune. The choir to great sub-octave coupler was used chiefly as a substitute for a double on the great organ. It is common in organs of the transition period, but is not a good arrangement.

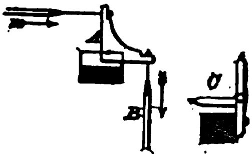

FIG. 7.—A, square; B, tracker; C, metal square.

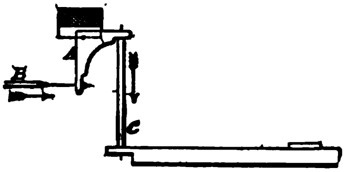

FIG. 8.—A and B as in fig. 7; C, sticker.

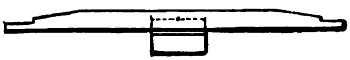
FIG. 9.—Backfall.

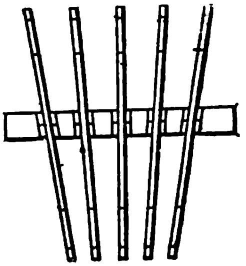
FIG. 10.—Fan frame.

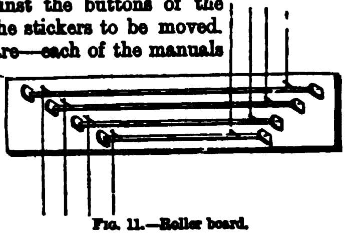
FIG. 11.—Roller board.

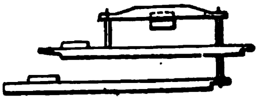
FIG. 12.—Coupler.

The *pneumatic lever* (fig. 13) consists of a small power bellows attached to each key, so that the depression of the key admits high-pressure wind to the power bellows. The power bellows then performs the work of opening the valves, &c. In large organs the work to be done would be beyond the reach of the most powerful finger without this device. Similar devices are sometimes applied to the compositions and other mechanical arrangements.

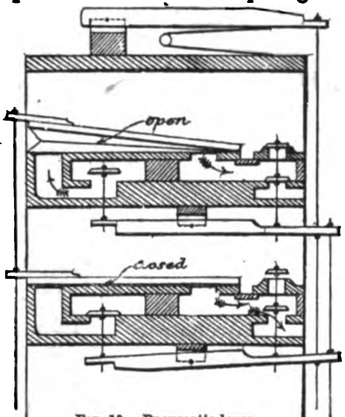

Fig. 13.—Pneumatic lever.

Pneumatic transmission, with many other mechanical devices, was invented by Willis. It consists of a divided pneumatic action. The pneumatic wind, instead of being at once admitted to the power bellows, is made to traverse a length of tubing, at the farther end of which it reaches the work to be done. This principle admits of application to divided organs, the pneumatic transmission passing under the floor, as in the organ at St Paul's Cathedral. It is peculiarly suitable for the pedals of large organs.

Ventils are valves which control the wind-supply of the different groups of stops. They were much recommended at one time as a substitute for compositions. The practical difference is that compositions shift the stop-handles, so that one can always see what there is on the organ; ventils leave the stop handles unmoved, so that the player is liable to be deceived. Other inconveniences might be mentioned, but it is enough to say that practical opinion appears decidedly to condemn the use of ventils.

The original *pedal boards* of Germany were flat and of very large scale. The early practice in England was to make them very small, as well as of short compass. Of late the compass C—*f*′, thirty notes, has been universally adopted with scales varying from 2¼ to 2½ inches from centre to centre of the naturals; 2⅝ inches is the scale now recommended. A large number of organs have been provided with what are called concave radiating pedal boards. These are most objectionable. All the best players dislike them. The objections are mainly two. They present different scales at different distances from the front; and, except just in front, they become so narrow that the smallest foot can hardly put down the pedals singly. This is fatal to legitimate playing, the essence of which consists in putting the feet over each other freely, so as to use the alternate method as much as possible; and this requires that the back of the pedal board shall be as available as the front. The concave parallel form appears to satisfy all requirements.

The diversities of the arrangements of different organs present a great difficulty. The best players take a certain time to master the arrangements of a strange instrument. With a view to the introduction of uniformity, a conference on the subject was arranged by the College of Organists in London, and a series of resolutions and a series of recommendations were published which deserve attention (1881). They go into considerable detail, and we must refer to the document itself. But we may mention that the parallel concave form is recommended for the pedal board, and 2⅝ inches for the scale. The positions of the stops of the various organs are to be as follows.

Left.	Right.
Swell.	Solo.
Pedal.	Great.
Couplers.	Choir.

The order of compositions, &c., from piano to forte is to be in all cases from left to right. The groups of compositions are to be in the order from left to right—pedal, swell, couplers, great. Some think that too much has been here sacrificed to uniformity. It is thought that, as the swell and great as a rule are provided with compositions, their stops are more properly placed on the right, leaving the solo and choir on the left, as the left hand is the more easily spared. Also some prefer to have the compositions arranged with the pianos in the middle and the fortes at the ends, so that the risk of putting down a loud composition in mistake for a soft one is avoided.

Two other points of detail may be alluded to. One is the position of the pedal board with reference to the keys. The height from the middle of the pedals to the great organ keys, it is agreed, should be 32 inches. But as to the forward position there is a difference. The resolutions say that "a plumb-line dropped from the front of the great organ sharp keys falls 2 inches nearer the player than the front of the centre short key of the pedal board." The old arrangement gave usually 1½ inches for this distance. But it is thought that the change has not gone far enough, and 4 inches has been found preferable. There is scarcely any single arrangement which is so important for the comfort of the player as having sufficient space in this direction (fig. 14). The second matter is the provision of some other means of acting on the swell than by the swell pedal. The use of the swell pedal is inconsistent with the proper use of both feet on the pedal keys; and there is no doubt that incorrect habits in this respect are commonly the result of the English use of the swell pedal. In fact, players sometimes keep one foot on the swell pedal all the time, so that proper pedal playing is impossible. Arrangements have been devised by means of which a movable back to the seat can be made the means of acting on the swell. The first "recommendation" of the College of Organists illustrates the requirement; it is, that "the consideration of organ-builders be directed to the widely-expressed desire for some means of operating on the swell in addition to the ordinary swell pedal."

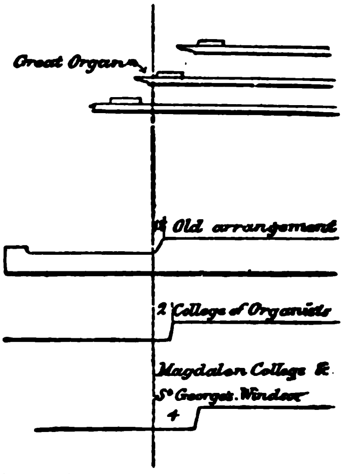

Fig. 14.—Relative position of manual and pedal.

As an example of an organ of a complete but not enormously large character, we give the details of the organ at St George's chapel, Windsor, which has been recently rebuilt by Messrs. Gray and Davison, according to Mr. Walter Parratt's designs.

Four manuals, C to *a*‴, 58 notes.
Pedal, C to *f*′, 30 notes.

Great Organ (3½-inch wind).

Double open diapason	16
Large open diapason	8
Open diapason	8
Stopped diapason	8
Clarabella	8
Principal	4
Harmonic flute	4
Twelfth	2⅔
Fifteenth	2
Sesquialtera[1]	III ranks
Mixture[1]	II ranks
Posaune	8
Clarion	4

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[1] These are the old mixtures.

Swell Organ (3 inch wind).

Lieblich bourdon	16
Open diapason	8
Stopped diapason	8
Dulciana	8
Vox cœlestis[1]	8
Principal	4
Octave dulciana	4
Fifteenth	2
Mixture[2]	III ranks
Contra fagotto	16
Cornopean	8
Oboe	8
Vox humana	8
Clarion	4

Choir Organ (2½-inch wind).

Dulciana	8
Keraulophon	8
Stopped diapason	8
Principal	4
Flute	4
Piccolo	2
Corno di bassetto (reed)	8

Solo Organ (6-inch wind).

Harmonic flute	8
Orchestral oboe	8
Tromba	8

Pedal Organ (4-inch wind).

Open diapason (wood)	16
Violone (metal)	16
Bourdon (wood)	16
Violoncello (metal)	8
Trombone (wood tubes)	16

Couplers.

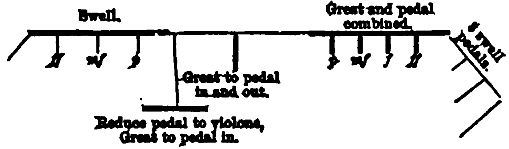
Solo to great. Swell to pedal.
Swell to great. Great to pedal.
Solo to pedal. Choir to pedal.

Pneumatic action to great organ and its couplers.

The arrangement of the stops and compositions is as follows:—

Left.	*Over the keys.*	*Right.*
Solo.	Couplers.	Swell.
Choir.	Tremulant.	Great.
Pedal. (Knob below swell keys.)		

Composition Pedals.


Swell.
Great and pedal combined.
3 swell pedals.
ff
mf
p
p
mf
f
ff
Great to pedal in and out.
Reduce pedal to violone, Great to pedal in.

The swell pedals control two sides of the swell box and the orchestral oboe. The vox humana is in a box which is always shut.

These swell pedals are on a new system, which admits of fixing them at any point, so that the tone can be determined to any strength.

HISTORY OF THE ORGAN.

The early history of the organ is very obscure.[3] As far back as classical times literary allusions occur occasionally to wind instruments involving the use of pipes and channels and reservoirs of air. Some form of bagpipe appears to have been alluded to in this way. Vitruvius has left a description of the hydraulicon, or hydraulic organ. It is clear that it must have been a machine of some complexity; but the way in which it acted is not intelligibly described.

Athenæus also has an account of the water organ. There is a treatise on pneumatics by Hero of Alexandria, which contains apparently actual drawings of a pneumatic organ and of an hydraulic organ, with fairly clear descriptions. If these drawings are authentic they are remarkable; for the pipes shown present very much the appearance of modern organ-pipes, and they are arranged in a row with the longest in the middle, just as pipes are often arranged now. There is a bit of sculpture on the obelisk of Theodosius at Constantinople (latter part of 4th century) which represents an instrument having eight pipes standing in a row. The mouths are not shown, and the manipulation is apparently going on on the farther side, so that its nature is not shown. The wind is furnished by a sort of blacksmith's bellows, on which two men are standing, as if to give the pressure or "weight to the wind." It appears probable that organs were introduced into churches during the latter half of the first millennium A.D. As the keyboard does not appear to have been invented till after the close of this period, the notes can only have been sounded one at a time, and rapid successions cannot have been used. The notes seem to have been few in number, about ten, but each note had latterly a number of pipes.

A treatise on the construction of organs by a monk named Theophilus is assigned to the early part of the 11th century. While some of the practical work is recognizable, most of the descriptions are unintelligible. It appears clear, however, that no keyboard is mentioned.

The first keyboard is said to have been introduced into the organ in the cathedral at Magdeburg about the close of the 11th century. There were sixteen keys; and a drawing exists in a work of the 17th century[4] which purports to represent them. They are said to have been an ell long and 3 inches broad. The drawing represents a complete octave with naturals and short keys (semitones), arranged in the same relative positions as in the modern keyboard. As it is generally admitted that the semitones were not invented till later, it would seem that this drawing is probably not authentic. In early organs with keyboards the keys are said to have required blows of the fist to put them down. In these cases probably sounding the notes of the plain song was all that could be accomplished.

As to the precise time and conditions under which the keyboard assumed its present form we know nothing. It is commonly said that the change to narrow keys took place in the course of the 14th century, and that the semitones were introduced about the same time. But all these statements rest on the authority of writers long subsequent to the dates in question, and the actual facts appear to be unknown. Many examples of organ keyboards still exist, both in England and on the Continent, which have black naturals and white short keys (semitones). The organ in the church at Heiligenblut in the Tyrol had in 1870 two manuals, one having black naturals and white semitones, the other white naturals and black semitones. In this organ the stops were acted on by iron levers which moved right and left. It possessed a reservoir bellows of great capacity, and was altogether a remarkable instrument. Harpsichords with black keyboards also exist.

The mode of blowing practised about the time of the introduction of the first keyboard appears to have been that which ultimately developed into the method still generally used in Germany. There were a great many separate bellows, each like a magnified kitchen-bellows, but provided with a valve, so that the wind could not return into the bellows. One man had charge of two of these. Each foot was attached to one bellows, and the blower held on by a bar above. It was possible, by raising each of the two bellows in turn and then resting his weight upon it, to produce a constant supply of wind with the pressure due to his weight. A great many such bellows were provided, and it seems that each pair required one man; so that great numbers of blowers were employed. This description is again drawn from the 17th-century work before alluded to; and its very completeness and the clearness of the accompanying drawing seem suspicious. A slight modification is enough to change this method into the German one. Instead of fastening the feet to the bellows and pulling them up, the blower treads on a lever which raises the bellows. The bellows being loaded then supplies the wind of itself. The bellows thus used have diagonal hinges, and various expedients are employed to make them furnish steady wind. But the English system of horizontal reservoirs and feeders appears far superior.

While the notes were still few, and many pipes were connected with each note, the system of forming a chord on each note appears to have originated, which survives in the modern mixture. There was not at that time anything of the nature of stops; all the pipes connected with any one note sounded without exception whenever the note was made use of. The object probably was to give the single notes a powerful and dominating character, so as to enable them to lead the church song.

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[1] This stop consists of a soft stop slightly out of tune, producing a waving tone with the dulciana.

[2] These are the old mixtures.

[3] As regards this section the writer desires to acknowledge his obligations to Rimbault's *History of the Organ*, published with Hopkins's treatise.

[4] Prætorius, *Theatrum Instrumentorum*.

The invention of the pedal may be set down to the 15th century. About that time the organ assumed on the Continent the general form which it has retained till lately, more especially in Germany. This may be described generally as having a compass of about four octaves in the manuals and of two octaves in the pedal, with occasionally extra notes at the top in both, and frequently "short octaves" at the bottom. German short octaves are as follows. The manual and pedal appear to terminate on E instead of C. Then the E key sounds C, F – F, F♯ – D, G – G, G♯ – E, and the rest as usual. There were often three, sometimes four, manuals in large organs. The character of all these was in general much the same, but they were more softly voiced in succession, the softest manual being sometimes spoken of as an echo organ. There are one or two examples of the echo as a fourth manual in England at the present time, in organs which have been designed more or less under German inspiration. The old echo was long ago superseded by the swell in England.

A few ancient cases survive in a more or less altered condition.[1] Of these the following are worthy of mention, as bearing on the question of date.

Sion (Switzerland). Gothic. A small instrument.........1390
Amiens. Originally Gothic. Large, with 16-foot pipes 1429
Perpignan. Gothic. Large, with 32-foot pipes 1490
Lübeck. One of the finest Gothic organs in Europe. 32s...1504 (or, according to Hopkins, 1518).

In all these the cases are sufficiently preserved to make it almost certain that pipes of the same lengths were originally employed. The actual pipes are generally modern. Shortly after this date we find Renaissance cases. At La Ferté Bernard (dep. Sarthe) part of the substructure is Gothic, and is known to be of date 1501; the organ above is Renaissance, and is known to be of date 1536. At St Maurice, Angers, an organ was built in 1511, with Renaissance case, two towers of 32-foot pipes, 48 stops, and a separate pedal. An account of the instrument in a procès verbal of 1533 furnishes good evidence. In the 16th century, therefore, the organ had attained great completeness, and the independent pedal was general on the Continent.

We cannot follow the history of German organs through the intervening centuries; but we propose to give the items of one of the principal organs of the Silbermanns, the great builders of the 18th century,—namely, that standing in the Royal Catholic Church, Dresden. Without being an enormously large instrument it is complete in its way, and gives a very good idea of the German organ. The account is taken from Hopkins. The date is 1754.

Great.

Principal	16	Octave	2
Bourdon	16 tone	Tertia	1⅗
Principal	8	Mixtur	IV ranks
Viola da Gamba	8	Cymbel	III
Rohrflöte	8 tone	Cornet	V
Octave	4	Fagott	16
Spitzflöte	4	Trumpet	8
Quinta	2⅔	Clarin	4

Echo.

Quintaton	16 tone	Octave	2
Principal	8	Tertia	1⅗
Gedackt	8 tone	Flageolet	1
Unda Maris	8 tone	Mixtur	IV ranks
Octave	4	Echo	V
Rohrflöte	4 tone	Vox humana	8 tone
Nassat	2⅔		

Choir.

Gedackt	8	Quinta	1⅓
Principal	4	Sifflöte	1
Rohrflöte	4 tone	Mixtur	III ranks
Nassat	2⅔	Sesquialtera	II
Octave	2	Chalumeaux	8 tone

Pedal.

Untersatz	32 tone	Mixtur	IV ranks
Principal	16	Pausan (trombone)	16
Octav-bass	8	Trompette	8
Octave	4	Clarin	4

Accessories.

Echo to great.	Tremulant echo.
Great to pedal.	Tremulant great.

Compass.

Manuals—C to *d'''* in alt.	Pedal—C_1 to tenor *a*.

The chief difference between English organs and those of the Continent was that until the present century the pedal was absolutely unknown in England. The heavy bass given by the pedal being absent, a lighter style of voicing was adopted, and the manuals were usually continued down below the 8-foot C so as to obtain additional bass by playing octaves with the hands. Thus the old organ (date 1697) of Father Smith in St Paul's Cathedral had manuals descending to the 16-foot C (C_1), with two open diapasons throughout. Green's old organ at St George's, Windsor, had manuals descending to the 12-foot F, also two open diapasons throughout, no F♯. But the more usual practice was to make the manual descend to the 10⅔ G, leaving out the G♯. At the Revolution most of the organs in England had been destroyed. Shortly afterwards Bernard Smith, a German, commonly called Father Smith, and Thomas and René Harris, Frenchmen, were largely employed in building organs, which were wanted everywhere. Father Smith perhaps had the greatest reputation of any builder of the old time, and his work has lasted wonderfully. There is a list in Rimbault of forty-five organs built for churches by him. The list of René Harris is scarcely less extensive.

The most important step in the development of the old English organ was the invention of the swell. This was first introduced into an organ built by two Jordans, father and son, for St Magnus's church near London Bridge, in 1712.

Burney writes (1771):—

> "It is very extraordinary that the swell, which has been introduced into the English organ more than fifty years, and which is so capable of expression and of pleasing effects that it may be well said to be the greatest and most important improvement that was ever made in any keyed instrument, should be utterly unknown in Italy; and, now I am on this subject, I must observe that most of the organs I have met with on the Continent seem to be inferior to ours by Father Smith, Byfield, or Snetzler, in everything but size! As the churches there are very often immense, so are the organs; the tone is indeed somewhat softened and refined by space and distance; but, when heard near, it is intolerably coarse and noisy; and, though the number of stops in these large instruments is very great, they afford but little variety, being for the most part duplicates in unisons and octaves to each other, such as the great and small 12ths, flutes, and 15ths; hence in our organs, not only the touch and tone, but the imitative stops, are greatly superior to those of any other organs I have met with."

(As to these opinions, compare section on great organ open diapasons above, p. 830.)

In the course of the 18th century most of the old echoes were altered into swells, and the swell came into almost universal use in England. The development of the swell is inseparably associated with the peculiar quality of English swell reeds. These must have originated during the development of the swell. We hear of a "good reed voicer" named Hancock, who worked with Crang, changing echoes into swells. However it originated, the English reed is beautiful when properly made. It has recently entirely superseded the free reed, which had been long used in Germany. The original swells were usually short in compass downwards, frequently extending only to fiddle *g*. It is only lately that the value of the bass of the swell has been properly appreciated. Short-compass swells may be said to have now disappeared.

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[1] In the remarks next following the writer is indebted for information to Hill's work on organ-cases.

The organ in St Stephen's, Coleman Street, is probably nearly in its original condition. It was built by Avery in 1775. At all events the following arrangements might very well have been the original ones. The pedal clavier without pipes is no doubt a subsequent addition and is omitted.

Great.

Open diapason.
Stopped diapason.
Principal.
Twelfth.
Fifteenth.
Sesquialtera—III ranks.
Mixture—II ranks.
Trumpet.
Clarion.
Cornet to middle *c*—V ranks.

Choir.

Stopped diapason.
Principal.
Flute.
Fifteenth.
Cremona to tenor *c*.

Swell.

Open diapason.
Stopped diapason.
Principal.
Cornet—III ranks.
Trumpet.
Hautboy.

Compass.

Great and choir—G_1 to e''', no $G_1\sharp$.
Swell—fiddle *g* to e'''.

This gives an excellent idea of the old English organ. There are several different accounts of the introduction of pedals into England. It took place certainly before the end of the 18th century, but only in a few instances. And, for long after, the usual arrangement was simply to provide a pedal clavier, usually from F_1 or G_1 to tenor *c* or *d*, which took down the notes of the great organ. Unison diapason pipes (12-foot) were occasionally used. In one or two cases, as in the transition states of the old organ at St George's, Windsor, a 24-foot open diapason was employed as well as the unison stop. But a more usual arrangement, of a most objectionable character, was to combine the G_1—*c* pedal-board with a single octave of so-called pedal-pipes, extending from the 16-foot to the 8-foot C; so that, instead of a uniform progression in ascending the scale, there was always a break or repetition in passing C.

About the middle of the present century it began to be generally admitted that the German arrangement of the pedal was the better, and the practice gradually became general of providing a complete pedal-board of 2½ octaves (*C*—f'), with at least one stop of 16-foot tone throughout, even on the smallest organs that pretended to be of any real use. The study of the classical works of Bach and Mendelssohn went hand in hand with this change; for that study was impossible without the change, and yet the desire for the study was one of the principal motives for it. In the meantime Bishop, an English builder, had invented composition pedals, which so greatly facilitate dealing with groups of stops. About the same time (1850) the mechanics of the organ were advanced by the general introduction of the pneumatic lever into large instruments; the whole mechanism of the organ was revolutionized by Willis's improvements; and the organ-builders of England, having obtained from the Continent the fundamental ideas necessary for completeness, advanced to a point at which they appear to be decidedly ahead. The English organ is now probably superior to that of any other country

General Remarks on Organ Treatment.

The organ probably presents more difficulties than any other instrument in the way of a sound elementary mastery. A person of ordinary capacity may work at it for years before being able to play passages of moderate difficulty with confidence and correctness. The special difficulty appears to be chiefly mental, and arises from the number of things that have to be thought of simultaneously. It does not lie in the execution—at least not chiefly; for to play a hymn-tune correctly, the bass being taken with the pedals, the tenor with the left hand, and the two upper parts with the right, is a matter in which there is no execution required; but it is of great difficulty to an inexperienced player. Other distributions of parts—such as bass with pedals, treble with right hand on a solo stop (*e.g.*, clarionet), two inner parts with a soft open diapason, or something of the kind—are of much greater difficulty in the first instance. Another distribution is bass with pedals, melody with reed or solo combination in the tenor with left hand (an octave below its true pitch), inner parts with right hand on a soft open diapason, or something that balances. This is of far greater difficulty. All this can be practised with common hymn-tunes; but the performer who can do these things with ease is in some respects an advanced player.

What has been said above has much bearing on the arrangement of the different departments of the organ. It is one of the first requisites that as many balances of tone as possible should be available between the different manuals and the pedal. How many large organs there are on which such a balance can hardly be obtained!

It would be difficult to lay too much stress on the above observations with respect to balance between the manuals. This is all-important in the performance of organ trios, such as the organ sonatas of Bach. In these compositions there are generally three notes sounding, which may be regarded as belonging to three different voices, of nearly equal strength, but different mean pitch, and, if possible, different quality; of these one is appropriated by each hand and one by the pedal. They are written in three lines, and are intended to be played on two manuals and the pedal. If there is a good choir organ, not too weak in tone, the clearest way is to play these things with a medium strength open diapason on the great organ for the right hand, the full 8-foot choir with or without the 4-foot flute with the left, and a metal 16-foot and 8-foot bass flute on the pedal. A usual course in England is to play the treble on a swell reed (oboe) with open swell, tenor on great diapason, and pedal as before; or treble great diapason, tenor oboe, pedal as before. Here there is some risk of the reed in the tenor being unpleasant. We may also suggest harmonic flute solo treble, open diapason great tenor, pedal as before. These compositions, however, admit of infinite variety in treatment. It appears probable that they were written for harpsichords, and in any case the intentions of the composer have not come down to us. As a matter of fact they are rarely successful on large English organs, on account of the want of balance between the manuals. And nothing could point the direction in which improvement is needed more than this observation.

The fugues of Bach are the classical organ music *par excellence*. As to these it is also true that nothing has come down to us as to the composer's intentions, except that he generally played the fugues on the full organ with doubles. It does not seem clear that this was the case with the preludes; and, any way, the modern organ, with its facilities for managing the stops, appears to countenance a different treatment. The effect of doubles when a subject or tune is given out in solo is very bad. They may be drawn with advantage when the parts are moving in massive chords. The usual practice is perhaps to employ various manual effects of a light character until the pedal enters, and then to produce full organ in its various modifications, but always to aim at variety of tone. If a prelude begins with heavy chords and pedal, then produce full organ at once. If it then passes to lighter matter, reduce to some extent. Some begin a fugue on the stopped diapason of the great organ, add more as the parts enter, and continue working up throughout. But perhaps it is the better practice to throw in loud organ during the pedal parts, and soften between times.

One of the greatest requisites in organ-playing is dignity of treatment. This is continually competing with clearness. The chief mode of keeping the different parts distinct, where that is necessary, is by using reeds of a pronounced character. These reeds almost invariably verge on the comic, and anything more than the most sparing and careful employment of them is undesirable. Expression is not possible unless the stops are enclosed in a swell box,—a most desirable arrangement. In all cases hurry is to be avoided. A calm steadiness, a minute finish of all the phrasing, forms most of the difference between first and second rate players.

With reference to the general treatment of modern music we quote the preface to Mendelssohn's *Organ Sonatas*:—"In these sonatas very much depends on the correct choice of the stops; but, since every organ with which I am acquainted requires in this respect special treatment, the stops of given names not producing the same effect in different instruments, I have only indicated certain limits, without specifying the names of the stops. By *fortissimo* I mean the full organ; by *pianissimo*, usually one soft 8-foot stop alone; by *forte*, full organ without some of the most powerful stops; by *piano*, several soft 8-foot stops together; and so on. In the pedal I wish everywhere, even in pianissimo, 8-foot and 16-foot (tone) together, except where the contrary is expressly indicated, as in the sixth sonata [this refers to a passage where an 8-foot pedal is used without 16]. It is therefore left to the player to combine the stops suitably for the different pieces, but particularly to see that, in the simultaneous use of two manuals, the one keyboard is distinguished from the other by its quality, without forming a glaring contrast."

The treatment thus indicated is very different from that to which the suitability of English swell reeds for solo purposes has given rise. The effects commonly obtained by means of these reeds could hardly be more expressly described than in the final warning sentence above quoted. However, these reed effects possess great clearness, and, with the improved character of modern reeds and the toning down of the swell box, they are probably not so objectionable as what Mendelssohn had in his mind. Indeed the deficiency of good balances between flue stops answering the requirements above described is usually such that there is hardly any option but to employ swell reeds in such cases.

Consider particularly the pianissimo balances necessary for carrying out the above directions. In the first place it is clear that the soft 8-foot stops alluded to are not stops of extreme softness, such as the dulciana or salicional, as the attempt to produce a melody on such stops would everywhere be a failure. We must recognize for such purposes a further degree of softness, which may be denoted by *ppp*. We may take the average great organ stopped diapason as the measure of loudness of the soft stops *pp*; then it is requisite that on the choir or elsewhere there should be stops that will, especially in the tenor, combine and balance singly with the great stopped diapason in two-manual work. Choir stops would have to be decidedly stronger than usual for this purpose. Such a stop might be a small open diapason, or perhaps a gamba or keraulophon. Other balances of various kinds might be suggested. Some such must be present if the smooth and liquid character, which the soft parts of Mendelssohn's works at least were undoubtedly intended to possess, is to be preserved at all.

As a *ppp* is needed for extreme softness, so an *fff* is needed to express the exceptional degree of force attainable in modern instruments by adding the solo reed (tromba) to the ordinary full organ.

Modern music generally indicates in detail the treatment intended by the author. We may mention one matter which has come forward lately; this is the use of one hand on two manuals. This has become possible in consequence of the modern arrangement by which the manuals overhang.

For further details as to the history and construction of the organ, with numerous specifications, we must refer to the work of Hopkins and Rimbault on the organ. (R. H. M. B.)

ORGIES is a name given to certain rites in the worship of Dionysus-Bacchus. The rites, which were restricted to women, were calebrated in the winter among the hills in spots remote from city life. The women met in such places clad in fawn-skins (*νεβρίς*), with hair dishevelled, swinging the thyrsus and beating the cymbal; they danced and worked themselves up to a state of mad excitement. The holiest rites took place at night by the light of torches. A bull, the representative of the god, was torn in pieces by them as Dionysus-Zagreus had been torn; his bellowing reproduced the cries of the suffering god. The women tore the bull with their teeth, and the eating of the raw flesh was a necessary part of the ritual. Then the dead god was sought for. Some further rites, which varied in different districts, represented the resurrection of the god in the spring. On Mount Parnassus the women carried back Dionysus-Liknites, the child in the cradle. The most famous festival of the kind was the *τριετηρίς*, celebrated every second winter on Parnassus by the women of Attica and Phocis. The celebrants were called Mænads or Bacchæ. The ecstatic enthusiasm of the Thracian women, *Κλώδωνες* or *Μιμαλλόνες*, was especially distinguished. There is no doubt that in earlier times the murdered god was represented by a man, and the myths of Pentheus and Orpheus refer to the original form of the ritual.

ORIBASIUS. See Medicine, vol. xv. p. 804.

ORIFLAMME. See Flag, vol. ix. p. 279.

ORIGEN (*c.* 185-*c.* 254). Of all the theologians of the ancient church, with the possible exception of Augustine, Origen is the most distinguished and the most influential. He is the father of the church's science; he is the founder of a theology which was brought to perfection in the 4th and 5th centuries, and which still retained the stamp of his genius when in the 6th century it disowned its author. It was Origen who created the dogmatic of the church and laid the foundations of the scientific criticism of the Old and New Testaments. He could not have been what he was unless two generations before him had laboured at the problem of finding an intellectual expression and a philosophic basis for Christianity (Justin, Tatian, Athenagoras, Pantænus, Clement). But their attempts, in comparison with his, are like a schoolboy's essays beside the finished work of a master. Like all great epoch-making personalities, he was favoured by the circumstances of his life, notwithstanding the relentless persecution to which he was exposed. He lived in a time when the Christian communities enjoyed almost uninterrupted peace and held an acknowledged position in the world. By proclaiming the reconciliation of science with the Christian faith, of the highest culture with the gospel, Origen did more than any other man to win the Old World to the Christian religion. But he entered into no diplomatic compromises; it was his deepest and most solemn conviction that the sacred oracles of Christendom embraced all the ideals of antiquity. His character was as transparent as his life was blameless; there are few church fathers whose biography leaves so pure an impression on the reader. The atmosphere around him was a dangerous one for a philosopher and theologian to breathe, but he kept his spiritual health unimpaired, and even his sense of truth suffered less injury than was the case with most of his contemporaries. To us, indeed, his conception of the universe, like that of Philo, seems a strange medley, and one may be at a loss to conceive how he could bring together such heterogeneous elements; but there is no reason to doubt that the harmony of all the essential parts of his system was obvious enough to himself. It is true that in addressing the Christian people he used different language from that which he employed to the cultured; but there was no dissimulation in that,—on the contrary, it was a requirement of his system. Orthodox theology has never, in any of the confessions, ventured beyond the circle which the mind of Origen first measured out. It has suspected and amended its author, it has expunged his heresies; but whether it has put anything better or more tenable in their place may be gravely questioned.

Origen was born, perhaps at Alexandria, of Christian parents in the year 185 or 186. As a boy he showed evidence of remarkable talents, and his father Leonidas gave him an excellent education. At a very early age, about the year 200, he listened to the lectures of Pantænus and Clement in the catechetical school. This school, of which the origin is unknown, was the first and for a long time the only institution where Christians were instructed simultaneously in the Greek sciences and the doctrines of the Holy Scriptures. Alexandria had been, since the days of the Ptolemies, a centre for the interchange of ideas between East and West—between Egypt, Syria, Greece, and Italy; and, as it had furnished Judaism with an Hellenic philosophy, so it also brought about the alliance of Christianity with Greek philosophy. Asia Minor and the West developed the strict ecclesiastical forms by means of which the church closed her lines against heathenism, and especially against heresy; in Alexandria Christian ideas were handled in a free and speculative fashion and worked out with the help of Greek philosophy. Till near the end of the 2d century the line between heresy and orthodoxy was less rigidly drawn there than at Ephesus, Lyons, Rome, or Carthage. In the year 202 a persecution arose, in which the father of Origen became a martyr, and the family lost their livelihood. Origen, who had distinguished himself by his intrepid zeal, was supported for a time by a lady of rank, but began about the same time to earn his bread by teaching; and in 203 he was placed, with the sanction of the bishop Demetrius, at the head of the catechetical school. Even then his attainments in the whole circle of the sciences were extraordinary. But the spirit of investigation impelled him to devote himself to the highest studies, philosophy and the exegesis of the Sacred Scriptures. With indomitable perseverance he applied himself to these subjects; although himself a teacher, he regularly attended the lectures of Ammonius Saccas, and made a thorough study of the books of Plato and Numenius, of the Stoics and the Pythagoreans. At the same time he endeavoured to acquire a knowledge of Hebrew, in order to be able to read the Old Testament in the original. His manner of life was ascetic; the sayings of the Sermon on the Mount and the practical maxims of the Stoics were his guiding stars. Four oboli a day, earned by copying manuscripts, sufficed for his bodily sustenance. A rash resolve led him to mutilate himself that he might escape from the lusts of the flesh, and work unhindered in the instruction of the female sex. This step he afterwards regretted. As the attendance at his classes continually increased—pagans thronging to him as well as Christians—he handed over the beginners to his friend Heraclas, and took charge of the more advanced pupils himself. Meanwhile the literary activity of Origen was increasing year by year. He commenced his great work on the textual criticism of the Scriptures; and at the instigation of his friend Ambrosius, who provided him with the necessary amanuenses, he published his commentaries on the Old Testament and his dogmatic investigations. In this manner he laboured at Alexandria for twenty-eight years (till 231-232). This period, however, was broken by many journeys, undertaken partly for scientific and partly for ecclesiastical objects. We know that he was in Rome in the time of Zephyrinus, again in Arabia, where a Roman official wanted to hear his lectures, and in Antioch, in response to a most flattering invitation from Julia Mammæa (mother of Alexander Severus, afterwards emperor), who wished to become acquainted with his philosophy. In the year 216—the time when the imperial executioners were ravaging Alexandria—we find Origen in Palestine. There the bishops of Jerusalem and Cæsarea received him in the most friendly manner, and got him to deliver public lectures in the churches. In the East, especially in Asia Minor, it was still no unusual thing for laymen, with permission of the bishop, to address the people in the church. In Alexandria, however, this custom had been given up, and Demetrius took occasion to express his disapproval and recall Origen to Alexandria. Probably the bishop was jealous of the high reputation of the teacher; and a coolness arose between them which led, fifteen years later, to an open rupture. On his way to Greece (apparently in the year 230) Origen was ordained a presbyter in Palestine by his friends the bishops. This was undoubtedly an infringement of the rights of the Alexandrian bishop; at the same time it was simply a piece of spite on the part of the latter that had kept Origen so long without any ecclesiastical consecration. Demetrius convened a synod, at which it was resolved to banish Origen from Alexandria. Even this did not satisfy his displeasure. A second synod, composed entirely of bishops, determined that Origen must be deposed from the presbyterial status. This decision was communicated to the foreign churches, and seems to have been justified by referring to the self-mutilation of Origen and adducing objectionable doctrines which he was said to have promulgated. The details of the incident are, however, unfortunately very obscure. No formal excommunication of Origen appears to have been decreed; it was considered sufficient to have him degraded to the position of a layman. The sentence was approved by most of the churches, in particular by that of Rome. At a later period Origen sought to vindicate his teaching in a letter to the Roman bishop Fabian, but, it would seem, without success. Even Heraclas, his former friend and sharer of his views, took part against him; and by this means he procured his own election shortly afterwards as successor to Demetrius.

In these circumstances Origen thought it best voluntarily to retire from Alexandria (231-232). He betook himself to Palestine, where his condemnation had not been acknowledged by the churches any more than it had been in Phœnicia, Arabia, and Achaia. He settled in Cæsarea, and very shortly he had a flourishing school there, whose reputation rivalled that of Alexandria. His literary work, too, was prosecuted with unabated vigour. Enthusiastic pupils sat at his feet (see the *Panegyric* of Gregory Thaumaturgus), and the methodical instruction which he imparted in all branches of knowledge was famous all over the East. Here again his activity as a teacher was interrupted by frequent journeys. Thus he was for two years together at Cæsarea in Cappadocia, where he was overtaken by the Maximinian persecution; here he worked at his recension of the Bible. We find him again in Nicomedia, in Athens, and twice in Arabia. He was called there to combat the unitarian christology of Beryllus, bishop of Bostra, and to clear up certain eschatological questions. As he had formerly had dealings with the house of Alexander Severus, so now he entered into a correspondence with the emperor Philip the Arabian and his wife Severa. But through all situations of his life he preserved his equanimity, his keen interest in science, and his indefatigable zeal for the instruction of others. In the year 250 the Decian persecution broke out, Origen was arrested, imprisoned, and maltreated. But he survived these troubles—it is a malicious invention that he recanted during the persecution—and lived a few years longer in active intercourse with his friends. He died, probably in the year 254 (consequently under Valerian), at Tyre, where his grave was still shown in the Middle Ages.

Writings.—Origen is probably the most prolific author of the ancient church. "Which of us," asks Jerome, "can read all that he has written?" The number of his works was estimated at 6000, but that is certainly an exaggeration. Owing to the increasing unpopularity of Origen in the church, a comparatively small portion of these works have come down to us in the original. We have more in the Latin translation of Rufinus; but this translation is by no means trustworthy, since Rufinus, assuming that Origen's writings had been tampered with by the heretics, considered himself at liberty to omit or amend heterodox statements. Origen's real opinion, however, may frequently be gathered from the *Philocalia*—a sort of anthology from his works prepared by Basil the Great and Gregory Nazianzenus. The fragments in Photius and in the *Apology* of Pamphilus serve for comparison. The writings of Origen consist of letters, and of works in textual criticism, exegesis, apologetics, dogmatic and practical theology.

(1) Eusebius collected more than a hundred of Origen's letters, arranged them in books, and deposited them in the library at Cæsarea (*H. E.*, vi. 36). In the church library at Jerusalem (founded by the bishop Alexander) there were also numerous letters of this father (Euseb., *H. E.*, vi. 20). But unfortunately they have all been lost except two,—one to Julius Africanus (about the history of Susanna) and one to Gregory Thaumaturgus. There are, besides, a couple of fragments.

(2) Origen's textual studies on the Old Testament were undertaken partly in order to improve the manuscript tradition, and partly for apologetic reasons, to clear up the relation between the LXX. and the original Hebrew text. The results of more than twenty years' labour were set forth in his *Hexapla* and *Tetrapla*, in which he placed the Hebrew text side by side with the various Greek versions, examined their mutual relations in detail, and tried to find the basis for a more reliable text of the LXX. The *Hexapla* was probably never fully written out, but excerpts were made from it by various scholars at Cæsarea in the 4th century; and thus large sections of it have been

saved.[1] Origen worked also at the text of the New Testament, although he produced no recension of his own.

(3) The exegetical labours of Origen extend over the whole of the Old and New Testaments. They are divided into *Scholia* (σημειώσεις, short annotations, mostly grammatical), *Homilies* (edifying expositions grounded on exegesis), and *Commentaries* (τόμοι). In the Greek original only a very small portion has been preserved; in Latin translations, however, a good deal. The most important parts are the homilies on Jeremiah, the books of Moses, Joshua, and Luke, and the commentaries on Matthew, John, and Romans. With grammatical precision, antiquarian learning, and critical discernment Origen combines the allegorical method of interpretation—the logical corollary of his conception of the inspiration of the Scriptures. He distinguishes a threefold sense of scripture, a grammatico-historical, a moral, and a pneumatic,—the last being the proper and highest sense. He thus set up a formal theory of allegorical exegesis, which is not quite extinct in the churches even yet, but in his own system was of fundamental importance. On this method the sacred writings are regarded as an inexhaustible mine of philosophical and dogmatic wisdom; in reality the exegete reads his own ideas into any passage he chooses. The commentaries are of course intolerably diffuse and tedious, a great deal of them is now quite unreadable; yet, on the other hand, one has not unfrequently occasion to admire the sound linguistic perception and the critical talent of the author.[2]

(4) The principal apologetic work of Origen is his book κατὰ Κέλσου (eight books), written at Cæsarea in the time of Philip the Arabian. It has been completely preserved in the original. This work is invaluable as a source for the history and situation of the church in the 2d century; for it contains nearly the whole of the famous work of Celsus (Λόγος ἀληθής) against Christianity. What makes Origen's answer so instructive is that it shows how close an affinity existed between Celsus and himself in their fundamental philosophical and theological presuppositions. The real state of the case is certainly unsuspected by Origen himself; but many of his opponent's arguments he is unable to meet except by a speculative reconstruction of the church doctrine in question. Origen's apologetic is most effective when he appeals to the spirit and power of Christianity as an evidence of its truth. In details his argument is not free from sophistical subterfuges and superficial reasoning.[3]

(5) Of the dogmatic writings we possess only one in its integrity, and that only in the translation of Rufinus,[4] Περὶ ἀρχῶν (On the Fundamental Doctrines). This work, which was composed before 228, is the first attempt at a dogmatic at once scientific and accommodated to the needs of the church. The material is drawn from Scripture, but in such a way that the propositions of the *regula fidei* are respected. This material is then formed into a system by all the resources of the intellect and of speculation. Origen thus solved, after his own fashion, a problem which his predecessor Clement had not even ventured to grapple with. The first three books treat of God, the world, the fall of spirits, anthropology, and ethics. "Each of these three books really embraces, although not in a strictly comprehensive way, the whole scheme of the Christian view of the world, from different points of view, and with different contents." The fourth book explains the divinity of the Scriptures, and deduces rules for their interpretation. It ought properly to stand as first book at the beginning. The ten books of *Stromata* (in which Origen compared the teaching of the Christians with that of the philosophers, and corroborated all the Christian dogmas from Plato, Aristotle, Numenius, and Cornutus) have all perished, with the exception of small fragments: so have the tractates on the resurrection and on freewill.[5]

(6) Of practical theological works we have still the *Προτρεπτικὸς εἰς μαρτύριον* and the *Σύνταγμα περὶ εὐχῆς*. For a knowledge of Origen's Christian estimate of life and his relation to the faith of the church these two treatises are of great importance. The first was written during the persecution of Maximinus Thrax, and was dedicated to his friends Ambrosius and Protoctetus. The other also dates from the Cæsarean period; it mentions many interesting details, and concludes with a fine exposition of the Lord's Prayer.

(7) In his own lifetime Origen had to complain of falsifications of his works and forgeries under his name. Many pieces still in existence are wrongly ascribed to him; yet it is doubtful whether a single one of them was composed on purpose to deceive. The most noteworthy are the *Dialogues* of a certain Adamantius "de recta in Deum fide," which seem to have been erroneously attributed to Origen so early as the 4th century.

Outline of Origen's View of the Universe and of Life.—The system of Origen was formulated in opposition to the Greek philosophers on the one hand, and the Christian Gnostics on the other.[6] But the science of faith, as expounded by him, bears unmistakably the stamp both of Neo-Platonism and of Gnosticism. As a theologian, in fact, Origen is not merely an orthodox traditionalist and believing exegete but a speculative philosopher of Neo-Platonic tendencies. He is, moreover, a judicious critic. The union of these four elements gives character to his theology, and in a certain degree to all subsequent theology. It is this combination which has determined the peculiar and varying relations in which theology and the faith of the church have stood to each other since the time of Origen. That relation depends on the predominance of one or other of the four factors embraced in his theology.

As an orthodox traditionalist Origen holds that Christianity is a practical and religious saving principle, that it has unfolded itself in an historical series of revealing facts, that the church has accurately embodied the substance of her faith in the *regula fidei*, and that simple faith is sufficient for the renewal and salvation of man. As a philosophical idealist, however, he transmutes the whole contents of the faith of the church into ideas which bear the mark of Neo-Platonism, and were accordingly recognized by the later Neo-Platonists as Hellenic.[7] In Origen, however, the mystic and ecstatic element is held in abeyance. The ethico-religious ideal is the sorrowless condition, the state of superiority to all evils, the state of order and of rest. In this condition man enters into likeness to God and blessedness; and it is reached through contemplative isolation and self-knowledge, which is divine wisdom. "The soul is trained as it were to behold itself in a mirror, it shows the divine spirit, if it should be found worthy of such fellowship, as in a mirror, and thus discovers the traces of a secret path to participation in the divine nature." As a means to the realization of this ideal,

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[1] Field, *Origenis Hexaplorum quæ supersunt*, 2 vols., Oxon., 1867-74.

[2] See Reuss, *Geschichte der heil. Schriften d. N. T.*, 5th ed., § 511.

[3] Keim, *Celsus*, 1878; Aubé, *Hist. des persécut. de l'église*, vol. ii., 1875; Ornsby, "Origen against Celsus," *Dublin Review*, July 1879, p. 58; Pélagaud, *Étude sur Celse*, 1878; Lebedeff, *Origen's Book against Celsus*, Moscow, 1878 (Russian); Overbeck in the *Theolog. Lit. Zeitung*, 1878 No. 22, 1879 No. 9; *Orig. c. Cels.*, ed. Selwyn, 1876.

[4] There are, however, extensive fragments of the original in existence.

[5] See Redepenning, *Origenis de principiis*, first sep. ed., Leips., 1836; Schnitzer, *Orig. über die Grundlehren des Glaubens*, an attempt at reconstruction, 1835.

[6] The opposition to the unitarians within the church must also be kept in mind.

[7] Porphyry says of Origen, *κατὰ τὰς περὶ πραγμάτων καὶ τοῦ θείου δόξας Ἑλληνίζων* (Euseb., *H.E.*, vi. 19).

Origen introduces the whole ethics of Stoicism. But the link that connects him with churchly realism, as well as with the Neo-Platonic mysticism, is the conviction that complete and certain knowledge rests wholly on divine revelation, *i.e.*, on oracles. Consequently his theology is cosmological speculation and ethical reflexion based on the Sacred Scriptures. The Scriptures, however, are treated by Origen on the basis of a matured theory of inspiration in such a way that all their facts appear as the vehicles of ideas, and have their highest value only in this aspect. That is to say, his gnosis neutralizes all that is empirical and historical, if not always as to its actuality, at least absolutely in respect of its value. The most convincing proof of this is that Origen (1) takes the idea of the immutability of God as the regulating idea of his system, and (2) deprives the historical "Word made flesh" of all significance for the true Gnostic. To him Christ appears simply as the Logos who is with the Father from eternity, and works from all eternity, to whom alone the instructed Christian directs his thoughts, requiring nothing more than a perfect—*i.e.*, divine—teacher. In such propositions historical Christianity is stripped off as a mere husk. The objects of religious knowledge are beyond the plane of history, or rather—in a thoroughly Gnostic and Neo-Platonic spirit—they are regarded as belonging to a supramundane history. On this view contact with the faith of the church could only be maintained by distinguishing an exoteric and an esoteric form of Christianity. This distinction was already current in the catechetical school of Alexandria, but Origen gave it its boldest expression, and justified it on the ground of the incapacity of the Christian masses to grasp the deeper sense of Scripture, or unravel the difficulties of exegesis. On the other hand, in dealing with the problem of bringing his heterodox system into conformity with the *regula fidei* he evinced a high degree of technical skill. An external conformity was possible inasmuch as speculation, proceeding from the higher to the lower, could keep by the stages of the *regula fidei*, which had been developed into a history of salvation. The system itself aims in principle at being thoroughly monistic; but, since matter, although created by God out of nothing, was regarded merely as the sphere in which souls are punished and purified, the system is pervaded by a strongly dualistic element. The immutability of God requires the eternity of the Logos and of the world. At this point Origen succeeded in avoiding the heretical Gnostic idea of God by assigning to the Godhead the attributes of goodness and righteousness. The preexistence of souls is another inference from the immutability of God, although Origen also deduced it from the nature of the soul, which as a spiritual potency must be eternal. Indeed this is the fundamental idea of Origen—"the original and indestructible unity of God and all spiritual essences." From this follows the necessity for the created spirit, after apostacy, error, and sin, to return always to its origin in God. The actual sinfulness of all men Origen was able to explain by the theological hypothesis of pre-existence and the premundane fall of each individual soul. He holds that freedom is the inalienable prerogative of the finite spirit; and this is the second point that distinguishes his theology from the heretical Gnosticism. The system unfolds itself like a drama, of which the successive stages are as follows:—the transcendental fall, the creation of the material world, inaugurating the history of punishment and redemption, the clothing of fallen souls in flesh, the dominion of sin, evil, and the demons on earth, the appearing of the Logos, His union with a pure human soul, His esoteric preaching of salvation, and His death in the flesh, then the imparting of the Spirit, and the ultimate restoration of all things. The doctrine of the restoration appeared necessary because the spirit, in spite of its inherent freedom, cannot lose its true nature, and because the final purposes of God cannot be foiled. The end, however, is only relative, for spirits are continually falling, and God remains through eternity the creator of the world. Moreover, the end is not conceived as a transfiguration of the world, but as a liberation of the spirit from its unnatural union with the sensual. Here the Gnostic and philosophical character of the system is particularly manifest. The old Christian eschatology is set aside; no one has dealt such deadly blows to Chiliasm and Christian apocalypticism as Origen. It need hardly be said that he spiritualized the church doctrine of the resurrection of the flesh. But, while in all these doctrines he appears in the character of a Platonic philosopher, traces of rational criticism are not wanting. Where his fundamental conception admits of it, he tries to solve historical problems by historical methods. Even in the christology, where he is treating of the historical Christ, he entertains critical considerations; hence it is not altogether without reason that in after times he was suspected of "Ebionitic" views of the Person of Christ. Not unfrequently he represents the unity of the Father and the Son as a unity of agreement and harmony and "identity of will."

Although the theology of Origen exerted a considerable influence as a whole in the two following centuries, it certainly lost nothing by the circumstance that several important propositions were capable of being torn from their original setting and placed in new connexions. It is in fact one of the peculiarities of this theology, which professed to be at once churchly and philosophical, that most of its formulæ could be interpreted and appreciated *in utramque partem*. By arbitrary divisions and rearrangements the doctrinal statements of this "science of faith" could be made to serve the most diverse dogmatic tendencies. This is seen especially in the doctrine of the Logos. On the basis of his idea of God Origen was obliged to insist in the strongest manner on the personality, the eternity (eternal generation), and the essential divinity of the Logos.[1] On the other hand, when he turned to consider the origin of the Logos he did not hesitate to speak of Him as a *κτίσμα*, and to include Him amongst the rest of God's spiritual creatures. A *κτίσμα*, which is at the same time *ὁμοούσιον τῷ* Θεῷ, was no contradiction to him, simply because he held the immutability, the pure knowledge, and the blessedness which constituted the divine nature to be communicable attributes. In later times both the orthodox and the Arians appealed to his teaching, both with a certain plausibility; but the inference of Arius, that an imparted divinity must be divinity in the second degree, Origen did not draw. With respect to other doctrines also, such as those of the Holy Spirit and the incarnation of Christ, &c., Origen prepared the way for the later dogmas. The technical terms round which such bitter controversies raged in the 4th and 5th centuries are often found in Origen lying peacefully side by side. But this is just where his epoch-making importance lies, that all the later parties in the church learned from him. And this is true not only of the dogmatic parties; solitary monks and ambitious priests, hard-headed critical exegetes,[2] allegorists, mystics, all found something congenial in his writings. The only man who tried to shake off the theological influence of Origen was Marcellus of Ancyra, who did not succeed in producing any lasting effect on theology.

The attacks on Origen, which had begun in his lifetime, did not cease for centuries, and only subsided during the time of the fierce Arian controversy. It was not so much the relation between pistis and gnosis—faith and knowledge—as defined by Origen that gave offence, but rather isolated propositions, such as his doctrines of the preexistence of souls, of the soul and body of Christ, of the resurrection of the flesh, of the final restoration, and of the plurality of worlds. Even in the 3d century Origen's view of the Trinity and of the Person of Christ was called in question, and that from various points of view. It was not till the 5th century, however, that objections of this kind became frequent. In the 4th century Pamphilus, Eusebius of Cæsarea, Athanasius, the Cappadocians, Didymus, and Rufinus were on the side of Origen against the attacks of Methodius and many others. But, when the zeal of Epiphanius was kindled against him, when Jerome, alarmed about his own reputation, and in defiance of his past attitude, turned against his once honoured teacher, and Theophilus, patriarch of Alexandria, found it prudent, for political reasons, and out of consideration for the uneducated monks, to condemn Origen,—then his authority received a shock from which it never recovered. There were, doubtless, in the 5th century church historians and theologians who still spoke of him with reverence, but such men became fewer and fewer. In the West Vincent of Lerins held up Origen as a warning example (*Commonit.*, 23), showing how even the most learned and most eminent of church teachers might become a misleading light. In the East the exegetical school of Antioch had an aversion to Origen; the Alexandrians had utterly repudiated him. Nevertheless his writings were much read, especially in Palestine. The monophysite monks appealed to his authority, but could not prevent Justinian and the fifth œcumenical council at Constantinople (553) from anathematizing the teaching of Origen. It is true that many scholars (*e.g.*, Hefele, *Conciliengesch.*, ii. p. 858 *sq.*) deny that Origen was condemned by this council; but Möller rightly holds that the condemnation is proved (*Realencyklop. f. protest. Theol. u. Kirche*, vol. xi. p. 113).

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[1] "Communis substantiæ est filio cum patre; *ἀπόρροια* enim *ὁμοούσιος* videtur, *i.e.*, unius substantiæ cum illo corpore ex quo est *ἀπόρροια*."

[2] *E.g.*, Dionysius of Alexandria; compare his judicious verdict on the Apocalypse.

Sources and Literature.—Next to the works of Origen (see Redepenning, "Des Hieronymus wiederaufgefundenes Verzeichniss der Schriften des Origens," in *Zeit. f. d. hist. Theol.*, 1851, p. 66 *sq.*) the most important sources are:—Gregory Thaumat., *Panegyricus in Orig.*; Eusebius, *H. E.*, vi.; Epiphanius, *Hær.*, 64; the works of Methodius, the Cappadocians, Jerome (see *De vir. ill.*, 54, 61), and Rufinus; Vincent. Lerin., *Commonit.*, 23; Palladius, *Hist. Laus.*, 147; Justinian, *Ep. ad Mennam* (Mansi, ix. p. 487 *sq.*); Photius, *Biblioth.*, 118, &c. There is no complete critical edition of Origen's works. The best edition is that of Car. and C. Vinc. Delarue, 4 vols. fol., Paris, 1733-59,—reprinted by Lommatzsch, 25 vols. 8vo, Berlin, 1831-48, and by Migne, *Patrol. curs. compl.*, ser. Gr., vols. xi.-xvii. Several new pieces have been edited by Gallandi and A. Mai. Amongst the older works on Origen those of Huetius (printed in Delarue, vol. iv.) are the best; but Tillemont, Fabricius, Walch (*Historie d. Ketzereien*, vii. pp. 362-760), and Schröckh also deserve to be mentioned. In recent times the doctrine of Origen has been expounded in the great works on church history by Baur, Dorner, Böhringer, Neander, Möller (*Geschichte der Kosmologie in der griechischen Kirche*), and Kahnis (*Die Lehre vom h. Geist*, vol. i.); compare with these the works on the history of philosophy by Ritter, Erdmann, Ueberweg, and Zeller. Of monographs, the best and most complete is Redepenning, *Origenes, eine Darstellung seines Lebens und seiner Lehre*, 2 vols., 1841, 1846. Compare Thomasius, *Orig.*, 1837; Krüger, "Ueber das Verhältniss des Orig. zu Ammonius Sakkas," in the *Ztschr. f. hist. Theol.*, 1843, i. p. 46 *sq.*; Fischer, *Comment. de Orig. theologia et cosmologia*, 1846; Ramers, *Orig. Lehre von der Auferstehung des Fleisches*, 1851; Knittel, "Orig. Lehre von der Menschwerdung," in the *Theol. Quartalschr.*, 1872; Schultz, "Christologie des Orig.," in the *Jahrb. f. protest. Theol.*, 1875; Mehlhorn, "Die Lehre von der menschlichen Freiheit nach Orig.," in *Zeitschr. f. Kirchengesch.*, vol. ii., 1878; Freppel, *Origène*, vol. i., 2d ed., Paris, 1875. (A. HA.)

ORIHUELA, a town and episcopal see of Spain, in the southern portion of the province of Alicante, 13 miles north-east from Murcia and about 15 from the sea, is situated in a beautiful and exceedingly fertile "huerta," at the foot of a limestone ridge of moderate height, and on both sides of the Segura, here crossed by two bridges. There are remains of an old fort on the hill commanding the town; and the gateway on the side of Valencia—the Puerta del Colegio—is a fine lofty arch, surmounted by an emblematic statue and the city arms. The most prominent buildings are the episcopal palace (1733), with a frontage of 600 feet, but partly ruinous; the town-house (1843), containing the municipal archives and a considerable number of curious and important documents of national history; and the cathedral, a comparatively small Gothic structure built on the site of a former mosque in the 14th century, and enlarged and tastelessly restored in 1829. There are large barracks on the outskirts, and many noblemen have town houses or "palaces" in Orihuela. There are also a considerable number of convents, now suppressed. The university of Orihuela, founded in 1568 by the archbishop of Valencia, was closed in 1835, part of the revenue being applied to the support of a college affiliated to the university of Valencia. Besides numerous primary schools there are a theological seminary and a normal school. The final separation of Orihuela from the diocese of Cartagena took place in 1564. The inhabitants are largely engaged in agriculture, the trade in fruit (oranges and citrons, pomegranates, dates), as well as in cereals, oil, and wine, being considerable. There is a lively and picturesque weekly market. The manufactures, which are of secondary importance, include textile fabrics, leather, saltpetre, and hats; dyeing is also carried on. The population of the ayuntamiento was 20,929 in 1877.

Orihuela is not mentioned in ancient geography, for a proposed identification with the Orcelis of Pliny is almost certainly wrong. As Auriela or Aurivalet, on the other hand, it figures frequently in the annals of the Moorish period; in 718 it was held successfully for some time by Theodemir against Abd-al-Aziz. It was conquered by Jayme of Aragon, for his father-in-law Alphonso of Castile, in 1265. It suffered sack during the disturbances at the beginning of the reign of Charles V. (1520), and again in the War of Succession (1706). Local annals specially mention the plague of 1648, the flood of 1651, and the earthquake of 1829.

ORINOCO, a river in the north of South America, which falls into the Atlantic on the north-east seaboard between 60° 20′ and 62° 30′ W. long., after draining an area of at least 366,000 square miles (belonging to Venezuela and Colombia) in a course of about 1500 miles. Between the source of its westmost affluent, the Guaviare, and that of its eastmost, the Caroni, there is a difference of 14 degrees of longitude. The head-waters of the main stream rise on the southern slope of the Sierre Parime; but the branch which keeps the name Orinoco has not yet been traced by any European, and the position of the lake from which, according to native report, it issues can only be vaguely fixed. Michelena y Rójas, who ascended the Orinoco as far as the mouth of the Mawaca (itself about 30 feet deep), found it even there a deep and navigable river; and a little way lower down it receives no inconsiderable accession from the Ocamo and Padamo. Below Esmeralda, a settlement in 65° 50′ W. long., long known as the limit of definite exploration, occurs one of the most remarkable bifurcations in the world; while the main stream holds on in a north-west direction, a branch called the Casiquiare turns south and, increased by numerous small tributaries, runs for about 180 miles to the Rio Negro (an affluent of the Amazons) with so rapid a current that, while a boat takes only four natural days to descend, the return voyage requires twenty to thirty days. In the neighbourhood of San Fernando de Atabapo (in 4° 2′ N. lat. and 68° 10′ W. long., a miserable village, but officially the capital of the Venezuelan province of the Amazons, and famous in the history of the river) the Orinoco is joined by the united waters of the Atabapo, the Ynirida, and the Guaviare,—the Guaviare receiving the Ynirida, about 10 or 15 miles west of San Fernando and then meeting the Atabapo opposite the village. The Guaviare is the first of the great rivers which bring down the waters of the Andes to the Orinoco, and is fit for steamboat traffic a long way up. From its junction with the Guaviare to the great rapid of Mariapiri (a distance of about 180 miles) the Ynirida, which was explored in 1872 by Frédéric Montolieu, hastens through a rugged country with a swift and frequently interrupted stream; above Mariapiri, and as far as Guacamayo (Montolieu's farthest), it forms, on the other hand, a succession of lakes and lagoons with hardly any current (*Bull. Soc. Géogr.*, Paris, 1880). Though smaller than either the Guaviare, the Ynirida, or the Orinoco, the Atabapo gives its northward direction to the united river, which below the confluence widens out into a noble flood several miles broad, but before long has its channel contracted and twisted and broken by the rough granitic rocks of the country through which it has to force its way. About 80 miles bring the river to the great cataracts of Maypures, and a few miles more to that of Atures; both are complete barriers to upward navigation, and, since Humboldt's glowing description, have been ranked among the most striking pieces of river scenery in South America (Humboldt and Bonpland, *Voy. au Nouv. Continent*, vol. ii. pp. 360-363). Some distance below Atures is the confluence of the Meta, a powerful many-watered affluent from the Andes, which has been ascended by steamer within 60 miles of Bogotá; but the Orinoco still continues northward till, meeting the Apure, which drains the whole Merida Cordillera, it turns westwards through the great Venezuelan valley. In its onward course it receives a great many tributaries from both north and south, the former being comparatively short, but the latter, especially the Caura and Caroni, rising in the highlands hundreds of miles away. About 50 miles below the mouth of the Caroni and 120 miles from the sea begins the enormous delta, embracing 200 miles of coast. The southmost branch, Boca de Navios or Boca de Varime, continues in the line of the river; the Manamo or Vagre branch strikes off almost at right angles northward to the Gulf of Paria or Golfo Triste. The annual inundation of the Orinoco, which makes a kind of false start in April, and, gradually increasing in May, June, and July, reaches its height in September, is extensive enough to lay the country under water in some places for scores of miles inland. As most of the regions through which it passes are in a state of nature, and there is hardly, with the exception of Angostura (*q.v.*), a town of any considerable size on the banks of either main stream or affluents, this noble river-system is but little turned to account for commerce. Not only, however, is it easily navigable for steamers for nearly 800 miles, but, as the lower part of its course lies in the line of the trade-winds, sailing craft are able to make their way slowly upwards against the current. Even at the junction of the Guaviare the height above the sea is only 744 feet.

In 1498 Columbus entered Golfo Triste, and probably observed the northern mouths of the Orinoco, and in 1499 the main channel appears to have been noted by Ojeda. The first to attempt the ascent of the river was Diego de Ordas in 1535, who reached the mouth of the Meta. For its scientific exploration we are mainly indebted to José Iturriaga and José Solano (1756), Humboldt (1800), and Michelena y Rójas (1855-1856).

See Gumilla, *El Orinoco ilustrado* (Madrid, 1741); Michelena y Rójas, *Exploracion oficial* (Brussels, 1867).

ORIOLE, from the Old French *Oriol* and that from the Latin *aureolus*, the name once applied to the bird, from its golden colouring, which is now generally admitted to be the *Vireo* or Icterus (vol. xii. p. 696) of classical authors—the *Oriolus galbula* of Linnæus—but now commonly used in a much wider sense. The Golden Oriole, which is the type of the Family *Oriolidæ* of modern ornithologists, is a far from uncommon spring-visitor to the British Islands; but the conspicuous plumage of the male—bright yellow contrasted with black, chiefly on the wings and tail—always attracts attention, and generally brings about its death. Yet a few instances are known in which it is supposed to have bred in England. The nest is a beautifully interwoven fabric, suspended under the horizontal fork of a bough, to both branches of which it is firmly attached, and the eggs are of a shining white sometimes tinged with pink, and sparsely spotted with dark purple. On the Continent it is a well-known if not an abundant bird, and its range in summer extends so far to the east as Irkutsk, while in winter it is found in Natal and Damaraland. In India it is replaced by a closely allied form, *O. kundoo*, chiefly distinguishable by the male possessing a black streak behind as well as in front of the eye; and both in Asia and Africa are several other species more or less resembling *O. galbula*, but some depart considerably from that type, assuming a black head, or even a glowing crimson instead of the ordinary yellow colouring, while others again remain constant to the dingy type of plumage which characterizes the female of the more normal form. Among these last are the aberrant species of the group *Mimetes* or *Mimeta*, belonging to the Australian Region, respecting which Mr Wallace pointed out, first in the Zoological Society's *Proceedings* (1863, pp. 26-28), and afterwards in his *Malay Archipelago* (ii. pp. 150-153), the very curious facts—as yet only explicable on the theory of "mimicry"—of which mention has already been made (Honey-eater, vol. xii. p. 139). It is a singular circumstance that this group *Mimeta* first received its name from Captain King (*Survey &c. of Australia*, ii. p. 417) under the belief that the birds composing it belonged to the Family *Meliphagidæ*, which had assumed the appearance of Orioles, whereas Mr Wallace's investigations tend to show that the imitation (unconscious, of course) is on the part of the latter. The external similarity of the *Mimeta* and the *Tropidorhynchus* of the island of Bouru, one of the Moluccas, is perfectly wonderful, and has again and again deceived some of the best ornithologists, though the birds are structurally far apart. Another genus which has been referred to the *Oriolidæ*, and may here be mentioned, is *Sphecotheres*, peculiar to the Australian Region, and distinguishable from the more normal Orioles by a bare space round the eye. (A. N.)

ORION, the name of a constellation which has been the centre of many legends in Greece. It bears the form of a warrior carrying a club, and wearing a girdle which is composed of three very beautiful stars. Its disappearance in the autumn is the prelude to storms and rain. The legendary hero Orion, or, as Pindar calls him, Oarion, was according to Homer a giant, fairer and taller than the Aloidea. Eos, the dawn-goddess, loved him, but the gods were angry; Artemis slew him in Ortygia with kindly shaft. A doubtful passage in the *Odyssey* calls him a mighty hunter. The later poets give various discrepant accounts of his parentage. They usually connect him with some deed of violence to a maid, either the daughter of Œnopion in Chios, or the nymph Upis in Delos, or even Artemis herself. Others say that Artemis loved him, and was induced, by an artifice of the angry Apollo, to shoot him unwittingly. The Old Testament name of the constellation appears to be *kĕsil*, the fool or impious (Amos v. 5; Job ix. 9, xxxviii. 31). In Arabic and Semitic it is called the giant. Late writers (Cedrenus and the *Paschal Chronicle*) speak of a Persian identification of Orion with Nimrod.

ORISSA, a province of British India, forming a division or commissionership under the jurisdiction of the lieutenant-governor of Bengal, situated between 19° 28′ and 22° 34′ 15″ N. lat. and between 83° 36′ 30″ and 87° 31′ 30″ E. long. It forms the extreme south-western portion of Bengal, bounded on the N. and N.E. by Chutiá Nágpur and Lower Bengal proper, E. and S.E. by the Bay of Bengal, S. by Madras, and W. by the Central Provinces.

Orissa consists of two distinct territories—a fertile alluvial delta, comprising the three British districts of Cuttack, Balasor, and Purí, occupying an area of 8056 square miles; and a wild region of sparsely populated tributary Hill States, with an area of 16,084 square miles, the latter walling out the former from the central Indian plateau. In the latter district the two small territories of Angul and Banki (area 997 square miles) are subject to British management. Including these, the area of British Orissa is 9053 square miles.

British Orissa.—The Orissa delta is formed from the deposits of the Mahánadi, the Bráhmani, and the Baitaraní, which converge towards the coast, to within 30 miles of each other, upon Orissa. The three rivers, together with two minor streams, the Sálandí and Subanrekhá, represent an accumulated drainage of 63,350 square miles, which, during the height of the hot weather, amounts only to a discharge of 1690 cubic feet per second. The average cold-weather discharge is 5360 cubic feet, but during the rains it rises to 2,760,000 cubic feet. This enormous mass of water falls suddenly upon a narrow level strip of country in which the river-beds are altogether inadequate to carry it off. The Orissa canal-system now affords an outlet to much of this surplus water, which it also utilizes for irrigation.

The population of the British districts was 3,730,735 in 1881, distributed over an area of 9053 square miles. The Hindus form the great mass of the population (3,634,049 in 1881), Mohammedans numbering 85,611, and aboriginal tribes still following their primitive modes of worship 10,923. The population is entirely rural, the people living almost solely by husbandry. In 1881 there were only five towns in the province containing upwards of 5000 inhabitants:—Cuttack (42,656), the headquarters of the provincial administration, and the starting-point of the great system of canals which irrigate the province; Purí (22,095), the capital of the third district of Orissa, and the religious capital of the province; Balasor (20,265), the official headquarters of the district of the same name, and the site of the earliest British factory on the seaboard of Bengal; Kendrapára (15,969); and Jáipur (11,233), also a great religious centre, with numerous ruined Sivaite temples.

The whole of Orissa is holy ground. On the southern bank of the Baitaraní shrine rises after shrine in honour of Siva, the All-Destroyer. On leaving the stream the pilgrim enters Jáipur, literally the city of sacrifice, the headquarters of the region of pilgrimage sacred to the wife of the All-Destroyer. There is not a fiscal division in Orissa without its community of cenobites, scarcely a village without consecrate lands, and not a single ancient family that has not devoted its best acres to the gods. Every town is filled with temples, and every hamlet has its shrine. The national reverence of the Hindus for holy places has been for ages concentrated on Purí, sacred to Vishnu under his title of Jagannáth, the Lord of the World.

Rice forms the great staple, every variety of it being grown, from the dwarf plant, 18 inches high, on the dry uplands, to the long-stemmed paddy which rears its head above 6 or 7 feet of water. Other crops consist of wheat, many varieties of pulse, oil-seeds, hemp, tobacco, cotton, sugar-cane, betel-leaf, tubers, and vegetables of many kinds. Besides its copious water-supply in time of high flood, the province has a local rainfall of 62½ inches per annum. Nevertheless, the uncontrolled state of the water-supply has subjected the country from time immemorial to droughts no less than to inundation. Thus the terrible famine of 1865-66, which swept away one-fourth of the entire population, was followed in 1866 by a flood which destroyed crops to the value of £3,000,000. Since then much has been done by Government to husband the abundant water-supply.

The early history of the kingdom of Orissa (Odra-desa), as recorded in the archives of the temple of Jagannáth, is largely mythical. A blank in the records from about 50 B.C. to 319 A.D. corresponds to a period of Yavana occupation and Buddhist influence, during which the numerous rock monasteries of Orissa were excavated. The founder of the Kesari or Lion dynasty, which ruled from 474 to 1132 A.D., is said to have restored the worship of Jagannáth, and under this line the great Sivaite temple at Bhuvaneswar was constructed. In 1132 a new line (the Gangetic dynasty) succeeded, and Vishnu took the place of Siva in the royal worship. This dynasty was extinguished in 1532-34, and in 1578, after half a century of war, Orissa became a province of the Mogul empire. In 1751 it passed to the Marhattás and suffered great miseries under their rule till the British conquest in 1803.

Orissa Tributary States.—These form a cluster of eighteen dependent territories or chiefships in the mountainous background of the Orissa division, occupying a succession of wooded mountain and rocky ranges, enclosing the rich valleys of the Mahánadi, Bráhmani, and Baitaraní. The following table gives a list of the states, with their area in square miles and their population.

TRIBUTARY STATES OF ORISSA IN 1881.

	States.	Area.	Population.		States.	Area.	Population.
1	Athgarh	168	31,079	10	Khandpára ..	244	66,296
2	Athmallik	730	21,774	11	Morbhanj	4,243	385,737
3	Barambá	134	29,772	12	Narsinhpur ..	199	32,583
4 } 5 }	Bod and Khundmal	2,064	130,103	13	Nílgiri	278	50,972
				14	Nayágarh	588	114,622
6	Daspalla	568	41,608	15	Pal Lahára .	452	14,887
7	Dhenkánal ..	1,463	208,316	16	Ranpur	203	36,539
8	Hindol	312	33,802	17	Tálcher	399	35,590
9	Keunjhar	3,096	215,612	18	Tigariá	46	19,850
					Total....	15,187	1,469,142

The largest town in the whole of the Tributary States is Khandpára, with 5543 inhabitants. It lies on the right bank of the Mahánadi, and is a considerable seat of trade.

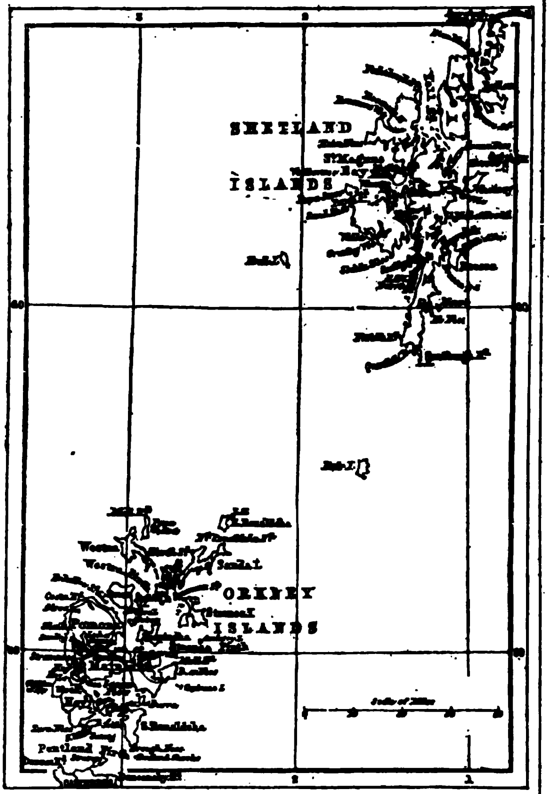
Tillage is conducted in two methods, common to the whole Tributary States: (1) rice cultivation in hollows and on low lands which have a command of irrigation; (2) upland or *táila* cultivation, upon newly-cleared patches of land, which depends entirely on the local rainfall. In the valleys, where the mountain rivulets can be utilized, the peasants throw a dam across the stream and store up the water. The lower levels thus secure a supply of moisture the whole year round, and wet rice cultivation goes on throughout the twelve months. In the uplands the forests are cut down and burnt upon the spot; and the soil, thus enriched with salts, yields abundant crops of early rice, oil-seeds, and cotton. At the end of four or five years such clearings are abandoned for new ones, and the land relapses into jungle.

The states are under the political superintendence of the British commissioner of Orissa.

ORIZABA, or **ORIZAVA**, a city of Mexico, in the state of Vera Cruz, is situated at a height of 3975 feet above the sea in a well-wooded valley 65 miles south-west of Vera Cruz, on one of the two high roads between that city and Mexico, and since 1872 on the Vera Cruz and Mexico Railway. It is a thriving place of 16,000 inhabitants, has a good exchange, a theatre, and two hospitals, spins cotton, and manufactures cotton and woollen cloth, and trades in tobacco, sugar, rum, and other local products. Originally called Izhuatlan, Orizaba is one of the oldest cities of Mexico. At the time of the Spanish conquest it formed part of the Aztec kingdom. In 1521 the natives massacred a large number of Spaniards. In 1862 Orizaba was the headquarters of the French army, which inflicted a defeat on the Mexicans on the outskirts of the city. Six miles north of the city stands the Pico de Orizaba or Citlaltepetl, "The Mountain of the Star," an extinct volcano 17,665 feet high, and thus one of the loftiest summits in the continent. It was ascended by W. F. Reynolds of the United States Topographical Engineers in 1848.

ORKNEY AND SHETLAND, a county of Scotland, formed of two separate groups of islands in the North Sea. The Orkneys are situated between 58° 41′ and 59° 24′ N. lat. and between 2° 22′ and 3° 25′ W. long., and are separated from the mainland of Scotland by the Pentland Firth, the breadth of which between Brough Ness in South Ronaldshay and Duncansby Head, Caithness, is about 7 miles. The Shetlands lie to the north-east of the Orkneys, between 59° 50′ and 60° 52′ N. lat. and between 0° 55′ and 2° 14′ W. long. The distance from Dennis Head in Orkney to Sumburgh Head in Shetland is about 50 miles, but Fair Isle, which is included in Shetland, is situated midway between the two main groups. The total area of the Orkneys and Shetlands is 593,352 acres or about 927 square miles, the area of the Orkneys being 240,476 acres, and that of the Shetlands 352,876 acres.

In the Orkney group there are fifty-six islands and islets, of which twenty-nine are inhabited, the others, which are called "holms," being frequently made use of for pasture. Besides Pomona or the Mainland, which has an area equal to all the others combined, the principal islands are, to the north, Rousay, Westray, Papa-Westray, North Ronaldshay, Sanday, Eday, Stronsay, and Shapinshay, and to the south, Hoy, North Walls, South Walls, Flotta, South Ronaldshay, and Burray. The members of the Shetland group are more numerous than the Orkneys, consisting of about a hundred islands and islets; besides the Mainland, the more important are Yell, Unst, and Fetlar to the north, Whalsay and Bressay to the east, and East and West Burra, Papa-Stour, Muckle Roe, and Foula to the west. Except towards the west the surface of the Orkneys is comparatively flat, and in some cases, as in Sanday, the coast is so low as to be a frequent cause of shipwreck. The island of Hoy consists principally of lofty black barren rocks, of which the Ward Hill attains a height of 1564 feet. In the southern part of the Mainland, to the west of Kirkwall, the hills also reach a considerable elevation, the highest summits being Wideford Hill near Kirkwall (740 feet) and the Ward Hill of Orphir (880 feet); and there is another hilly region in the north-west of the Mainland, opposite the island of Rousay. The centre of Rousay is occupied by hills of considerable height. On the west of Hoy perpendicular precipices of great height descend sheer to the Atlantic. The outline of the islands is very irregular, and through the numerous firths and sounds the tides rush with great rapidity, forming occasionally whirlpools called *roosts*, which in stormy weather frequently suck in fishing-boats and prove dangerous even to large vessels.



The coast-scenery of the Shetland group is strikingly picturesque. The islands present an irregular rocky surface generally rising into hills of considerable elevation, the highest summit being Roeness Hill (1475 feet) in the Mainland. By the action of the waves the rocks have been worn into numerous fantastic shapes, and the coast-line is also deeply indented by bays and "voes" or sea-lochs, caused partly by denudation and partly by glacial action. The greater part of the coast is stern and precipitous, but Sumburgh Head, the Noup of Noss, Fitful Head, the island of Papa-Stour with its surrounding rocks, Foula (especially on its western side), the Drongs and adjoining rocks of the parish of Northmavine with the coast-line from Roeness Voe to Haevdadal Head, and Unst the most northern of the group may be singled out for their picturesque beauty or impressive grandeur. The action of the sea has formed numerous caves, the more remarkable of which are the immense Orkneyman's Cave near the Bard of Bressay, and the fantastic caves of Papa-Stour.

Geology.—The geological formation of the Orkneys is very similar to that of the adjoining mainland, and consists almost entirely of the lower Old Red Sandstone of the flagstone series. A red and yellow sandstone series occupies part of Sanday, Eday, Burray, Flotta, and South Ronaldshay, and a long narrow strip of the Mainland to the south of Kirkwall. The mountainous district of Hoy belongs to the upper Old Red Sandstone, in which are interbedded volcanic rocks consisting of amygdaloidal lavas and ashes, and forming the terraces of the northern slopes of the Hoy hills. These rocks rest unconformably on the lower Old Red Sandstone. North-west from Stromness Bay to Inga Ness there is an outcrop of crystalline rocks consisting of granite and micaceous gneiss. The flagstone series, especially in the neighbourhood of Stromness, contains numerous fossils,—ichthyolites, crustaceans, and plants being all represented. From the character of the striated surfaces of the rocks, and the presence of foreign rocks in the boulder-clay, it has been concluded that the Orkneys were subjected to a glacial action crossing from the North Sea to the Atlantic; and there are also traces of local glaciers, especially at Hoy.

The geological formation of the Shetlands, like that of the Orkneys, belongs principally to the lower Old Red Sandstone and the metamorphic rocks on which they rest unconformably; but the proportion between the two species of rocks is reversed, the metamorphic rocks cropping to the surface throughout the greater part of the Shetland group. The central portion of the islands, including the north-western half of the Mainland and its eastern seaboard in the parish of Northmavine, Whalsay, Yell, and the western seaboard of Unst, is occupied chiefly by micaceous and hornblendic gneiss with limestones and quartzites. In the southern portion of the Mainland the clay-slate series, with associated limestones and quartzites, prevails. In Unst and Fetlar there are large masses of serpentine and gabbro, and diorite occupies a large area in the districts of Delting and Northmavine. The lower Old Red Sandstone occupies the islands of Foula and Bressay, skirts the eastern seaboard of the Mainland from Lerwick southwards, and includes the greater part of Walls. It is associated with a series of igneous rocks, especially in the western district of Northmavine, and there is also an intrusive series. Even more striking evidence of glacial action exists in Shetland than in Orkney. The metamorphic rocks are very rich in beautiful minerals, especially along the coast of Northmavine, among the varieties being felsite, epidote, actinolite, serpentine, anthophyllite, fluor-spar, steatite, magnetite, and cyanite. Both in Orkney and Shetland there are large deposits of peat.

Climate and Agriculture.—The temperature, both of the Orkneys and of the Shetlands, presents smaller variations than that of Scotland or England. The yearly average is a little over 45° Fahr., the average for the coldest months—

January, February, and March—being nearly 39°, and for the warmest months—July, August, and September—about 53°. Though fogs are common, the rainfall is not excessive, but it is higher in Shetland than in Orkney. As the temperature is influenced by the Gulf Stream, the coldest month of the year is March, when the tide reaches its lowest point. The soil of Orkney varies in different islands, but generally it is either a sandy loam or a strong but friable clay, and remarkably fertile. Large quantities of seaweed, as well as lime and marl, are available for manure. Since the opening up of more constant communication with the south, and the construction of a complete system of roads, begun in 1857, the system of cultivation has undergone a complete transformation. Many of the holdings in Orkney are now occupied by farmers from Scotland.

Between 1875 and 1880 the number of holdings in Orkney increased from 3147 to 3319, and their area from 93,618 acres to 104,958. In 1880 2873 holdings, or more than two-thirds of the total number, did not exceed 50 acres each, while 279 ranged from 50 to 100 acres, 131 from 100 to 300, and 36 were above 300. The total number of acres under cultivation in 1883 was 112,148, of which 38,459 were under corn crops, 32,051 rotation grasses, 22,755 permanent pasture, and 1031 fallow. Of the corn crops, 32,781 acres were under oats and 5641 under barley or bere, while 14,387 of the green crops were under turnips and 3104 under potatoes. Horses, which are for the most part a small and active breed, numbered 6092 in 1883, of which 4884 were used solely for agricultural purposes. Cattle numbered 25,624, of which 9405 were cows and heifers in milk or in calf. Shorthorned and polled Angus are now the most common breeds, cattle-feeding being largely practised. Sheep, which in 1883 numbered 31,548, are now chiefly Cheviots and a cross between them and Leicesters, but the native sheep (identical with those of Shetland) are still kept in considerable numbers in Hoy and South Ronaldshay. Pigs numbered 4745.

In Shetland there has been no agricultural progress corresponding to that in operation in Orkney, the principal reason being insufficiency of soil, which in many cases has to be made or increased by collecting turf. Between 1875 and 1880 the number of holdings decreased from 3839 to 3604, but the area under cultivation increased from 52,256 to 58,357 acres. In 1880 3529 holdings did not exceed 50 acres each, while 36 ranged from 50 to 100 acres, 30 from 100 to 300, and 11 were above 300. Although there are some good arable farms in a few favoured districts, the majority are small crofts held on a yearly tenancy by the fishermen along with their cottages. For the most part the cottages are only slightly improved specimens of the original cabin, the fireplace of at least the "but" end being in the centre of the apartment, which was formerly shared with calves, pigs, and other young animals. The cows are now for the most part housed in separate buildings. Originally the rent was paid in kind, and it was a general custom for the landlord or tacksman to compel the crofter to barter a considerable portion of the fruits of his industry for provisions and clothing, and the practice is not yet quite obsolete in certain districts. The cottages are generally grouped together in small hamlets called "touns." The size of a croft varies from 5 to 10 acres; but the old Norwegian measurement by merks is still retained. Originally the land was held on the "runrig" system—that is, different owners held alternate ridges—but now in most cases each holding is separate. The implement anciently used for turning over the soil was the Norwegian plough drawn by four oxen abreast, but as the holdings became subdivided and distinctly separated from each other it was superseded by the small sharp spade now in almost universal use. Until lately implements with wheels were scarcely known, and even yet the crofters generally carry out even the manure for the land in straw baskets slung over the shoulders. A system of roads was constructed during the potato famine of 1846-49, and wheeled vehicles are in general use in the neighbourhood of Lerwick and various other places. According to the agricultural returns of 1883 there were 58,393 acres under cultivation, of which 10,528 were under corn crops, 4511 green crops, and 41,628 permanent pasture. No system of rotation is practised. Of the corn crops 8050 acres were under oats and 2478 under bere; and of the green crops 3357 acres were under potatoes and 948 under turnips. Originally the grain supplies were obtained almost wholly from the Orkneys, and for a long period grey and black oats and bere or bigg were the only species grown, but now white oats are quite common. Frequently the grain does not ripen till the end of October or beginning of November. The culture of the cabbage is said to have been introduced by a detachment of Cromwell's soldiers, potatoes in 1730, and turnips in 1807. Black and red currants ripen in sheltered situations. Horses in 1883 numbered 5305, of which only 908 were used solely for agricultural purposes; cattle numbered 21,345, of which 8132 were cows and heifers in milk or in calf; sheep numbered 31,163, and pigs 3788. The small ponies peculiar to the islands are now becoming scarce, though entire ponies are greatly in demand for working underground in collieries. The native cattle are a diminutive breed with small horns and short legs. They are said to possess many of the points of the best breeds. The beef is remarkable for tenderness and flavour; and, when well fed, the cows yield a large supply of rich milk. In some districts crosses have been introduced. The native sheep of Shetland possess many of the characteristics of goats. The ewes, as well as the rams, have generally short horns, and the wool is long and of very fine quality. White, black, speckled grey, and a peculiar russet brown called "moorat" are the prevailing colours. It is the common custom to tear out the wool from the roots by the hand, as this is said to ensure a finer second crop. A few black-faced and Cheviot sheep are kept in some places. The Shetland pigs, which are very inferior, are often fed on fish. Large numbers of geese and poultry are kept.[1]

According to the *Valuation Roll*, 1883-84, Orkney was divided among 1149 proprietors, possessing 220,878 acres, with an annual value of about £82,416, or 7s 5d per acre. According to the *Parliamentary Return* of 1873 546 of the proprietors, or about 42 per cent. at that date, possessed less than 1 acre, and the following 10 possessed upwards of 5000 acres each:—J. G. M. Heddle, 50,410; earl of Zetland, 29,846; D. Balfour, 29,054; R. Baikie, 7846; H. C. Hebden, 7500; F. T. Burroughs, 6698; A. S. Graeme, 6444; trustees of late J. Stuart of Brugh, 6243; T. Traill, 5780; trustees of the late G. Traill, 5031. Shetland in 1883-84 was divided among 575 proprietors, possessing 352,876 acres, with a total value of £44,108, or nearly 2s 6d per acre. In 1873 240 of the proprietors, or about 45 per cent., possessed less than 1 acre, 15 possessed upwards of 5000 acres, 13 above 10,000, and the following 5 above 20,000 acres each:—trustees of Busta estate, 29,820; curators of W. A. Bruce, 25,180; Lady Nicolson, 24,785; T. M. Cameron, 24,363; A. G. Grierson, 22,006.

Fauna.—The faunas of the two groups of islands are very similar. Remains of deer have been found in the Orkneys, although few, if any, remained in the time of the Norse jarls. For some centuries hares were extinct, but they were reintroduced about 1830. Rabbits are very numerous in some districts. The otter and walrus are met with. Seals may occasionally be observed basking on the rocks, especially in the neighbourhood of the Ve Skerries off the western coast of the Mainland (Shetlands); and whales, both large and small, are frequently captured in the bays and sounds. The common porpoise is abundant, and the grampus also haunts the coasts. Nearly all the *Falconidæ* found anywhere else in Britain at one time frequented the Orkneys, and the hen-harrier, the merlin, the peregrine, and the sparrow-hawk are still numerous. The short-eared owl is common, and various other species occasionally haunt the islands. The raven, the Royston crow, the rook, and the jackdaw are all met with. The red grouse, the golden plover, the dotterel plover, and the grey plover are abundant in some districts. The snipe, the woodcock, the common heron, the curlew, the little bittern, the white stork, the white spoonbill, the knot, the ruff, and the common coot frequent the more remote regions. There is an immense variety of water-fowl. Most of the singing birds found in Scotland are either natives or occasional visitants. The great skua gull still breeds in the island of Foula, where its eggs are carefully preserved.

Flora.—Although the Orkneys contain some plants which are rare in the British Isles, the flora of the group is much smaller in variety than that of the more mountainous Shetlands. For lists the reader is referred to the paper on the flora of the Orkneys by W. Irvine Fortescue, and that on the flora of Shetland by Dr Peter White, both contained in Tudor's *Orkneys and Shetland*, 1883.

Manufactures.—According to Barry the woollen manufacture was at one time of some importance in the Orkneys, but by the end of last century had been superseded by that of linen, introduced about 1747. For the manufacture flax was at one time largely grown. After the introduction of machinery in the south it was no longer possible to continue the manufacture with profit, and, although straw-plaiting for a time took its place, it also succumbed to southern competition. Next to the linen trade the most important industry in the 18th century was the manufacture of kelp, introduced in 1722. With the abolition of the duty on Spanish barilla the manufacture for a time suffered severely, but of late years it has revived and now yields about £1500 annually. It is, however, chiefly on agriculture that the Orkneys depend, and their rapid progress in this respect has been greatly facilitated by the very ample steam communication by three different routes with Scotland. Since 1871 telegraphic communication has extended to Unst, the most northerly of the Shetland group. Straw-plaiting was at one time practised in Shetland, but kelp-making is no longer practised. The staple manufacture is knitted goods. According to Edmonston, stockings to the value of about £17,000 were annually exported from Shetland about the beginning of the present century. The manufacture of gloves was introduced about 1800, of shawls about 1840, and of veils about 1850. Fair Island has long been famous for its coloured hosiery, into the art of knitting which the inhabitants are said to have been initiated by the wrecked mariners of one of the ships of the Spanish Armada. The various dyes employed are extracted from the plants and lichens of the island.

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[1] Interesting information, not yet altogether out of date, on the agriculture of the Orkneys will be found in a paper by R. O. Pringle, and on that of the Shetlands in papers by H. Evershed and R. S. Skirving in the *Trans. of the Highland and Agricultural Society*, 1874.

Fisheries.—For some centuries the neighbourhood of the Orkneys and Shetlands was frequented by the fleet of Dutch vessels connected with the great herring fishery, but Barry states that fishing in his time was almost wholly neglected by the inhabitants of the Orkneys. The principal herring-stations are at Papa-Stronsay, Deersound, Holm, and South Ronaldshay. The greater part of the catch of spring herrings is despatched direct to Hamburg. The cod and ling fishing is prosecuted chiefly by the inhabitants of the north isles, both in open boats and in smacks, at the Faroes and near Iceland. Fishing is almost the sole occupation of the Shetland men, the women doing nearly all the farm-work and occupying also every spare moment in knitting both in the house and when carrying their burdens. The Shetland herring fishery has lately (1884) made rapid strides, but the increase in the take of herrings is partly due to boats from the south. As the herring fishery has increased, the deep-sea ling and cod fishing, formerly the mainstay of the islands, has proportionately diminished. The whole of the fisheries were originally in the hands of the Dutchmen, but in 1712 their supremacy was destroyed by the imposition of the duty on salt. Until within recent years the boats chiefly used were the old "sixerns" built in the islands after the model of the Norwegian yawl, but whole or half-decked boats are now rapidly taking their place. The total number of persons now employed in the fisheries of the Orkneys and Shetlands together is about 11,000, Shetland employing over 7430. The number of smacks belonging to the Orkneys is about 30, employing over 300 men; Shetland possesses about double this number, and the Shetland smacks are much more successful than those of Orkney, as more of them frequent the distant fishing-grounds. Shetland possesses, in addition to these, 285 decked first-class and 15 second-class fishing boats.

Administration and Population.—The islands of Orkney and of Shetland form one sheriffdom or stewartry, but the sheriff has a substitute in Orkney and another in Shetland. The county of Orkney and Shetland returns one member to parliament, and Kirkwall is included in the Wick district of burghs, which returns one member. Orkney includes 18 parishes and Shetland 12. From 24,445 in 1801 the population of Orkney had in 1831 increased to 28,847, and in 1861 to 32,395, but in 1881 was only 32,044, of whom 14,982 were males and 17,062 females. The population of Shetland in 1801 was 22,379, which had increased in 1831 to 29,392, and in 1861 to 31,670, but by 1881 had diminished to 29,705, of whom 12,656 were males and 17,049 females. In Orkney there were 113·88 females to every 100 males, but in Shetland the proportion is 134·71, by far the largest in any county of Scotland. The number of inhabited islands in Orkney was 29, the Mainland numbering 17,165 persons, while 5 other islands had a population of over 1000 each, viz., South Ronaldshay 2557, Westray 2200, Sanday 2082, Hoy 1380, and Stronsay 1274. Shetland comprised 30 inhabited islands, of which the Mainland contained 20,821, Yell 2529, and Unst 2173. In the Orkneys the only town is Kirkwall (3947), a royal and parliamentary burgh, and the villages are Stromness (1705) and St Margaret's Hope (412). Stromness, which received an independent charter in 1817, has risen within the last century from a mere fishing hamlet to a port of some importance. It possesses a fine natural harbour, with a pier accessible to vessels of large tonnage at high tides, and a patent slip. It is the rendezvous of vessels for the whale fishery at Davis Straits and Greenland. In the Shetlands Lerwick (4045) is the principal town, distant 272 miles from Edinburgh and 95 from Kirkwall. It dates from the beginning of the 17th century. Its harbour can afford safe accommodation for an immense fleet. Scalloway (648), the only village of the Shetlands, and the original capital, is situated on a fine bay about 6 miles west of Lerwick. It possesses the ruins of an ancient castle, and is the seat of a herring fishery.

History and Antiquities.—Scarcely any information is obtainable from Roman writers regarding the Orkneys, and none regarding the Shetlands, but there is abundant evidence that both groups of islands were originally inhabited by a Pictish population. Of the two forms of Picts' houses—chambered mounds and underground habitations or weems—many are still so entire as to afford an accurate notion of the character of the buildings; and of the barrows or burial-mounds, which number over 2000, the majority belong to the Pictish period. The rings of Brogar and Stenness are the only stone circles in the Orkneys, and there are only five groups in Shetland, three being in Unst and two in Fetlar. It has been disputed whether the fortresses known as borgs or brochs are to be attributed to the Picts or the Norsemen, but the balance of probability seems to indicate that they were erected before the Norse invasion, and in defence against the Northmen. Orkney possessed 70 and Shetland 75, the most perfect of existing specimens being the tower of Mousa in Shetland. Although few implements, and those of the rudest kind, have been discovered in the Picts' houses, the brochs contain handmills used for grinding corn, stone whorls and bone combs employed in woollen manufactures, and examples of a rude kind of pottery. Various scattered notices occur of early expeditions to the Orkneys, the most important being those of the Dalriadic Scots about the beginning of the 6th century; but the Picts soon regained their power, and the islands remained in their possession until the Norse invasions of the 9th century.

The earliest notice regarding the Christianization of the islands is that of a visit of Cormac and other companions of St Columba to the Orkneys about 565. The Irish monk Dicuil, writing about 825, states that a "certain honest monk had visited" certain islands "in the northern British seas," which are evidently identical with the Shetland Islands. Other proofs of the early Christianization of the Orkneys and Shetlands are the dedications to St Columba, St Bridget, St Ninian, and St Tredwell; the designation *Papa* applied to several of the islands, that being the Norse name for the Irish missionaries; monumental stones like those on the mainland of Scotland bearing the Ogham inscription, four having been found in Shetland and one in the broch of Burrian in North Ronaldshay in Orkney; the discovery of square-sided bells peculiar to the early ages of the church; and the occurrence of the crescent symbol on various sculptured slabs.

About the end of the 8th century the Orkneys and Shetlands became the rendezvous of the northern vikings, who sailed thence to ravage the coasts of Norway and the western coasts and islands of Scotland. About 872 the Norse settlement in the islands became perpetual by the flight to it of the jarls, dispossessed of their authority by Harold Haarfager. As the jarls began a retaliatory warfare on the coasts of Norway, Harold fitted out a great expedition against them, and placed the Orkneys and Shetlands under the government of Rognvald, earl of Mœri, who, with the permission of Harold, handed it over to his brother Sigurd. Guttorm succeeded his father Sigurd, but, dying childless about a year afterwards, was succeeded by Hallad, son of Rognvald, who, being unable to cope with the vikings, returned to Norway, Einar, another son of Rognvald, taking his place. He thoroughly subdued the vikings, and also taught the inhabitants to use peat for fuel, from which he received the name of Torf Einar. The two eldest sons of Einar were slain in battle in England, and the third, Thorfinn Hausakliuf, who succeeded in 950, having married Grelauga, daughter of Duncan, earl of Duncansby, became joint-earl of Orkney and Caithness. Thorfinn had five sons, all of whom were shortly afterwards slain, except the youngest, Hlödver. He was succeeded, about 980, by Sigurd the Stout, who fought against the Scots, but ultimately came to an agreement with Malcolm, king of the Scots, whose daughter he obtained in marriage. Sigurd was slain in a great battle at Clontarf against Brian Boroime, king of Munster, in 1014, upon which King Malcolm of Scotland bestowed the earldom of Caithness on Thorfinn, a son of Sigurd by his daughter, the earldom of the islands being divided among Somerled, Brusi, and Einar, Sigurd's sons by a former marriage. After the death of Somerled and Einar the claim of Brusi to the earldom of the islands was disputed by Thorfinn. An arrangement was finally made that Thorfinn should receive two-thirds of the islands; but on the death of Brusi he took possession of all the islands; he came to an agreement, however, with Rognvald Brusison which lasted for eight years, when Thorfinn, having defeated Rognvald in a sea-fight in the Pentland Firth, took possession of the earldom also. Finally he obtained recognition from the king of Norway, and, after making a pilgrimage to Rome, built Christ's Church in Birsay, where he established a bishop's see. Thorfinn was succeeded, about 1064, by his two sons Paul and Erlend, whom King Magnus (Barefoot) of Norway subsequently replaced by his son Sigurd. He, on his father's death, became king of Norway, and was succeeded in the earldom of the Orkneys by Hakon, Paul's son, and Magnus, Erlend's son, the latter of whom was murdered by the former in 1115. Hakon was succeeded by his two sons Harold and Paul, the former of whom shortly afterwards died, when Kali, a nobleman of Norway, receiving from King Sigurd the gift of half of the Orkneys, surprised Paul and induced him to consent to this arrangement, whereupon, in accordance with a vow he had made, he built a "stone minster" at Kirkwall. Paul was carried off by the vikings, and his place as joint-earl was taken by Harold, the son of Maddad, earl of Athole. King Eystein superseded Harold by Erlend, son of Harold the son of Hakon. Erlend fortified himself against Harold in the broch of Mousa in Shetland, until Harold came to an agreement with him. Afterwards Erlend was slain in a battle with Harold and Rognvald, who then reigned jointly till the death of Rognvald in 1158. On account of Harold's support of Sigurd, son of Magnus Erlingson, against King Sverri of Norway, he was deprived of the whole of Shetland. He was succeeded in 1206 by his sons John and David, the former of whom, on the death of his brother seven years afterwards, became sole ruler. He was slain in an inn in Thurso in 1231, and, as the line of

Norse earls became with him extinct, the earldom of Caithness was granted to Magnus, second son of Gilbride, earl of Angus, who was apparently confirmed in the earldom by the king of Norway. About 1321 the earldom passed from the Angus to the Strathearn line, and about 1379 to Henry St Clair, who erected the castle of Kirkwall. In 1468 the Orkneys and Shetlands were pledged by Christian I. of Denmark for the payment of the dowry of his daughter Margaret, betrothed to James III. of Scotland, and, as the money was never paid, their connexion with the crown of Scotland became perpetual. In 1471 King James III. bestowed the castle and lands of Ravenscraig in Fife on William, earl of Orkney, in exchange for all his rights to the earldom of Orkney, and an Act of Parliament was passed 20th February of the same year annexing the earldom of Orkney and Shetland to the Scottish crown.

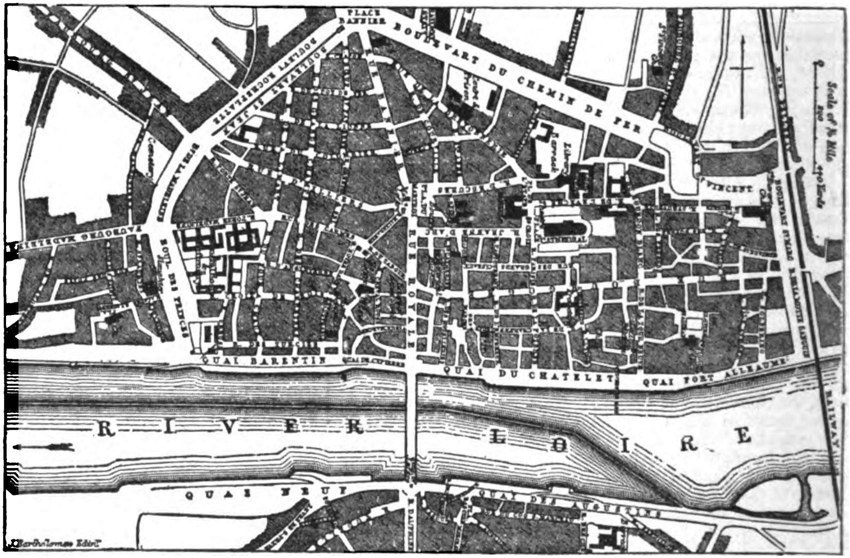
In 1540 Kirkwall was visited by James V. In 1564 Lord Robert Stewart, natural son of James V., was made sheriff of the Orkneys and Shetlands, and received possession of the estates of the odallers; in 1581 he was created earl of Orkney by James VI., the charter being ratified in 1591 to his son Patrick. In 1615 the earldom was again annexed to the crown. The islands were made the rendezvous of the disastrous expedition of Montrose in 1650. During the Protectorate the Orkneys were visited by a detachment of Cromwell's troops, who initiated the inhabitants into various industrial arts and new methods of agriculture. In 1707 the islands were granted to James, twelfth earl, in mortgage, redeemable by the crown on payment of £30,000, and subject to an annual feu-duty of £500; but in 1766 his estates were sold to Sir Lawrence Dundas of the family of the earls of Zetland.

Among the relics of the Norse settlement in the islands the most remarkable are the inscriptions on the great sepulchral cairn of Maeshow, the Orkahaug of the saga, which was, however, itself of Pictish origin. The topography, both of Orkney and of Shetland, is altogether Norse, and, although the influx of Scottish settlers gradually extinguished the old Norse tongue, many of the Norse names still linger, and even a form of the old odal succession and mode of land tenure still survives. Norse was generally spoken in the islands in the 16th century; and, according to Barry, in Orkney as late as the end of the 17th century it continued to be spoken in four parishes in the Mainland by the people in their own houses; but within his recollection it was almost entirely extinct, except in one parish in the heart of the Mainland. In Shetland it continued to be spoken much longer, and Low, during his tour in 1774, found the Norse language in Foula, "but much worn out." He states that it was the language of the last age, and he gives several specimens, including the Lord's Prayer and an old ballad (Low's *Tour*, pp. 105-112). The Shetlanders are still of almost unmixed Norse lineage, and words and phrases of Norse origin still tinge their dialect. Low describes a monument with Runic inscriptions in the churchyard of Crosskirk, Northmavine; and a Runic fragment found at Mail's Voe, Cunningsburgh, Shetland, is now in the museum of the (Scottish) Society of Antiquaries. Broken swords and fragments of shield-bosses have been dug up in many places, and also many of the peculiar brooches buried as relics in the graves of the Norse women during the Pagan period. At Birsay are remains of an old palace of the jarls.

In early times both the archbishop of Hamburg and the archbishop of York disputed with the Norwegians ecclesiastical jurisdiction over the Orkneys and the right of consecrating bishops; but ultimately the Norwegian bishops, the first of whom was William the Old, consecrated in 1102, continued the canonical succession. The see remained vacant from 1580 to 1606, and from 1638 till the Restoration; and, after the accession of William III., episcopacy was in 1697 finally abolished, although many of the clergy refused to conform. Besides the cathedral-church of KIRKWALL (*q.v.*), the most interesting of the old churches are Egilshay church, built about the beginning of the 12th century, and possessing a round tower; the ruins of the circular church at Orphir; the remains of Christ Church, Birsay, built by Earl Thorfinn in the 11th century; the chapel of Weir, supposed to have been built in the 12th century; St Peter's Church, Birsay; and the remains of a chapel on the brough of Deerness. In Shetland there were at one time three towered churches—St Lawrence in Burra, St Magnus at Tingwall, and Ireland Head; but of these there are now no remains. There are ruins of an old cruciform church at Culbinsbrough, of an old Norse church dedicated to St Olaf at Papil, and of various chapels in several of the islands.

The earliest written record on the Orkneys and Shetlands is *The Orkneyinga Saga*, an edition of which, with notes by Joseph Anderson, was published in 1873. Next to the saga in antiquity is Jo Ben's *Descriptio Insularum Orchadiarum*, 1529. Several works on both groups were written during last century, or about the beginning of the present, including Wallace, *Account of the Islands of Orkney*, 1700; Brand, *Brief Description of Orkney, Zetland, &c.*, 1701; Gifford, *Description of the Zetland Islands in* 1733, published in 1879; Low, *Tour through the Islands of Orkney and Shetland in* 1774, published in 1879; Barry, *History of the Orkney Islands*, 1805; Edmonston, *Zetland Islands*, 1809; and Shirreff, *General View of the Agriculture of the Orkney and Shetland Islands*, 1814. On the natural history there have been published—Low, *Fauna Orcadensis*, 1813; Baikie and Heddle, *Historia Naturalis Orcadensis*, part i., 1848; and Crichton, *A Naturalist's Ramble to the Orcades*, 1866. See also Gorrie, *Summers and Winters in the Orkneys*, 1868; Hibbert, *Description of the Shetland Isles*, 1822; Reid, *Art Rambles in Shetland*, 1869; Cowie, *Shetland*, 1874-80; Tudor, *Orkneys and Shetland; their Past and Present State*, 1883; and Rampini, *Shetland and the Shetlanders*, 1884. (T. F. H.)

ORLEANS, a city of France, chief town of the department of Loiret, lies on the right bank of the Loire, 75 miles south-south-west of Paris. At Les Aubrais, a mile to the north, is one of the chief railway junctions in the country. Besides the Paris and Orleans Railway, which there divides into two main lines—a western to Nantes and Bordeaux *via* Tours, and a southern to Bourges and Toulouse *via* Vierzon—branches leave Les Aubrais eastwards for Pithiviers, Châlons-sur-Marne, and Gien, north-west for Châteaudun and Rouen. The whole town of Orleans is clustered together on the right bank of the river and surrounded by fine boulevards, beyond which it sends out suburbs along the various roads. With the suburb of St Marceau on the left bank it is connected by a handsome stone bridge (1092 feet long and 51 feet wide) of nine arches, erected in the 18th century. Farther up is the railway bridge. The river is canalized on the right, and serves as a continuation of the Orleans Canal, which unites the Loire with the Seine by the canal of the Loing. Owing to its position on the northmost point of the Loire Orleans has long been the centre of communication between the Loire basin and Paris. Wines, grain, wool, and trees for planting are the main products of the surrounding districts and the commercial staples of the city, which, while devoted rather to trade than to manufactures, has establishments for the making of vinegar, blankets, hosiery, worsted, the so-called Rheims biscuits, confectionery, preserved foods, pins, pottery, boilers, paper, cardboard, soap, and dressed skins. The chief interest of the place, however, lies in its public buildings and the historical events of which it has been the scene. Proceeding from the railway station to the bridge over the Loire, the visitor crosses Orleans from north to south and passes through the Place du Martroi, the heart of the city. In the middle of the square stands an equestrian statue of Joan of Arc, 30 feet high, in bronze, resting on a granite pedestal surrounded by bas-reliefs representing the leading episodes in the life of the heroine. In 1855 it took the place of an older statue executed in the beginning of the century, which was then transferred to the left bank of the Loire at the end of the bridge, a few paces from the spot where a simple cross marks the site of the *Fort des Tournelles* captured by Joan of Arc on 7th May 1429. From the Place du Martroi, the Rue Jeanne d'Arc leads to the cathedral of Ste Croix. This church, commenced in 1287, was burned by the Huguenots in 1567 before its completion. Henry IV., in 1601, laid the first stone of the new structure, the building of which has continued until now. It is a Gothic cathedral on a large scale, consisting of a vestibule, a nave with double aisles, a corresponding choir, a transept, and an apse. Its length is 482 feet, its greatest width 206, and the height of the central vaults 108 feet. The west front has two flat-topped towers each of three stories, of which the first is square, the second octagonal, and the third cylindrical. The whole front is Gothic, but was designed and constructed in the 18th century and exhibits all the defects of the period. A central spire 328 feet high, on the other hand, raised about twenty-five years ago, recalls the pure ogival style of the 13th century. In the interior the choir chapels and the apse, dating from the original erection of the building, are worthy of note. In the episcopal palace and the great seminary are several remarkable pictures and pieces of wood-carving; and the latter building has a crypt which some antiquaries hold to belong to the 6th century. The church of St Aignan, said to have been founded by the son of Constantine, and often rebuilt, contains in a gilded and carved wooden shrine the remains of its patron saint, who occupied the see of Orleans at the time of Attila's invasion. The crypt dates from the reign of Robert the Pious (the beginning of the 11th century). The once beautiful sculpture of the exterior has been altogether ruined; the interior has been restored, but not in keeping with the original style. A third church, St Euverte, consecrated to one of the oldest bishops of Orleans (*ob.* 391), is an early Gothic building dating from the 12th century. To the west of Rue Royale stand the church of St Paul, whose façade and isolated tower both bear fine features of Renaissance work, and Notre Dame de Recouvrance, rebuilt between 1517 and 1519 in the Renaissance style and dedicated to the memory of the deliverance of the city. The Hôtel de Ville, built in 1530, was formerly the residence of the governors of Orleans, and was occupied by the kings and queens of France from Francis II. to Henry IV. The front of the building, with its different coloured bricks, its balconies supported by caryatides attributed to Jean Goujon, its gable-ends, and its windows, recalls the Flemish style. There are several niches with statues. Beneath, between the double flight of steps leading up to the entrance, stands a bronze reproduction of the statue of Joan of Arc, a masterpiece of the princess Mary of Orleans, which is preserved in the Versailles museum. The richly-decorated apartments of the first story contain paintings, interesting chimneys, and a bronze statuette (also by the princess Mary) representing Joan of Arc mounted on a caparisoned horse and clothed in the garb of the knights of the 15th century. The great hall in which it is placed also possesses a copy of Ingres's picture, "Joan of Arc at the Consecration of Charles VII.," and a plaster model of the Bigot tower at Rouen, where the heroine was imprisoned; the chimney is decorated with three bas-reliefs of Domremy, Orleans, and Rheims, all associated with her life. The historical museum at Orleans is one of the most interesting of provincial collections; a special section consists of all the objects—tapestries, banners, pictures, statuettes—relating to Joan, as well as of arms or bullets found on the battle-field of Patay; and the numismatic, mediæval, and Renaissance departments, and the collection of ancient vases, are all of great value. The city also possesses a separate picture gallery, a sculpture gallery, a natural history museum, and four learned societies. The public library (50,000 volumes) comprises among its manuscripts a number dating from the 7th century, and obtained in most cases from St Benoît on the Loire. At Orleans the general hospital has incorporated the almshouse for the aged, the orphan asylum, the lunatic asylum, the Hôtel Dieu, the maternity hospital, and the preparatory school of medicine and pharmacy. It is one of the finest institutions in France. In the corn-exchange is embodied a vast cloister formed by 16th-century arcades, once belonging to the old cemetery. Among the private houses those of Agnes Sorel and Francis I., and that occupied by Joan of Arc during the siege of 1429, are of historical interest. The "White Tower" is the last representative of the towers rendered famous by that siege. Near the Quai du Châtelet a stretch of wall, dating at least from the 9th century, was discovered some years ago; it is supposed to be a portion of the *châtelet* or *tête du pont* of the Roman period. A statue has been erected in front of the town-house to the jurisconsult Pothier, one of the most illustrious of the natives of Orleans. The anniversary of Joan of Arc is celebrated every year with great pomp. After the English had raised the siege the popular enthusiasm improvised a procession, which marched with singing of hymns to the cathedral of St Paul; and the ceremony is still repeated on the first days of May by the clergy and the civil and military functionaries. The population of Orleans is 57,264.



Plan of Orleans.

Whether Genabum is to be identified with Orleans or with Gien is matter of dispute; but Aurelianum appears as a flourishing town in the 5th century. St Aignan (as already mentioned) was bishop when, in 451, it was vainly besieged by Attila. Clovis got possession of the city in 498, and in 511 held there the first council assembled in France. Though the dignity which it then obtained, of being the capital of a separate kingdom, was lost by its union with that of Paris in 613, Orleans remained during all the mediæval period one of the first cities of the French monarchy; several of the kings dwelt within its walls, or were consecrated in its cathedral; it had a royal mint, was the seat of councils, and obtained for its schools the name of university (1305), and for its soldiery an equal standing with those of Paris. It became the apanage of one of the first princes of the blood under Philip of Valois, who made it a duchy for his second son, and under Charles VI., who bestowed the duchy on his brother Louis. After the assassination of this last prince by Jean sans Peur, duke of Burgundy (1407), the people of Orleans sided resolutely with the Armagnacs, and in this way brought upon themselves the attacks of the Burgundians and the English. Joan of Arc, having entered the beleaguered city on 29th April 1429, effected the raising of the siege by 7th May by means of an attack on the Fort des Tournelles, in the course of which she was wounded. After the Amboise conspiracy (1560) the States-General were convoked at Orleans, where Francis II. died. In 1562 it became the headquarters of Condé, the Protestant commander-in-chief, and the duke of Guise was assassinated on his way to besiege it. Huguenot and Leaguer were alternately in possession till Henry IV. came in person to take it in 1594. The duchy of Orleans, united to the crown by Louis XII., was again detached in favour of Gaston, brother of Louis XIII., and afterwards for Philip, brother of Louis XIV. and founder of the present house of Orleans. Since 1789 the title "duke of Orleans" has been purely honorary. During the Revolution the city suffered from the sanguinary excesses of Barère and Collot d'Herbois. It was occupied by the Prussians in 1815 and in 1870. As the centre of the preparations made by the Government of the National Defence for raising the siege of Paris, it bore the brunt of numerous battles fought in its vicinity, and of the hostile occupation to which they led.

ORLEANS, Charles, Duke of (1391-1465), commonly called Charles d'Orléans, was the eldest son of Louis, duke of Orleans (brother of Charles VI. of France), and of Valentina Visconti, daughter of Galeaso of Milan. He was born on 26th May 1391. Although many minor details are preserved of his youth, nothing except his reception in 1403, from his uncle the king, of a pension of 12,000 livres d'or is worth noticing, until his marriage three years later (29th June 1406) with Isabella, his cousin, widow of Richard II. of England. The bride was two years older than her husband, and is thought to have married him unwillingly, but she brought him a great dowry,—it is said, 500,000 francs. She died three years later, leaving Charles a widower and father of a daughter at the age of eighteen. He was already duke of Orleans, for Louis had been assassinated by the Burgundians two years before (1407). He soon saw himself the most important person in France, except the dukes of Burgundy and Brittany, the king being a cipher. This position his natural temperament by no means qualified him to fill. His mother was eager for vengeance for her husband; and for years Charles did his best to carry out her wishes by filling France with intestine war. Of this, however, he was only nominally one of the leaders, the real guidance of his party resting with the great count of Armagnac, whose daughter, Bonne, he married, or at least formally espoused, in 1410. Five years of confused negotiations, plots, and fightings passed before the English invasion and the battle of Agincourt, where Charles was joint commander-in-chief. According to one account he was dangerously wounded and narrowly escaped with his life. He was certainly taken prisoner and carried to England, which country was his residence thenceforward for a full quarter of a century. Windsor, Pontefract, Ampthill, Wingfield (Suffolk), and the Tower are named among other places as the scenes of his captivity, which, however, was anything but a rigorous one. He was maintained in the state due not merely to one of the greatest nobles of France but to one who ranked high in the order of succession to the crown. He hunted and hawked and enjoyed society amply, though the very dignities which secured him these privileges made his ransom high, and his release difficult to arrange. Above all, he had leisure to devote himself to literary work. But for this he would hardly be remembered as anything better than a more than usually amiable and less than usually able example of the higher feudal nobility, whose political position rather than their personal faults made government difficult or impossible in the later Middle Ages.

The work which secures a measure of immortality to Charles d'Orléans consists wholly of short poems in the peculiar artificial metres which had become fashionable in France about half a century or more before his birth, and which continued to be fashionable till nearly a century after his death. Besides these a certain number of English poems have been attributed to him. It is certain that he studied the language of his captors, but it is more than doubtful whether the extant English poems which bear his name are genuine, and in any case they are of no value. The ingenuity of a single English critic has striven to attribute to him a curious book in prose, called *Le Débat des Hérauts de France et d'Angleterre*, but M. Paul Meyer, in his edition of the book in question, has completely disposed of this theory. For all practical purposes, therefore, Charles's work consists of some hundreds of short poems, a few in various metres, but the majority either ballades or rondels. The chronology of these poems is not always clear, still less the identity of the persons to whom they are addressed, and it is certain that some, perhaps the greater part of them, belong to the later years of the poet's life. But many are expressly stated in the manuscripts to have been "composed in prison," others are obviously so composed, and, on the whole, there is in them a remarkable unity of literary flavour. Charles d'Orléans is not distinguished by any extraordinary strength of passion or originality of character; but he is only the more valuable as the last and not the least accomplished representative of the poetry of the middle of the Middle Ages, in which the form was almost everything, and the personality of the poet, save in rare instances, nothing. Yet Charles d'Orléans is not entirely without *differentia*. If he were he would hardly hold the place which at present he justly occupies. He is a capital example of the cultivated and refined—it may almost be called the lettered—chivalry of the last chivalrous age, expert to the utmost degree in carrying out the traditional details of a graceful convention in love and literature. But he is more than this; in a certain easy grace and truth of expression, as well as in a peculiar mixture of melancholy, which is not incompatible with the enjoyment of the pleasures, even the trifling pleasures, of life, with listlessness that is fully able to occupy itself about those trifles, he stands quite alone. He has the urbanity of the 18th century without its vicious and prosaic frivolity, the poetry of the Middle Ages without their tendency to tediousness. His best-known rondels—those on Spring, on the Harbingers of Summer, and others—rank second to nothing of their kind.

Poetry, however, could hardly be an entire consolation, and it is not surprising to find that Charles, during all the long years of his captivity, was perpetually scheming for liberty. But the English Government had too many reasons for keeping him, and it was not till his hereditary foe Philip the Good of Burgundy interested himself in him that the Government of Henry VI., which had by that time lost most of its hold on France, released him in return for an immediate payment of 80,000 *saluts d'or*, and an engagement on his part to pay 140,000 crowns at a future time. The agreement was concluded on 2d July 1440. He was actually released on 3d November following, and almost immediately cemented his friendship with Duke Philip by marrying his niece, Mary of Cleves, who brought him a considerable dowry to assist the payment of his ransom. He had, however, some difficulty in making up the balance, as well as the large sum required for his brother, Jean d'Angoulême, who also was an English prisoner. The last twenty-five years of his life (for, curiously enough, it divides itself into three almost exactly equal periods, each of that length) were spent partly in negotiating, with a little fighting intermixed, for the purpose of gaining the Italian county of Asti, on which he had claims through his mother, partly in travelling about, but chiefly at his principal seat of Blois. Here he kept a miniature court which, from the literary point of view at least, was not devoid of brilliancy. At this most of the best-known French men-of-letters at the time—Villon, Olivier de la Marche, Chastelain, Meschinot, and others —were residents or visitors or correspondents. His son, afterwards Louis XII., was not born till 1462, three years before Charles's own death. He had become, notwithstanding his high position, something of a nullity in politics, and tradition ascribes his death to vexation at the harshness with which Louis XI. rejected his attempt to mediate on behalf of the duke of Brittany. At any rate he died, on 4th January 1465, at Amboise. Many of his later poems are small occasional pieces addressed to his courtiers and companions, and in not a few cases answers to them by those to whom they were addressed exist. The best edition of Charles d'Orléans's poems, with a brief but sufficient account of his life, is that of C. d'Héricault in the *Nouvelle Collection Jannet*, Paris, 1874. (G. SA.)

ORLEANS, **Dukes of**. The title duke of Orleans was borne by three distinct dynasties of French princes of the blood. The first duke of Orleans was **Louis** (1371-1407), second son of King Charles V., who was born in 1371, and received the title from his brother Charles VI. in 1392. Both he and his son and heir played very important parts in the history of the Hundred Years' War with England (see **France**) in opposition to the duke of Burgundy. He had been appointed regent of France during the madness of his brother, Charles VI., and had, by his immorality and his intimacy with the queen, raised a great scandal throughout the kingdom. The duke of Burgundy made himself the mouthpiece of the general discontent, and on 23d November 1407 had the regent murdered in the streets of Paris in revenge for his own father's death. Louis's son **Charles** is the subject of the preceding article. With his son's accession to the throne as Louis XII. the dukedom of Orleans merged in the crown. It was revived in 1626, when Louis XIII. created his brother, **Jean Baptiste Gaston** (1608-1660), the third son of Henry IV., duke of Orleans and Chartres and count of Blois. Gaston of Orleans's fruitless intrigues fill the history of France from the time of Richelieu and Mary de' Medici to that of Mazarin and Anne of Austria. Four times he was banished from France, and more than four times did he sacrifice his associates, who had plotted the overthrow of Richelieu. To him Montmorency, Cinq-Mars, and De Thou owed their deaths, and he was only protected from sharing their fate by the fact of his royal birth. On the death of Louis XIII. he was appointed lieutenant-general of the kingdom for the minority of Louis XIV. But Mazarin never meant him to exercise any real power, and when he became convinced that his power was subordinate to the cardinal's he entered the ranks of the Fronde (see **Mazarin**), in which he played a conspicuous part, but always as the tool or the mouthpiece of others. Far more manly and determined was his daughter, best known as La Grande Mademoiselle, who with her own hands directed the guns of the Bastille upon Turenne's soldiers on the day of the battle of St Antoine. He was afterwards exiled to his castle of Blois, where he died without male issue in 1660. The title was at once revived by Louis XIV., who created his brother **Philippe** (1640-1701) duke of Orleans and of Chartres, and married him to Henrietta, the sister of Charles II. of England. The court was soon entertained by the details of the quarrels between the duke and duchess, and by the former's jealousy even of his brother the king, and, when Henrietta, after successfully detaching Charles from the Triple Alliance and negotiating the treaty of Dover, died suddenly in 1670, the duke was universally accused of poisoning her. In the following year he married Princess Charlotte Elizabeth of Bavaria. In the campaign of 1677 he so distinguished himself that Louis XIV. became afraid of his popularity and refused to allow him to go again to the frontier. He was obliged to waste his time at Paris like other noblemen, in attendance on the court, until his death in 1701. He left one son and three daughters: the daughters married Charles II. of Spain, Victor Amadeus II. of Savoy, and Prince Charles of Lorraine; the son was **Philippe** (1674-1723), the regent, who has been spoken of in **France**, vol. ix. p. 584. Before succeeding to the dukedom of Orleans in 1701 he had given no indication of political ambition or capacity, yet Louis XIV. distrusted him, and thought to mar his chance of allying himself with any royal or noble family, and to unite his interest with that of his own natural children, by marrying him to his illegitimate daughter by Madame de Montespan, Mademoiselle de Blois. This distrust was increased as the king's legitimate descendants died off, and in his will he left his natural son, the duke of Maine, guardian of the person of his great-grandson and heir, and greatly circumscribed the authority of Orleans as regent. On the death of the grand monarque in 1715 Philippe, guided by the advice of the duke of Saint Simon, induced the parliament of Paris to upset the will and make him regent of the realm with the fullest authority. By the same nobleman's advice he procured the degradation of the natural children of the late king from the precedence above the peers of France which had been conferred on them. Saint Simon hoped he would go yet further, and that he would entrust the nobility with their old political authority; but the regent had no mind to restore the privileges which Richelieu had had so much difficulty in combating, and which the policy of Louis XIV. had only, after long years, been able to destroy. He determined to hand down to Louis XV. the absolute power of his great-grandfather. Another main object he sought was to keep France at peace, which alone could restore her to her former prosperity. With this intention he joined the Quadruple Alliance. He remained in close union with Stanhope, the prime minister of England, and the emperor, whilst Dubois worked out his intentions. This alliance enabled the kingdoms of England and France to overthrow Alberoni and prevent his disturbing the peace of Europe. In compliance with the wishes of Lord Stair, the able English ambassador, Orleans expelled the Pretender from France, and was helped to overthrow the conspiracy of Cellamare—the French part of Alberoni's scheme by which the bastards of Louis XIV. were to overthrow the regent. Under this peaceful policy France rapidly began to recover prosperity, and Philippe hoped to restore the condition of her finances by listening to the advice of a Scotch adventurer, and buying out the farmers-general of the taxes, who were the real causes of the financial distress (see **Law, John**, vol. xiv. p. 367). It should also be noted that the regent showed both courage and determination in putting a stop to the insane speculations of the Rue Quincampoix. He cannot be called a great statesman; he indeed formed great plans, but left all details of government to Dubois. Yet his real political ability must not be overlooked, as is often done, because the period of the regency is only regarded, as a rule, as a period of wild debauchery, in which the regent ruled a court of bacchanals. Philippe never allowed his pleasures to interfere with his politics. His fidelity to the youthful monarch is no less remarkable in a man of his seemingly abandoned character, hence it is no wonder that when Louis XV. attained his majority he maintained the duke of Orleans and with him Dubois in power. But a career of debauchery had weakened his physical powers, and, in the very year in which his ward had thus shown his gratitude to him (1723), he died. His character is best painted in an apologue of his mother's. "The fairies were all invited to my bedside, and, each giving my son one talent, he had them all. Unhappily an old fairy had been forgotten, who, on arriving after the others, exclaimed, 'He will have all the talents, excepting that of making good use of them.'"

The son of the regent, Louis (1703-1752), who succeeded him as duke of Orleans, played no part in politics, though his name frequently occurs in the social history of the time, and fills a great place in contemporary memoirs. Louis's son, Louis Philippe (1725-1785), was equally averse to politics, though he served as a soldier at the battle of Dettingen; his great delight was the theatre, and his place is rather in the history of the Paris greenrooms than in the history of France. But to Louis Philippe Joseph (1747-1793), son of the preceding, a more adventurous life was allotted, and his part in the history of the French Revolution is one of the most difficult problems to solve of that exciting period. He was born at St Cloud in 1747, and bore the title of duke of Montpensier until his grandfather's death in 1752. He then became duke of Chartres, and in 1769 married Louise Marie Adelaide de Bourbon Penthièvre, only daughter and heiress of the duke of Penthièvre, grand admiral of France, and the richest heiress of the time. Her wealth made it certain that he would be the richest man in France, and he determined to play a part equal to that of his great-grandfather, the regent, whom he resembled in character and debauchery. As duke of Chartres he opposed the plans of Maupeou in 1771, and was promptly exiled to his country estate of Villers-Cotterets (Aisne). When Louis XVI. came to the throne in 1774 Chartres still found himself looked on coldly at court; Marie Antoinette hated him, and envied him for his wealth, wit, and freedom from etiquette, and he was not slow to return her hatred with scorn. In 1778 he served in the squadron of D'Orvilliers, and was present in the naval battle of Ushant. He hoped to see further service, but the queen was opposed to this, and he was removed from the navy, and given the honorary post of colonel general of hussars. He then abandoned himself to pleasure; he often visited London, and became an intimate friend of the prince of Wales (afterwards George IV.); he brought to Paris the "anglomania," as it was called, and made jockeys as fashionable as they were in England. He also made himself very popular in Paris by his large gifts to the poor in time of famine, and by throwing open the gardens of the Palais Royal to the people. Before the meeting of the notables in 1787 he had succeeded his father as duke of Orleans, and showed his liberal ideas, which were largely learnt in England, so boldly that he was believed to be aiming at becoming constitutional king of France. In November he again showed his liberalism in the *lit de justice*, which Brienne had made the king hold, and was again exiled to Villers-Cotterets. The approaching convocation of the States-General made his friends very active on his behalf; he circulated in every *bailliage* the pamphlets which Sieyès had drawn up at his request, and was elected in three—by the noblesse of Paris, Villers-Cotterets, and Crépy-en-Valois. In the estate of the nobility he headed the liberal minority under the guidance of Adrien Duport, and led the minority of forty-seven noblemen who seceded from their own estate (June 1789) and joined the Tiers État. The part he played during the summer of 1789 is one of the most debated points in the history of the Revolution. The court accused him of being at the bottom of every popular movement, and saw the "gold of Orleans" as the cause of the Reveillon riot and the taking of the Bastille, as the republicans later saw the "gold of Pitt" in every germ of opposition to themselves. There can be no doubt that he hated the queen, and bitterly resented his long court disgrace, and also that he sincerely wished for a thorough reform of the government and the establishment of some such constitution as that of England; and no doubt such friends as Adrien Duport and Choderlos de Laclos, for their own reasons, wished to see him king of France. The best testimony for the behaviour of Orleans during this summer is the testimony of an English lady, Mrs Grace Dalrymple Elliott, who shared his heart with Comtesse de Buffon, and from which it is absolutely certain that at the time of the riot of 12th July he was on a fishing excursion, and was rudely treated by the king on the next day when going to offer him his services. He indeed became so disgusted with the false position of a pretender to the crown, into which he was being forced, that he wished to go to America, but, as Comtesse de Buffon would not go with him, he decided to remain in Paris. He was again accused, unjustly, of having caused the march of the women to Versailles on 5th October. La Fayette, jealous of his popularity, persuaded the king to send the duke to England on a mission, and thus get him out of France, and he accordingly remained in England from October 1789 to July 1790. On 7th July he took his seat in the Assembly, and on 2d October both he and Mirabeau were declared by the Assembly entirely free of any complicity in the events of October. He now tried to keep himself as much out of the political world as possible, but in vain, for the court would suspect him, and his friends would talk about his being king. The best proof of his not being ambitious of such a doubtful piece of preferment is that he made no attempt to get himself made king, regent, or lieutenant-general of the kingdom at the time of the flight to Varennes in June 1791. He, on the contrary, again tried to make his peace with the court in January 1792, but he was so insulted that he was not encouraged to sacrifice himself for the sake of the king and queen, who persisted in remembering all old enmities in their time of trouble. In the summer of 1792 he was present for a short time with the army of the north, with his two sons, the duke of Chartres and the duke of Montpensier, but had returned to Paris before 10th August. After that day he underwent great personal risk in saving fugitives; in particular, he saved the life of the count of Champcenetz, the governor of the Tuileries, who was his personal enemy, at the request of Mrs Elliott. It was impossible for him to recede, and, after accepting the title of Citoyen Égalité, conferred on him by the commune of Paris, he was elected twentieth and last deputy for Paris to the Convention. In that body he sat as quietly as he had done in the National Assembly, but on the occasion of the king's trial he had to speak, and then only to give his vote for the death of Louis. His compliance did not save him from suspicion, which was especially aroused by the friendship of his eldest son, the duke of Chartres, with Dumouriez, and when the news of the desertion of Chartres with Dumouriez became known at Paris all the Bourbons left in France, including Égalité, were ordered to be arrested on 5th April. In prison he remained till the month of October, when the Reign of Terror began. He was naturally the very sort of victim wanted, and he was decreed "of accusation" on 3d October. He was tried on 6th November and was guillotined on the same day, with a smile upon his lips and without any appearance of fear. No man ever was more blamed than Orleans during the Revolution, but the faults of ambition and intrigue were his friends', not his; it was his friends who wished him to be on the throne. Personally he possessed the charming manners of a polished grand seigneur: debauched and cynical but never rude or cruel, full of gentle consideration for all about him but selfish in his pursuit of pleasure, he has had to bear a heavy load of blame, but it is ridiculous to describe the idle and courteous voluptuary as being a dark and designing scoundrel, capable of murder if it would serve his ambition. The execution of Philippe Égalité made the friend of Dumouriez, who was living in exile, duke of Orleans. Louis Philippe (1773-1850) was known as duke of Orleans throughout his long emigration and under the Restoration, and as duke of Orleans he was called upon to become king of the French in 1830. His eldest son, Ferdinand Louis Philippe Charles Henri (1810-1842), at once took the title of duke of Orleans. He was a brave soldier, and served in Algeria from 1834 to 1836. In 1837 he married Princess Helena of Mecklenburg, and became the father of the count of Paris, who is therefore *de jure* duke of Orleans. In 1839 he again went to Algeria, but the fatigues of the campaign were too much for him, and he died at Naples in 1842. With him died the last duke of Orleans, for his son will not take the title; but the whole party which supports him is rightly known as the Orleanist party.

The chief authorities on the three most important dukes of Orleans are:—for Gaston of Orleans, Avenel's *Lettres de Richelieu, &c.*; Chéruel, *Correspondance de Mazarin*; Id., *Histoire de France pendant la minorité de Louis XIV.*; Id., *Histoire de France pendant le ministère de Mazarin*; for the regent Orleans, the portions of Michelet's and Martin's *Histories* of France; and for Philippe Égalité, Baschet's *Histoire de Philippe Égalité*, and the *Journal* of Mrs Grace Dalrymple Elliott (1859). (H. M. S.)

ORME, Robert (1728-1801), author of a *History of British India*, was the son of John Orme, surgeon in Bombay, and was born at Anjengo, Travancore, in June 1728. He was sent to Harrow school in 1736, and in 1742 to a school near London to obtain an education preparing him for commercial pursuits. In 1744 he became a clerk in the East India Company's service in Calcutta. In 1752 he went to Madras, and in the following year he returned home with Lord Clive, with whom he lived on terms of close intimacy. His knowledge of Indian affairs gave him considerable influence with the company. Returning to Madras in 1755, he was appointed a member of the council, and in this position took an active part in directing the military operations in the Carnatic in 1755-59. By the court of directors he was appointed to succeed Lord Pigot in the government of Madras, and in 1757-59 he was commissary-general. In the latter year bad health compelled him to quit India, and he took up his residence in London, where he occupied himself in writing a *History of the Military Transactions of the British Nation in Indostan from* 1745, the first volume appearing in 1763, the second in 1775, and the third in 1778. In acknowledgment of his services he was appointed historiographer to the East India Company with a salary of £400 a year. In

1770 he was chosen a fellow of the Society of Antiquaries. He died at Ealing 13th January 1801.

The *History* is characterized by great clearness and accuracy; but, while the minute enumeration of unimportant details lends vividness to certain portions of his narrative it produces on the whole a feeling of tediousness, and tends to dull the leading episodes. In 1782 Orme also published *Historical Fragments of the Mogul Empire from the year* 1659, and in 1805 this was reprinted and published along with two other treatises, *The Origin of the English Establishment* and *A General Idea of the Government and People of Hindostan*, and preceded by a short *Life* of the author. He bequeathed several hundred volumes of manuscript collections, and a number of scarce tracts on Oriental subjects, to the library of the East India Company.

ORMONDE, James Butler, twelfth Earl and first Duke of (1610-1688), was born at London on or about 19th October 1610. He was grandson of Walter, earl of Ormonde, and eldest son of Thomas, Viscount Thurles, and Elizabeth Poyntz.[1] His father having been drowned (15th December 1619) during the lifetime of Earl Walter, he became heir to the title and estates. By some legal artifice the boy was made a royal ward, and James I. at once removed him from his Catholic tutor and placed him in the household of Abbot, archbishop of Canterbury, with whom he stayed until 1626, after which he resided with his grandfather. In 1629, by his marriage with his cousin Elizabeth, the daughter of the earl of Desmond, he put an end to the long-standing quarrel between the families. In 1630 he accompanied the old earl to Carrick, and in 1632 succeeded him in the earldom.

He was already noted, as had been many of his race, for his fine presence and great bodily vigour. His active career began with the arrival of Strafford in 1633. In all ways he was forward in assisting the deputy, but showed such independence and masterfulness of character, along with considerable capacity, that Strafford was for a while doubtful whether to crush or to favour him. Reflecting that Ormonde was one of the richest and probably the most influential of the Irish nobility, he decided to secure his interest; and Ormonde was throughout his government his chief friend and support. Such was the confidence felt in him that in April 1640, when Strafford was with Charles, he was made commander-in-chief of the forces. In August he was appointed lieutenant-general of the kingdom by Strafford, who, upon the death of Wandesford in December, urged Charles to make him deputy. His loyalty to his chief was shown by the vehemence with which he defended him against the attacks of the Irish House of Commons. Upon Strafford's death, and, it is said, at his request, Ormonde was offered the vacant Garter, but refused it for reasons characteristic of the man (Carte). On the arrival of the news of the rebellion in 1641 he received another commission as lieutenant-general from Charles himself, and, though much hampered by the lords justices, he did admirable service in the expedition to the Naas, and in the march into the Pale in 1642, after the rebellion had drawn in the Roman Catholic gentry of English descent. In both of these expeditions the ferocious traditions of Irish warfare were but too faithfully followed. So highly were his services regarded that he was publicly complimented by the English Parliament, who, along with their letter of thanks, sent him a jewel of the value of £620. On 15th April 1642 he gained the battle of Kilrush against Lord Mountgarret, and on 18th March in the following year that of Ross against Preston. In September 1643, the civil war in England having meanwhile broken out, the opposition between Ormonde, who always stood much upon his dignity, and the lords justices became more open and acute. Ormonde, seeing that the large army of Scots in Ulster was both unable to cope with the rebels and was ill-disposed to the king, and that the rebels had been successful at many points, concluded on 15th September the "cessation" with the latter, having power from Charles to treat with the recusants. He had previously, on 16th September 1642, been made a marquis by the king, and had been offered the lord-lieutenantship. This, however, he declined; but his command was made independent of Leicester. Ormonde now threw himself unreservedly into Charles's cause, and at his command sent a body of troops into England, having first exacted an oath of loyalty from the officers (see Monk); it, however, was shortly afterwards routed by Fairfax at the raising of the siege of Nantwich. On the arrival of the news of the "cessation" Charles, anxious to be quit of the Irish problem, which was complicated by the refusal of the Ulster Scots to concur in the "cessation," and desirous at the same time to see the country in safe hands, again offered Ormonde the supreme post, which he now accepted, receiving his commission in January 1644, with special instructions to do all in his power to keep the Scotch army occupied. In all the complications of Scots, Old Irish, Catholic Irish of English race, and Protestants, and in face of the intrigues of the Pope's nuncio as well as of the attempts of the Parliament's commissioners to Ulster to ruin his power, he showed firmness and ability, and especially did his utmost to assist Antrim in his expedition into Scotland. He kept his post until the ground was cut from beneath him by Glamorgan's treaty with the Catholics in 1646, and until it was clear that he could not long hope to hold Dublin against the Irish rebels. He thereupon applied to the English Parliament, gave Dublin into their hands upon terms which protected the interests of both Protestants and Roman Catholics so far as they had not actually entered into rebellion, and sailed for England at the beginning of August 1647. He attended Charles during August and October at Hampton Court, and, after the king's escape to the Isle of Wight, appears to have been his agent in the preliminary negotiation regarding the "engagement" with the Scots. Having good reason to fear that the Parliament intended to secure his person, he hurriedly left England and joined the queen and prince of Wales at Paris in March 1648, where he was of great service in dealing with the agents of the revolted Irish. In September of the same year, the pope's nuncio having been expelled, and affairs otherwise looking favourable, he returned to Ireland to endeavour to unite all parties for the king. He concluded a peace with the rebels on the basis of the free exercise of their religion, proclaimed Charles II., and upheld the royal cause with great vigour though with slight success. He was meanwhile urgent with Charles that he should come in person, but was outwitted and overborne by the Scots and their friends at the king's court. Cromwell having become irresistible, and Charles, under the influence of Argyll, having annulled the peace just concluded, Ormonde returned to France in 1650. He had meanwhile, in September 1649, received the Garter from Charles II.

Ormonde now, though in great straits for want of money, resided in constant attendance upon Charles and the queen-mother at Paris, and accompanied the former when, on his dismissal from France, he went to Aix and Cologne. He appears to have incurred the queen's enmity by frustrating the attempts which she made to induce the duke of Gloucester to become Catholic. In 1658, at great risk, he went upon a secret mission into England, to gain trustworthy intelligence as to the chances of a rising.[1] He attended the king at the treaty of Fontarabia, and was actively engaged in the secret transactions immediately preceding the Restoration. In the distribution of honours which followed he had a considerable share: he was at once made lord steward of the household, a privy councillor, lord-lieutenant of Somerset, high steward of Westminster, Kingston, and Bristol, chancellor of Dublin University, Baron Butler of Llanthony, and earl of Brecknock; and on 30th March 1661 he was created duke of Ormonde in the Irish peerage and lord high steward of England. At the same time large grants, in recompense of the fortune he had spent in the royal service, were made by the king, while in the following year the Irish parliament presented him with £30,000. His losses, however, according to Carte, exceeded his gains by a sum almost incredibly enormous. On 4th November 1661 he once more received the lord-lieutenantship of Ireland, and was busily engaged in the settlement of that country until 1664. His heart was in his government, and he vehemently opposed the bill prohibiting the importation of Irish cattle, which struck so fatal a blow at her trade; and, when it was passed, in order to lessen, as he thought, the misfortune, he prohibited the import of Scotch linen, and, further, obtained leave for a certain number of Irish vessels to trade with the foreign enemies of England. He encouraged Irish manufactures and learning to the utmost, and it was to his efforts that the Irish College of Physicians owes its incorporation.

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[1] His pedigree extends back to Henry II.'s expedition to Ireland, when Theobald Walter received, in addition to large estates, the hereditary butlership of Ireland, and the prisage of wines, which formed an important part of the vast wealth which the family always possessed. The title of Ormonde appears to have been granted to James the "noble earl," who by the female side was a great-grandson of Edward I. This title, at the request of Henry VIII., the 8th earl resigned to Sir Thomas Boleyn, receiving that of Ossory instead, and regaining that of Ormonde at Boleyn's death. The 9th earl, having borne a chief part in the suppression of the Geraldine rebellion, received a grant of the defeated chieftain's lands, and, in recognition of his further efforts when Henry threw off his allegiance to the pope, the title of Viscount Thurles was given him.

Ormonde's personality had always been a striking one. He had been noted for purity of life and purpose, and for generous and unswerving devotion to the royal cause, when purity and devotion, stimulated by the great argument, were not rare in the court of Charles I. In the court of Charles II. he assumed a still more noteworthy character. At a time when every form of baseness had free course, he figured as almost the sole representative of the high-toned virtues of a nobler generation. Where everything was little he, by force of what is emphatically called "character" far more than by any special ability, was great. The friend and comrade of Strafford, one who had in the royal cause ungrudgingly spent a princely fortune, we see him standing aloof while persons like Bennet intrigued and lied for office or money. Of strict purity of life, he was a living rebuke to the Sedleys and Castlemaines who turned the court into a brothel. Compelled to see the councils of the king guided by dishonour, he acquired over him the influence which Charles was always ready to concede to greatness (*e.g.*, Pepys, 19th May 1668). Proud of the loyalty of his race, which had been unspotted through five centuries, he bore with silent self-respect calumny, envy, and his seven years' loss of court favour, waiting until his master should be shamed into an acknowledgment of the wrong.

He soon became the mark for attack from all that was worst in the court. Buckingham especially did his utmost to undermine his influence. In his almost irresponsible government of Ireland during troublous times Ormonde had no doubt acted now and then in a way which offered advantage to men eager for his overthrow. He had billeted soldiers on civilians, and had executed martial law. The impeachment, however, threatened by Buckingham fell through. Nevertheless, by 1669, constant importunity had had its usual effect upon Charles, and Ormonde was removed from the government of Ireland and from the committee for Irish affairs. He made no complaint, insisted that his sons and others over whom he had influence should retain their posts, and continued to fulfil with dignified persistence the duties of his other offices. The compromise made by Charles with his conscience was marked by a public declaration that, in spite of what had happened, Ormonde had in no degree lost his confidence.

By way of recompense, unsought honours came to him and his family. At the suggestion of Sheldon, Oxford chose him as her chancellor, while Dublin, ignoring Roberts, the new lord-lieutenant, gave to his eldest son Ossory the freedom of the city.

In 1670, while driving through London, he was attacked and dragged out of his carriage by the well-known ruffian Blood, who had been deeply concerned in the attempt upon Dublin Castle in 1663. By whom he was set upon this deed is not known, though Ossory publicly laid it to the charge of Buckingham. Nothing appears to have saved Ormonde's life but the whim of Blood to hang him at Tyburn. The delay thus caused, and Ormonde's vigorous resistance, gave time for rescue. What was the mysterious connexion between Blood and the court has never been discovered; but it is certain that Charles, when Blood was captured, himself asked Ormonde to pardon him.

In 1671 Richard Talbot came over from Ireland in order, if possible, to secure the repeal of the Act of Settlement in favour of the dispossessed Irish gentry. Ormonde was placed on the committee of investigation, and did his utmost to frustrate Talbot's endeavours.

The return of Ormonde to favour, and his appointment to the government of Ireland in 1677, were characteristic both of the times and of Charles himself (Carte). It appears probable that it was the result in a great measure of the desire of James to set up a rival to Monmouth, for whom Shaftesbury had requested the lord-lieutenantship. On his arrival in Ireland he was for a considerable time occupied in placing the revenue and the army upon a proper footing. Upon the outbreak of the Popish terror in England he at once took the most vigorous and comprehensive steps, though with as little harshness as possible, towards rendering the Catholics, who were in the proportion of 15 to 1, powerless (Carte). So mild, however, did his measures appear that they served, in spite of the fact that Ireland was kept in perfect peace, as a reason for an attack upon him in England, which was led by Shaftesbury, and from which he was defended with great spirit by his son Ossory. He kept his course, giving even justice to both religious parties, and Charles had the good sense to refuse to remove him.

Hitherto Ormonde had been singularly fortunate in his family life. But in 1680 he lost his eldest son Ossory, a pure and gallant man, and this was but the beginning of his private sorrows. In 1682 Charles summoned Ormonde to court, and from that time retained him about his person. His first duty was to answer, at the king's request, the memoirs published by the earl of Castlehaven, in which he had reflected upon Charles I. His vigour also during the election of aldermen and during the disputed election of sheriffs for the city after Shaftesbury's acquittal was of the greatest service to the court. On 9th November 1683 an English dukedom was conferred upon him, and in June 1684 he returned to Ireland; scarcely, however, had he set out when intrigues against him once more proved successful, and he was recalled in October. Before, however, he could give up his government to Rochester, Charles II. died, and Ormonde's last act as lord-lieutenant was to proclaim James II. in Dublin. On his return to London he was met with all the pomp and ceremony which, while himself of simple tastes, he had always practised as befitting his office and name. He now lived much in retirement at Cornbury (Oxfordshire), signalizing, however, his loyalty to Protestantism and the Church of England by opposing the attempts of James to assume the dispensing power, in spite of which James to his credit refused to take away his offices, and continued to hold him in respect and favour to the last. On Saturday, 21st July 1688, he died quietly of decay, not having, as he rejoiced to know, "outlived his intellectuals." He was buried in Westminster Abbey on the 1st of August.

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[1] For a notice of this see Evelyn's *Diary*, 8th June 1658.

The principal authorities for Ormonde's life are Carte's *Life* and the Carte papers in the Bodleian, the article "Butler" in the *Biographia Britannica*, Cox's and Leland's *Histories* of Ireland, and the diaries and memoirs of the period. (O. A.)

ORMSKIRK, a market-town of Lancashire, is situated on the Lancashire and Yorkshire Railway, 11 miles north-east of Liverpool. It consists principally of four streets, diverging at right angles from the market-place. The church of St Peter and St Paul is a spacious edifice in various styles of architecture, with a square embattled tower and steeple, and a Saxon window. To the south-east of the church, and divided from it by a screen, is the Derby chapel, the exclusive property of the earls of Derby, whose vault is contained within. A free grammar school was founded about 1614. Among the other public buildings are the sessions-house and police offices, the working-men's institute, the public library, the dispensary, and the union workhouse. Rope and twine making, iron-founding, and brewing are carried on, and the town has long been famous for its gingerbread. The population of the town and urban sanitary district (area 573 acres) was 6651 in 1881 (6127 in 1871).

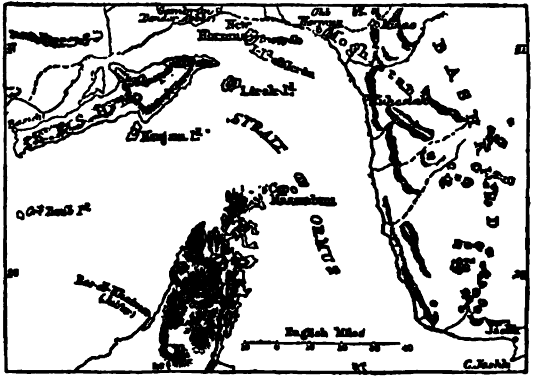
Ormskirk is not found in Domesday; but the parish according to tradition belonged to Orm, the Saxon proprietor of Halton. The name and church existed in the time of Richard I., when the priory of Burscough was founded. The prior and convent obtained from Edward I. a royal charter for a market at the manor of Ormskirk. On the dissolution of the monasteries the manor was granted to the earl of Derby

ORMUS. This is the European form of the name Hormus or Hurmúz, applied to a famous city on the shores of the Persian Gulf, which occupied more than one position in the course of history, and which has now long practically ceased to exist. The earliest mention of the name occurs in the voyage of Nearchus (325 B.C.). When that admiral beached his fleet at the mouth of the river Anamis on the shore of Harmozia, a coast district of Karmania, he found the country to be a kindly one, rich in every product except the olive. The Anamis appears to be the river now known as the Mináb, discharging into the Persian Gulf near the entrance of the latter. The name Hormuz is derived by some from that of the Persian god Hormuzd, but it is not unlikely that the original etymology was connected with *khurma*, "a date"; for the meaning of Moghistán, the modern name of the territory Harmozia, is "the region of date-palms." The foundation of the city of Hormuz in this territory is ascribed by one Persian writer to the Sassanian Ardashir Babegán (*c.* 230 A.D.). But it must have existed at an earlier date, for Ptolemy takes note of Ἁρμουζα πόλις (vi. 8).

Hormus is mentioned by Edrísí, who wrote *c.* 1150, under the title of Hormuz-al-sáhiliah, "Hormus of the shore" (to distinguish it from inland cities of the same name then existing), as a large and well-built city, the chief mart of Kirmán. Siráf and Kish (Ḳais), farther up the gulf, had preceded it as ports of trade with India, but in the 13th century Hormuz had become the chief seat of this traffic. It was at this time the seat also of a petty dynasty of kings, of which there is a history by one of their number (Túrán Sháh); an abstract of it is given by the Jesuit Teixeira. According to this history the founder of the dynasty was Sháh Mohammed Dirhem-Ku ("the Drachma-coiner"), an Arab chief who crossed the gulf and established himself here. The date is not given, but it must have been before 1100 A.D., as Ruknuddín Mahmúd, who succeeded in 1246, was the twelfth of the line. These princes appear to have been at times in dependence necessarily on the atábegs of Fars, and on the princes of Kirmán

About the year 1300 Hormuz was so severely and repeatedly harassed by raids of Tartar horsemen that the king and his people abandoned their city on the mainland and transferred themselves to the island of Jerún (Organa of Nearchus), about 12 miles westward, and 4 miles from the nearest shore.

The site of the continental or ancient Hormuz was first traced in modern times by Colonel (Sir Lewis) Pelly when resident at Bushire. It stands in the present district of Minão, several miles from the sea, and on a creek which communicates with the Minão river,[1] but which is partially silted up and not now accessible for vessels. There remain the traces of a long wharf and of extensive ruins.



Map of the Strait of Ormus.

The island adopted for the new site is of a pear-shape, with the stalk to the north, about 13½ miles in circumference and 4 miles in longest axis. The rounded southern portion is entirely composed of rugged serrated hills rising some 300 feet above the sea, and of an extraordinary variety of vivid colours, a few white peaks, like snow-covered hills, rising high above the general mass, one to a height of 690 feet. The hills, with the remarkable exception (according to the *Persian Gulf Pilot*) of the white peaks, and also of a range on the south and south-east, are all of salt. There is also sulphur. The island was devoid of fresh water except in one small well which exists, or formerly existed, at Ṭúrán Bágh, all the other water in use being collected in cisterns from rainfall; and of vegetation, with the exception of a very little scrub among the hills and of what was produced in the time of the kings by laborious gardening and irrigation at the spot above mentioned. The new city occupied a triangular plain forming the northern part of the island, the southern wall, as its remains still show, being about 2 miles in extent from east to west. A suburb with a wharf or pier, called Ṭúrán Bágh (garden of Ṭúrán) after one of the kings, a name now corrupted to Trumpák, stood about three miles from the town to the south-east.

ODORIC (*q.v.*) gives the earliest notice we have of the new city (*c.* 1320). He calls it Ormes, a city strongly fortified and abounding in costly wares, situated on an island 5 miles distant from the main, having no trees and no fresh water, unhealthy, and (as all evidence confirms) incredibly hot. Some years later it was visited more than once by Ibn Batuta, who seems to speak of the old city as likewise still standing. The new Hormuz, called also Jerún (*i.e.*, still retaining the original name of the island), was a great and fine city rising out of the sea, and serving as a mart for all the products of India, which were distributed hence over all Persia. The hills on the island were of rock-salt, from which vases and pedestals for lamps were carved. Near the gate of the chief mosque stood an enormous skull, apparently that of a sperm-whale. The king at this time was Kutbuddín Tahamtan, the son of Túrán Sháh; and the traveller gives a curious description of him, seated on the throne, in patched and dirty raiment, whilst holding a rosary of enormous pearls, procured from the Bahrein fisheries, which at one time or another belonged, with other islands in the gulf and on the Oman shores from Rás-al-ḥadd (C. Rosalgat of the Portuguese) on the ocean round to Julfar on the gulf, to the princes of Hormuz. Abdurazzák, the envoy of Sháh Rukh on his way to the Hindu court of Vijayanagar, was in Hormuz in 1442, and speaks of it as a mart which had no equal, frequented by the merchants of all the countries of Asia, among which he enumerates China, Java, Bengal, Tenasserim, Ṣhahr-í-nao (*i.e.*, Siam), and the Maldives. Nikitin, the Russian (*c.* 1470), gives a similar account; he calls it "a vast emporium of all the world."

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[1] It is alleged, however, in the *Persian Gulf Pilot*, 1864, that this creek, called Khor Mináb, "is in no way connected with" the river flowing past the town and fort of Minão or Mináb.

In September 1507 the king of Hormuz, after for some time hearing of the terrible foe who was carrying fire and sword along the shores of Arabia, saw the squadron of Alphonso d'Albuquerque appear before his city, an appearance speedily followed by extravagant demands, by refusal of these from the ministers of the young king, and by deeds of matchless daring and cruelty on the part of the Portuguese, which speedily broke down resistance. The king acknowledged himself tributary to Portugal, and gave leave to the Portuguese to build a castle, which was at once commenced on the northern part of the island, commanding the city and the anchorage on both sides. But the mutinous conduct and desertion of several of Albuquerque's captains compelled him suddenly to abandon the enterprise; and it was not till 1514, after the great leader had captured Goa and Malacca, and had for five years been viceroy, that he returned to Hormuz (or Ormuz, as the Portuguese called it), and, without encountering resistance to a name now so terrible, laid his grasp again on the island and completed his castle. For more than a century Ormuz remained practically in the dominions of Portugal, though the hereditary prince, paying from his revenues a tribute to Portugal (in lieu of which eventually the latter took the whole of the customs collections), continued to be the instrument of government. The position of things during the Portuguese rule may be understood from the description of Cesare de' Federici, a Venetian merchant who was at Ormuz about 1565. After speaking of the great trade in spices, drugs, silk and silk stuffs, and pearls of Bahrein, and in horses for export to India, he says the king was a Moor (*i.e.*, Mohammedan), chosen by and subordinate to the Portuguese. "At the election of the king I was there and saw the ceremonies that they use. . . . The old king being dead, the captain of the Portugals chooseth another of the blood-royal, and makes this election in the castle with great ceremony. And when he is elected the captain sweareth him to be true . . . to the K. of Portugal as his lord and governor, and then he giveth him the sceptre regal. After this . . . with great pomp . . . he is brought into the royal palace in the city. The king keeps a good train and hath sufficient revenues, . . . because the captain of the castle doth maintain and defend his right . . . he is honoured as a king, yet he cannot ride abroad with his train, without the consent of the captain first had" (in Hakluyt).[1]

The rise of the English trade and factories in the Indian seas in the beginning of the 17th century led to constant jealousies and broils with the Portuguese, and the successful efforts of the English company to open traffic with Persia especially embittered their rivals, to whom the possession of Ormuz had long given a monopoly of that trade. The officers of Sháh Abbás, who looked with a covetous and resentful eye on the Portuguese occupation of such a position, were strongly desirous of the aid of English ships in attacking Ormuz. During 1620 and 1621 the ships of Portugal and of the English company had more than once come to action in the Indian seas, and in November of the latter year the council at Surat had resolved on what was practically maritime war with the Portuguese flag. There was hardly a step between this and the decision come to in the following month to join with "the duke of Shiráz" (Imám Kúlí Khán, the governor of Fars) in the desired expedition against Ormuz. There was some pretext of being forced into the alliance by a Persian threat to lay embargo on the English goods at Jashk; but this seems to have been only brought forward by the English agents when, at a later date, their proceedings were called in question. The English crews were at first unwilling to take part in what they justly said was "no merchandizing business, nor were they engaged for the like," but they were persuaded, and five English vessels aided, first, in the attack of Kishm, where (at the east end of the large island so called) the Portuguese had lately built a fort,[2] and afterwards in that of Ormuz itself. The latter siege was opened on the 18th February 1622, and continued to 1st May, when the Portuguese, after a gallant defence of ten weeks, surrendered. It is to be recollected that Portugal was at this time subject to the crown of Spain, with which England was at peace; indeed, it was but a year later that the prince of Wales went on his wooing adventure to the Spanish court. The irritation there was naturally great, though it is surprising how little came of it. The company were supposed (apparently without foundation) to have profited largely by the Ormuz booty; and both the duke of Buckingham and the king claimed to be "sweetened," as the record phrases it, from this supposed treasure. The former certainly received a large bribe (£10,000). The conclusion of the transaction with the king was formerly considered doubtful; but entries in the calendar of East India papers lately published seem to show that James received an equal sum.[3]

Ormuz never recovered from this blow. The Persians transferred their establishments to Gombroon on the mainland, about 12 miles to the north-west, which the king had lately set up as a royal port under the name of Bandar Abbási. The English stipulations for aid had embraced an equal division of the customs duties. This division was apparently recognized by the Persians as applying to the new Bandar, and, though the trade with Persia was constantly decaying and precarious, the company held to their factory at Gombroon for the sake of this claim to revenue, which of course was most irregularly paid. In 1683-84 the amount of debt due to the company in Persia, including their proportion of customs duties, was reckoned at a million sterling. As late as 1690-91 their right seems to have been admitted, and a payment of 3495 sequins was received by them on this account. The factory at Gombroon lingered on till 1759, when it was seized by two French ships of war under Comte d'Estaing. It was re-established, but at the time of Niebuhr's visit to the gulf a few years later no European remained. Niebuhr mentions that in his time (*c.* 1765) Mulla 'Ali Sháh, formerly admiral of Nádir Sháh, was established on the island of Ormuz and part of Kishm as an independent chief. On Ormuz the solidly-built Portuguese castle still stands, and some of the immense water-tanks, with fresh water in them, in almost perfect integrity. "With their arched and groined roofs, supported on heavy pillars, they appeared like the crypts of some great cathedral" (Colomb, *Slave-catching in the Indian Ocean*, 1873, pp. 142-143). Of the city hardly anything stands except a minaret,[1] by some called a lighthouse, but the traces of buildings are numerous and extensive. A small band of fishermen and salt-diggers living in mat huts and a small guard from Muscat in the castle form the sole population. The island is, with Kishm and other places near, rented from Persia by the sultan of Muscat, chiefly for the salt and sulphur.

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[1] In Barros, *Dec.* II., book x. c. 7, there is a curious detail of the revenue and expenditure of the kingdom of Ormuz, which would seem to exhibit the former as not more than £100,000.

[2] The attack on Kishm was notable in that one of the two Englishmen killed there was the great navigator Baffin.

[3] *Colonial Series, E. Indies*, by Sainsbury, vol. iii. *passim*, especially see pp. 296 and 329.

Works consulted, besides some of those specifically quoted above, have been Barros, *Asia*; *Commentaries of Albuquerque*, trans. by Birch (Hak. Society); *Relaciones de Pedro Teixeira* (Antwerp, 1610); Narratives in Hakluyt's *Collection* (reprint of 1809, vol. ii.) and in Purchas's *Pilgrims*, vol. ii.; Pietro della Valle, *Persia*, lett. xii.-xvii.; *Calendar of E. I. Papers*, by Sainsbury, vol. iii.; Ritter, *Erdkunde*, xii.; *Jour. Roy. Geog. Soc.*, Kempthorne in vol. v., Whitelocke in vol. viii., Pelly in vol. xxxiv.; Fraser, *Narrative of a Journey into Khorasan* (1825); Constable and Stiffe, *Persian Gulf Pilot* (1864); Bruce, *Annals of the E. I. Company*, &c. (1810). (H. Y.)

ORMUZD (for Ahura-mazda or Auramazda, "the wise lord"), the good principle in the dualism of Zoroastrianism, opposed to Ahriman or Angromainyu. (See ZOROASTER.)

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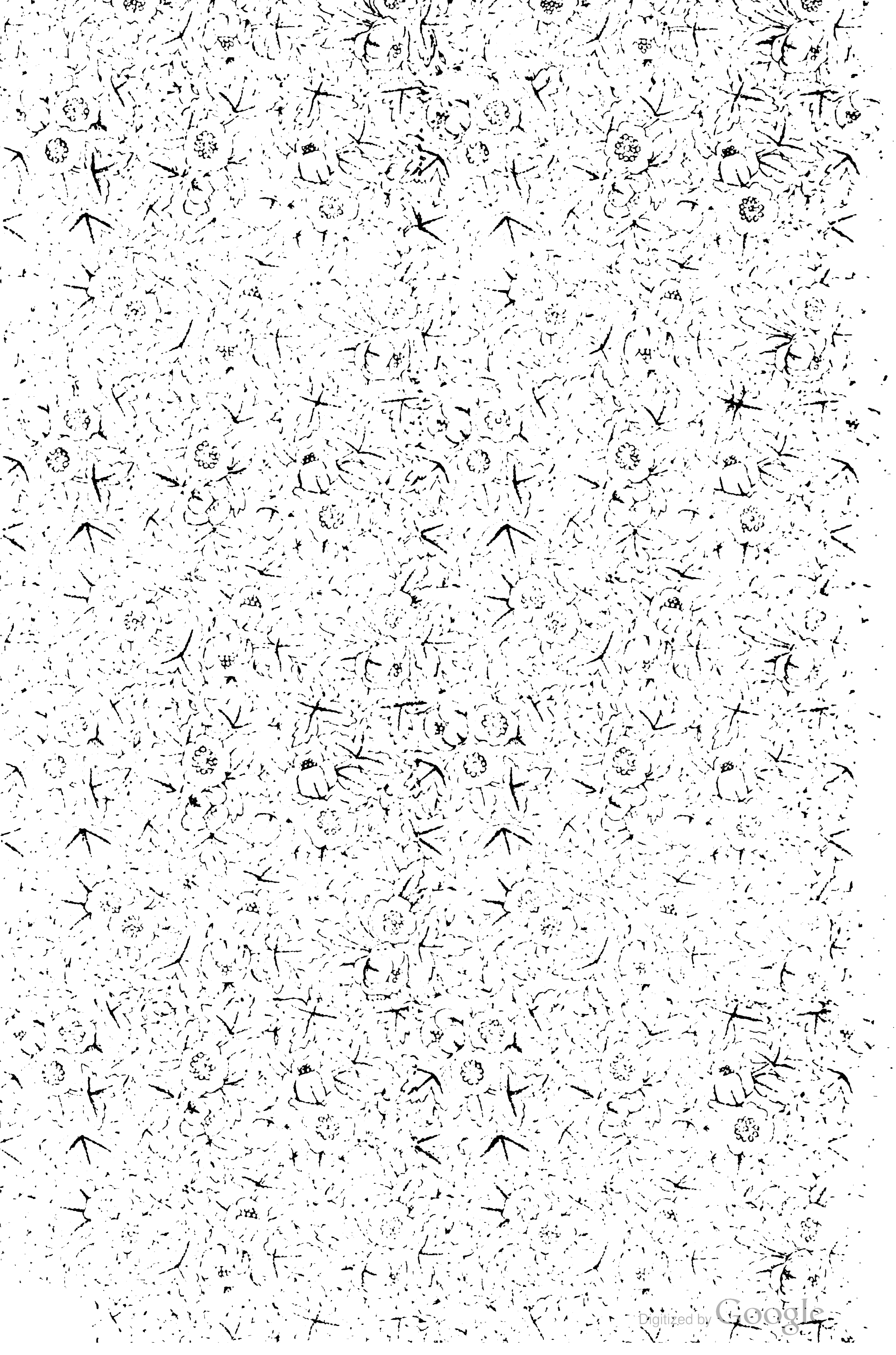
[1] Fraser heard that this was erected by Sháh Abbás after the capture.

END OF VOLUME SEVENTEENTH.



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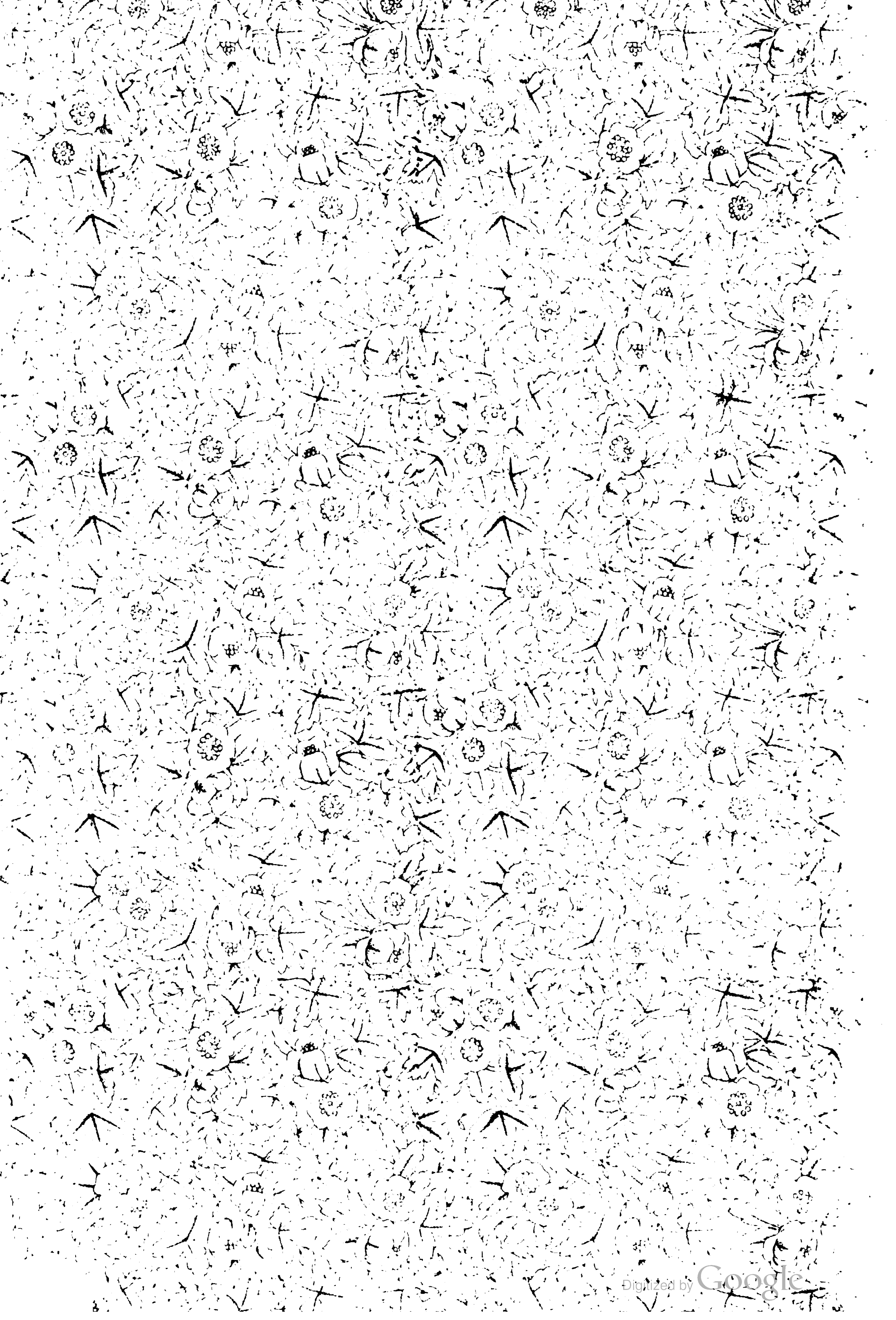

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